July 25, 2022

Submitted via ca.gov

Liane M. Randolph, Chair
California Air Resources Board
1001 I Street
Sacramento, CA 95814

Re: Tier 2 Pathway Application No. B0348

Dear Chair Randolph,

The Association of Irritated Residents, Leadership Counsel for Justice & Accountability, Central Valley Defenders of Clean Water & Air, Animal Legal Defense Fund, and Food & Water Watch (collectively, "Commenters") write in opposition to Shell Energy, North America and ampRenew Offtake I, LLC's Tier 2 pathway application. As Commenters have explained through numerous comments, the Petition for Rulemaking to Exclude All Fuels Derived from Biomethane from Dairy and Swine Manure from the Low Carbon Fuel Standard Program (included and incorporated here as Exhibit A), and the Petition for Reconsideration (included and incorporated here as Exhibit B), the California Air Resources Board's ("CARB") treatment of factory farm gas under the Low Carbon Fuel Standard ("LCFS") is flawed and staff's assessment of this application is no different. For the reasons detailed below, CARB cannot certify this application.

Commenters oppose this application for several reasons. First, the application applies an unlawfully truncated system boundary that ignores feedstock production at the source factory farm(s) and other emissions such as those from storage and disposal of digestate, resulting in exaggerated Carbon Intensity (CI) values. A fuel pathway life cycle analysis must take into account "feedstock production" and "waste generation, treatment and disposal."[1] In addition to the evidence provided in Exhibits A and B, more recent research indicates that emissions from factory farm gas production are significantly higher than currently appreciated, with especially high emissions from digestate storage.[2] This recent study did not consider additional emissions from digestate handling and application, which is another potentially large source of emissions resulting from this factory farm gas production that must be included in the pathway life cycle analysis.[3] Yet, CARB and the pathway applicants ignore these and other emissions. In other words, this application dramatically undercounts the greenhouse gas emissions associated with this fuel by failing to apply the required "well-to-wheels" analysis.

[1] Cal. Code Regs. Tit. 17 §§ 95481(a)(66), 95488.7(a)(2)(B).
[2] Semra Bakkaloglu et al., *Methane Emissions Along Biomethane and Biogas Supply Chains Are Underestimated*, 5 ONE EARTH 724–736 (June 17, 2022), https://www.sciencedirect.com/science/article/pii/S2590332222002676.
[3] *Id.* at 728; Michael A. Holly et al., *Greenhouse Gas and Ammonia Emissions from Digested and Separated Dairy Manure During Storage and After Land Application*, 239 AGRIC. ECOSYSTEMS & ENV'T 410, 418 (Feb. 15, 2017), https://doi.org/10.1016/j.agee.2017.02.007.

Concurrently, this application overcounts environmental benefits by ignoring what is essentially feedstock production. Liquified manure rotting anaerobically in massive waste "lagoons" is not an unavoidable and natural consequence of animal agriculture operations. This system—and the methane emissions that it causes—is the result of factory farms' intentional management decisions designed to maximize profits and externalize pollution costs. CARB cannot ignore that the emissions these pathway applicants claim as captured from an undisclosed number of factory farms' lagoons are intentionally created in the first place. The manure handling practices at these facilities are integrated parts of generating and using factory farm gas. Thus, the gas generated at these facilities is an intentionally produced product and cannot now be claimed as "captured" to secure a lucrative negative CI value.

Second, CARB has failed to ensure that the additionality requirements of Health and Safety Code § 38562 are met.[4] If CARB had done so, it would have concluded that the methane capture at issue is patently not additional. The District 45 digester—which is also one of the digesters for pathway application B0250—has existed since 2010 without taking advantage of the LCFS.[5] Accordingly, any purported emission reductions associated with this digester have already been occurring and presumably will continue to occur with or without being subsidized by the LCFS program.[6] Stated differently, these are emission reductions that "otherwise would occur."[7] Thus, certification of this pathway with this proposed CI value would openly violate § 38562 by crediting nonadditional reductions.

Third, this application is a good example of how CARB's flawed approach is rewarding the biggest factory farm polluters and incentivizing further expansion and herd consolidation, which does more climate harm than good. While the application does not disclose the factory farms that would produce the feedstock for this project, only the largest factory farms can produce enough manure to make methane digestion feasible. These factory farms are not sustainable family farms. They are large industrial operations that typically confine thousands—or even tens of thousands—of animals. District 45 Dairy,[8] for example, confines nearly 8,000 cows.[9] According to Minnesota Pollution Control Agency public records on file with Commenters, District 45 Dairy has violated its permit seven times since 2018. These violations concern District 45 Dairy's failure to submit an application for permit reissuance in October 2021; failure to submit an annual report in March 2021; failure to submit an application for permit reissuance in August 2020; and failure to consider second year available nitrogen when calculating manure application rates for transferred manure in October 2018. CARB should not allow this factory farm—or the applicants—to profit from the LCFS.

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[4] *See* Ex. 1, Petition for Rulemaking, section III.A.2; Ex. 2, Petition for Reconsideration, section III.A.3.
[5] Application B0250 CARB Staff Summary at 2.
[6] Note that ampRenew Offtake I, LLC, which is one of the joint applicants for B0348, admits that this digester was already operational prior to 2017 and since 2020. Letter from Cassandra Farrant to Richard Corey Re: Response to Public Comments for Tier 2 Pathway Application No. B0250 (June 27, 2022), https://perma.cc/7V3J-WNQT. It appears this digester is also being operated to take advantage of the federal Renewable Fuel Standard in addition to the LCFS. Application B0250 CARB Staff Summary at 1.
[7] Cal. Health & Safety Code § 38562(d)(2).
[8] Commenters assume that District 45 Dairy is the factory farm that is intentionally creating the manure that will be used as feedstock for this project. However, the application—which is riddled with redactions—does not disclose this information.
[9] Application B0250 CARB Staff Summary at 2.

Fourth, this application is so opaque that it is impossible for Commenters or other stakeholders to meaningfully evaluate it.[10] It does not disclose which factory farm(s) will be intentionally creating the feedstock manure; the number of factory farms; the location of the factory farm(s); the number of cows confined and used for manure production; or other salient details. Likewise, the lifecycle analysis redacts information critical to understanding the CI calculation.

Finally, the inflated CI value CARB proposes here work an additional environmental injustice on Californians who will be exposed to higher levels of pollution from fossil transportation fuel and dirty vehicles made possible by excessive credit generation at factory farm gas projects. CARB has acknowledged that pollution from transportation fuels inflicts a racially disparate impact, so this continued certification of fuel pathways with extreme negative CI values to allow more pollution from deficit holders contributes to this injustice.[11] And this application adds insult to injury, as it proposes to truck the factory farm gas from Morris, Minnesota to Wilmington, California—nearly ***1,800 miles***.

As this application highlights, CARB's unlawful and unjust administration of the LCFS program is causing environmental and public health harms not just in California, but to communities and ecosystems across the United States—in this case Minnesota—by incentivizing and rewarding some of the worst factory farm practices. If California is serious about being a climate leader, this is not the example to set.

For these reasons, Commenters request that CARB deny the application. To do otherwise will violate California law, further destroy the integrity of the LCFS market, undermine the state's climate change mitigation efforts, and harm communities in California and across the country.

Respectfully,



Christine Ball-Blakely
Staff Attorney
Animal Legal Defense Fund
(707) 795-2533
cblakely@aldf.org

[10] Publicly posted application materials "must provide sufficient information to allow for meaningful stakeholder review." CAL. AIR RES. BD., LOW CARBON FUEL STANDARD (LCFS) GUIDANCE 20-051 (Apr. 2020), https://perma.cc/856Y-CVVZ.
[11] *See* 2020 Mobile Source Strategy at 26–27, https://ww2.arb.ca.gov/sites/default/files/2021-12/2020_Mobile_Source_Strategy.pdf.

# Exhibit A: Petition for Rulemaking to Exclude All Fuels Derived from Biomethane from Dairy and Swine Manure from the Low Carbon Fuel Standard Program

**BEFORE THE CALIFORNIA AIR RESOURCES BOARD**

# PETITION FOR RULEMAKING TO EXCLUDE ALL FUELS DERIVED FROM BIOMETHANE FROM DAIRY AND SWINE MANURE FROM THE LOW CARBON FUEL STANDARD PROGRAM

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## PETITION FOR RULEMAKING

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# I. INTRODUCTION

The California Air Resources Board (CARB) allows inflated and non-additional credits derived from factory farm gas[1] to undermine the integrity of the Low Carbon Fuel Standard (LCFS) pollution trading scheme and exacerbate discriminatory environmental and public health harms in the San Joaquin Valley. The LCFS increases harmful pollution to air, water, and land in rural low-income and Latina/o/e communities; inflates factory farm gas reductions by excluding upstream and downstream emissions; allows non-additional reductions from other factory farm gas incentive programs to generate credits; fails to achieve reductions from transportation fuels when these inflated and non-additional factory farm credits justify excessive fossil fuel emissions; and perversely incentivizes increased greenhouse gas emissions and pollution from dairy and pig factory farms.

To remedy these deficiencies, the Association of Irritated Residents (AIR), Leadership Counsel for Justice & Accountability, Food & Water Watch, and Animal Legal Defense Fund petition the CARB for rulemaking to amend the LCFS to exclude all fuels derived from factory farm gas. In the alternative, CARB must reform the LCFS program to account for the full life cycle of factory farm gas emissions – including all upstream and downstream emissions from activities and inputs at dairy and pig facilities – and exclude non-additional emissions reductions that occur as a result of other factory farm gas incentives, including the Dairy Digester Research Development Program. CARB must also take steps to ensure that its policies and practices do not impose discriminatory harms on low-income and Latina/o/e communities in the San Joaquin Valley.

In 2006, the California Legislature determined that climate change posed "a serious threat to the economic well-being, public health, natural resources, and the environment of California."[2] To address these threats, CARB designed a range of programs that would monitor, regulate, and ultimately reduce greenhouse gas emissions, including the LCFS.[3] But as written and as implemented, the LCFS pathways for factory farm gas do not effectively reduce greenhouse gas emissions, violating CARB's obligation to achieve the maximum cost-effective and technologically feasible emissions reductions.

The LCFS intentionally promotes factory farm gas, a fusion of Big Ag and Big Oil & Gas, two of the industries most responsible for the climate crisis and whose entire business model relies on extraction and exploitation. Big Ag brought us polluted wells, foul air, antibiotic-resistant pathogens, methane-spewing manure lagoons, and workplace conditions that caused rampant outbreaks of COVID-19. Big Ag has driven family farmers off their farms, stripped wealth from our communities, and gutted our rural main streets. Big Oil & Gas brought us countless oil spills, tanker wrecks, pipeline explosions, and climate damage. There is no reason to entrust our future to the very industries responsible for the harms the LCFS seeks to address.

[1] Factory farm gas refers to the fuel the LCFS designates "biomethane from the anaerobic digestion of dairy and swine manure."
[2] CAL. HEALTH & SAFETY CODE § 38501.
[3] CAL. HEALTH & SAFETY CODE § 38510.

The results of CARB's embrace of these false solutions to the benefit of Big Ag and Big Oil & Gas are clear: due to the LCFS's deficient accounting of the emissions from factory farm gas, the program encourages increased production of the liquified manure necessary to generate factory farm gas, resulting in *more* intentionally created methane from new and expanding dairy and pig facilities. By propping up factory farm gas, the LCFS provides a new way for big corporations to get rich off a problem they created. In CARB's accounting of the carbon intensity of factory farm gas, the LCFS fails to include the full quantity of associated upstream and downstream greenhouse gas emissions, leading to an exaggerated negative carbon intensity value and a corresponding inflation of LCFS credit prices for factory farm gas. The resulting inflated credits do not encourage emissions reductions, instead, they reward factory farms for the production of toxic manure as though it were a cash crop. This "hot air" in the credit market, along with the award of credits for reductions from other incentive programs that would have occurred anyway, undermines the LCFS framework by allowing transportation fuel producers to emit more climate pollution based on illusory reductions.

No amount of corporate public relations spin, greenwashing, or deficient carbon intensity calculations can hide the fact that factory farm gas is created from massive harm. By incentivizing increased manure production and liquification, the LCFS program also fails to maximize additional environmental benefits in violation of the *Global Warming Solutions Act of 2006* (AB 32), and even increases the well-documented environmental and public health harms caused by pig and dairy factory farms. These facilities release enormous quantities of solid, liquid, and gaseous waste. In addition to greenhouse gas emissions, the waste from both pigs and dairy cows releases various co-pollutants including ammonia, hydrogen sulfide, volatile organic compounds (VOCs), and severe odor. The factory farm system relies on disposing the manure nitrogen on crops, which also leads to both nitrous oxide emissions and nitrate contamination of groundwater. Experience tells us that racism, exploitation, and extraction are embedded in the factory farm system – we know these harms are disproportionately imposed on Black, Indigenous, People of Color, and low-income communities around the country. In California, these harms discriminatorily impact low-income and Latina/o/e communities in the San Joaquin Valley in violation of state and federal law.[4]

CARB has an affirmative duty under Government Code section 11135 (CA 11135) and Title VI of the Civil Rights Act of 1964, 42 U.S.C. § 2000d, to ensure that its policies and practices do not have a discriminatory impact on the basis of race.[5] CARB has an affirmative duty under AB 32 to ensure that "activities undertaken to comply with the regulations do not disproportionately impact low-income communities" and to design regulations in a manner that is equitable.[6] Finally, Government Code section 12955 (CA 12955) prohibits any practice or program that has a discriminatory effect on members of protected classes with respect to housing opportunities, including with respect to the use and enjoyment of dwellings.[7] Furthermore, the

[4] Addressing discriminatory impacts resulting from the LCFS's inclusion of factory farm gas in other parts of the country where dairy and pig factory farms are concentrated is beyond the scope of this petition. However, CARB should also evaluate these potential impacts, given that the program includes applicants from around the country. CAL. AIR RES. BD., *LCFS Pathways Requiring Public Comments*, https://ww2.arb.ca.gov/resources/documents/lcfs-pathways-requiring-public-comments#t2.

[5] CAL. GOV'T CODE § 11135; 42 U.S.C. § 2000d.

[6] CAL. HEALTH & SAFETY CODE § 38562(b).

[7] CAL. GOV'T CODE § 12955.8; CAL. CODE REGS. TIT. 2 § 12161.

accountability our democracy depends on the public knowing the truth: who is benefiting, where the money is coming from, who is defining the problem, who is being impacted, and how they are harmed by the LCFS. By failing to even conduct a transparent disparity analysis of this highly-technical program, CARB impedes the public's ability to fairly evaluate CARB's choice to prop up Big Ag and Big Oil & Gas.

A people's government – our government – protects and serves the people's interests. It invests in food and climate solutions that create a healthy future for our children and grandchildren. It invests in good jobs that strengthen our rural communities. But CARB has created and implemented a pollution trading scheme that benefits polluters rather than uses the power granted by the people of California to prevent harms. On top of decades of discriminatory impacts in the San Joaquin Valley, California is facing the dire impacts of the climate crisis. We cannot afford a scheme that serves corporate interests over the people's needs.

To remedy these harms and to bring the LCFS regulation into compliance with state and federal law, the petitioners request that CARB amend section 95488.9 of the LCFS to exclude any "fuel pathway that utilizes biomethane from dairy and swine manure digestion."[8] In the alternative, petitioners request that CARB amend the LCFS regulation to (a) ensure that the life cycle analysis for biomethane from dairy and swine manure is expanded to include a full accounting of life cycle emissions; (b) amend section 95488.9 to ensure additionality of reductions; (c) properly classify methane from swine and dairy factory farms as intentionally occurring; (d) ensure compliance with state and federal civil rights law, including but not limited to conducting disparity analyses of LCFS pathways and credit trading; and (e) ensure the LCFS provides environmental benefits and does not degrade water quality and interfere with efforts to improve air quality in the San Joaquin Valley.

## II. BACKGROUND

### A. THE LCFS PROGRAM

AB 32 set a statewide target to reduce California's greenhouse gas emissions to 1990 levels by 2020.[9] In 2007, Governor Arnold Schwarzenegger issued Executive Order S-01-07, which directed CARB to adopt the LCFS pollution trading scheme to diversify California's transportation fuels and curb dependence on petroleum.[10] The California Office of Administrative Law approved the LCFS regulation in 2010 and the regulation has since undergone four rounds of amendments.[11]

According to CARB, "[T]he LCFS is designed to encourage the use of cleaner low-carbon transportation fuels in California, encourage the production of those fuels, and therefore, reduce

[8] CAL. CODE REGS. TIT. 17 § 95488.9.
[9] CAL. HEALTH & SAFETY CODE § 38550.
[10] CAL. EXEC. DEP'T, Exec. Order No. S-01-07, (Jan. 22, 2007), *available at* https://www.library.ca.gov/Content/pdf/GovernmentPublications/executive-order-proclamation/5107-5108.pdf; *see also generally,* CAL. HEALTH & SAFETY CODE § 38560.5 (requiring CARB to establish GHG reduction measures).
[11] CAL. CODE REGS. TIT. 17 § 95480 et seq.

greenhouse gas emissions and decrease petroleum dependence in the transportation sector."[12] The LCFS, like similar pollution trading schemes, constructs a market where credits and deficits that represent emissions in relation to a declining baseline can be traded. These tradeable LCFS credits provide a new revenue stream for producers of fuels that have been deemed low-carbon intensity with the goal of incentivizing increased production and displacing the use of more greenhouse gas-intensive fuels. The LCFS requires entities that produce conventional transportation fuels to report the carbon intensity of these fuels, while certain alternative fuel producers may opt into the program and demonstrate their fuel's carbon intensity in their application.[13]

Every year, CARB sets progressively lower benchmarks for the carbon intensity of fuels.[14] Transportation fuels with carbon intensity values above the annual benchmark generate deficits, and transportation fuels with carbon intensity values below the benchmark generate credits (see Figure 1, Appendix C).[15] While obligated parties are required to either meet the benchmark or purchase credits to offset the extra emissions associated with their fuel, voluntary parties that produce alternative, low-CI fuels are incentivized to participate because fuels with carbon intensities below the benchmark generate revenue through the sale of LCFS credits.[16]

The LCFS regulation defines "carbon intensity" as "the quantity of life cycle greenhouse gas emissions, per unit of fuel energy, expressed in grams of carbon dioxide equivalent per megajoule ($gCO_2e/MJ$)."[17] The emissions included in each fuel's carbon intensity calculation are usually bounded by "fuel pathways," defined as "the collective set of processes, operations, parameters, conditions, locations, and technologies throughout all stages that CARB considers appropriate to account for in the system boundary of a complete well-to-wheel analysis of [a given] fuel's life cycle greenhouse gas emissions."[18] Accurate and thorough life cycle analyses for each fuel and the accurate accounting of the baseline against which each fuel's carbon intensity is compared are independent and necessary preconditions for the program to identify which fuels to encourage to decrease net greenhouse gas emissions.

The LCFS classifies fuel pathways into three groups: Lookup Table, Tier 1, and Tier 2 pathways.[19] Regulated parties can register their fuels using the standard pathways in the Lookup

[12] *Low Carbon Fuel Standard: About,* CAL. AIR RES. BD., https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/about (last visited Oct. 12, 2021).
[13] CAL. CODE REGS. TIT. 17 §§ 95483-95483.1.
[14] CAL. CODE REGS. TIT. 17 § 95484.
[15] *Id.*
[16] CARB accounts for credits and implements credit transfers with the LCFS Reporting Tool and Credit Bank & Transfer System. CAL. AIR RES. BD., *LCFS Registration and Reporting*, https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/lcfs-registration-and-reporting (last visited Oct. 12, 2021).
[17] CAL. CODE REGS. TIT. 17 § 95481(a)(26). "Life Cycle Greenhouse Gas Emissions," in turn, is defined as "the aggregate quantity of greenhouse gas emissions (including direct emissions and significant indirect emissions, such as significant emissions from land use changes) as determined by the Executive Officer, related to the full fuel life cycle, including all stages of fuel and feedstock production and distribution, from feedstock generation or extraction through the distribution and delivery and use of the finished fuel to the ultimate consumer, where the mass values for all greenhouse gases are adjusted to account for their relative global warming potential. CAL. CODE REGS. TIT. 17 § 95481(a)(88).
[18] CAL. CODE REGS. TIT. 17 § 95481(a)(66).
[19] CAL. CODE REGS. TIT. 17 § 95488.1(a).

Table if the fuel produced "closely corresponds" to a Lookup Table pathway.[20] Tier 1 and Tier 2 pathways are open to voluntary applicants, including those seeking credit for factory farm gas. Tier 1 is for "the most common low carbon fuels" and uses a Simplified CI calculator, where Tier 2 is for "innovative, next generation fuel pathways," and uses the full CA-GREET3.0 model.[21] Tier 1 includes fuels like ethanol and biomethane anaerobic digesters of dairy and swine manure, among others.[22] Tier 2 includes fuels from sources not in Tier 1 as well as pathways included in Tier 1 that use "innovative production methods."[23] The majority of factory farm gas producers apply for Tier 2 pathways rather than the Tier 1 pathway.

Ten years after enacting AB 32, the California Legislature set a new target for greenhouse gas emissions in Senate Bill 32 (SB 32) – 40 percent below 1990 levels.[24] The Legislature stipulated, however, that SB 32 would only be operative if it also enacted Assembly Bill 197 (AB 197), which amended AB 32 in several ways.[25] AB 197 added Section 38562.5, which required that regulations promulgated to achieve emissions reductions beyond the statewide greenhouse gas limit, including the LCFS, consider the social costs of greenhouse gases, prioritize direct emissions reductions, and incorporate the requirements of Section 38562(b).[26] These requirements include crucial mandates to design the regulations in a manner that is equitable; ensure that activities taken to comply with the regulations "do not disproportionately impact low-income communities" and "do not interfere with, efforts to achieve and maintain federal and state ambient air quality standards and to reduce toxic air contaminant emissions;" and consider the overall societal benefits, including reductions in other air pollutants and other benefits to the environment.[27]

### B. THE SAN JOAQUIN VALLEY

California's San Joaquin Valley, as discussed in this petition, refers to eight counties that compose the valley floor from San Joaquin County in the north, to Kern County in the south. While disadvantaged communities within the region confront air pollution, toxic emissions, and unsafe drinking water at rates and degrees disproportionate to other communities in the state, the San Joaquin Valley is also home to resilient, diverse communities and networks that have worked together over decades to promote robust mutual aid networks, expand civic engagement, and lead

[20] CAL. CODE REGS. TIT. 17 § 95488.5(a)(1)-(6) ("Closely corresponds" means that the applicant's fuel pathway and a pathway on the Lookup Table are consistent in feedstock, production technology, the region in which the feedstock and fuel is produced, transport distance (if applicable), types and amount of thermal and electrical energy used in feedstock and finished fuel production, and that the CI of the entity's product is lower than or equal to the CI of the pathway in the lookup table.)

[21] CAL. AIR RES. BD., LCFS Guidance 19-01, Book and Claim Accounting for Low-CI Electricity 2, *available at* https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/guidance/lcfsguidance_19-01.pdf. While Tier 1 applicants provide a "discrete set of inputs" based on the specifics of their operations to be used by one of the pre-existing Tier 1 Simplified CI Calculators, Tier 2 applicants must conduct and submit a full life cycle analysis using the CA-GREET3.0 model for their own customized pathway. CAL. CODE REGS. TIT. 17 § 95488.3.

[22] CAL. CODE REGS. TIT. 17 § 95488.1(c).

[23] CAL. CODE REGS. TIT. 17 § 95488.1(d).

[24] CAL. HEALTH & SAFETY CODE § 38566.

[25] SB 32, 2016 CAL. LEGIS. SERV. CH. 249.

[26] AB 197, 2016 CAL. LEGIS. SERV. CH. 250.

[27] CAL. HEALTH & SAFETY CODE §§ 38562(2), (4), (6).

efforts from the household to the community level to model climate resilience and environmental stewardship.

The region is known for and, to a great extent, characterized by industrial agricultural operations, including large confined animal feeding operations. Decades of similar investment, land use, and economic development strategies have failed and continue to fail to prioritize the economic well-being and health of San Joaquin Valley residents, leading to severe income inequality, poverty, and environmental degradation despite the inherent assets of the region.

The "disadvantaged communities" of California, as defined pursuant to Senate Bill 535, are concentrated in the San Joaquin Valley.[28] Seven of the eight counties in the Valley (all except San Joaquin County) report mean income well below the 120% limit that defines low-income.[29] Every county in the San Joaquin Valley has lower household and per capita incomes, and higher poverty rates than California as a whole.[30] While median household income in California in 2019 was $75,235, countywide household median incomes for San Joaquin Valley Counties ranged from $49,687 to $64,432. The highest producing dairy counties in the state and in the San Joaquin Valley, Merced and Tulare, show median household incomes at $53,672 and $49.687 – both at 71 percent or below statewide median income.[31] Notably, nine of ten of the most recent applications for consideration for Low Carbon Fuel Standard Tier 2 Pathways from California factory farm gas were in Tulare County and Kern County. Kern County, like Merced and Tulare, faces disproportionately high poverty rates at 19 percent. Even this data likely inflates reported income level, because it may exclude the San Joaquin Valley's thousands of undocumented residents and residents of the Valley's unincorporated communities.[32]

San Joaquin Valley residents are disproportionately Latina/o/e as compared to California as a whole. All eight San Joaquin Valley Counties have higher Latino populations than the state,[33] with populations ranging from 42 percent to 65.6 percent, as compared to the state population with

[28] CAL. ENV'T PROT. AGENCY, *Designation of Disadvantaged Communities Pursuant to Senate Bill 535 (De León)* 1-32 (Apr. 2017), https://calepa.ca.gov/wp-content/uploads/sites/6/2017/04/SB-535-Designation-Final.pdf.
[29] Section 39711 of the Health and Safety Code sets the ceiling for low-income communities at 120% of the area median income. Additionally, Section 39711 designates communities with disproportionate environmental impacts and concentrations of low income, high unemployment, low educational attainment, and other burdensome socioeconomic factors as disadvantaged communities. All eight counties of the San Joaquin Valley fall within these categories. *See Maps & Data,* CAL. OFFICE OF ENV'T HEALTH HAZARD ASSESSMENT, https://oehha.ca.gov/calenviroscreen/maps-data (last visited Apr. 9, 2021) (flagging areas of California that exhibit high to low pollution burdening scores). *Income Limits*, U.S. DEP'T OF HOUSING AND URBAN DEV., https://www.huduser.gov/portal/datasets/il.html#2020_data (last updated Apr. 1, 2020) (choose 30% Income Limit for ALL Areas (Excel)); *FY 2020 State Income Limits* (2020), U.S. DEP'T OF HOUSING AND URBAN DEV., https://www.huduser.gov/portal/datasets/il/il20/State-Incomelimits-Report-FY20r.pdf.
[30] *Quick Facts*, U.S. CENSUS, https://www.census.gov/quickfacts/fact/table/POP645219 (last visited Oct. 12, 2021).
[31] Poverty rates in every single county in the San Joaquin Valley also exceed poverty rates in California, with Merced, Tulare facing 17 and 18.9 percent poverty rates (as compared to 11.8 percent at the statewide level). *Quick Facts*, U.S. CENSUS, https://www.census.gov/quickfacts/fact/table/POP645219 (last visited Oct. 12, 2021).
[32] 310,000 people live in low-income unincorporated communities in the San Joaquin Valley – "this is 70,000 more than what the Census Bureau included in its low-income Census Designated Places in the San Joaquin Valley." POLICYLINK, *California Unincorporated: Mapping Disadvantaged Communities in the San Joaquin Valley* 9 (2013), https://www.policylink.org/sites/default/files/CA%20UNINCORPORATED_FINAL.pdf.
[33] Latino is the term used by the U.S. Census.

39.4 percent of residents classified as Latino. At least seven of eight San Joaquin Valley communities have a lower proportion of white residents as compared to the state as a whole.[34] Merced and Tulare counties have white, non-Latino populations of 26.5 and 27.7 percent, and Latino populations of 65.6 and 61 percent, respectively.[35] Like Merced and Tulare, Kern County also demonstrates much higher Latino populations than the rest of the state, with a Latino population of 54.6 percent.

The disproportionately low-income and Latina/o/e residents of the San Joaquin Valley are exposed to the worst air quality in the state by most measures and lower income communities in the San Joaquin Valley are disproportionately subject to water contaminated with nitrates, arsenic, and 1,2,3 TCP, among others. The San Joaquin Valley is classified as an area that fails to meet several federal health-based standards for fine particulate matter ($PM_{2.5}$).[36] According to the American Lung Association, the San Joaquin Valley cities of Fresno-Madera-Hanford and Bakersfield are the second and third most polluted with respect to short-term exposure to $PM_{2.5}$.[37] The Valley cities of Bakersfield, Fresno-Madera-Hanford, and Visalia are the first, second, and third most polluted with respect to long-term exposure to $PM_{2.5}$.[38] The Valley also violates health-based standards for ozone.[39] Bakersfield, Visalia, and Fresno-Madera-Hanford are the second, third, and fourth most ozone-polluted cities in the in United States.[40] The San Joaquin Valley contains about half of California's 300 public water systems that currently serve unsafe drinking water.[41] Over the past three decades, nitrate levels in drinking water have exceeded the federal maximum contaminant level of 45 mg/L $NO_3$ (equivalent to 10 mg/L nitrate-N) in an estimated 24 to 40% of domestic wells in different counties in the San Joaquin Valley, compared to 10 to 15% of California's overall water supply.[42]

This pollution impacts the health and well-being of San Joaquin Valley residents.[43] Short-term exposure to $PM_{2.5}$ pollution causes premature death, decreased lung function, exacerbates respiratory disease such as asthma, and causes increased hospital admissions.[44] Long-term

[34] According to recent census data, 36.5 percent of the state population is classified as white, non-Latino, while 7 of the 8 counties in the San Joaquin Valley have white, non-Latino populations that range from only 26.5 to 33.2 percent. *Quick Facts*, U.S. CENSUS, https://www.census.gov/quickfacts/fact/table/POP645219 (last visited Oct. 12, 2021).
[35] *Quick Facts*, U.S. CENSUS, https://www.census.gov/quickfacts/fact/table/POP645219 (last visited Oct. 12, 2021).
[36] 80 FED. REG. 18,528 (April 7, 2015); 81 FED. REG. 2,993 (January 20, 2016); 80 FED. REG. 2,206, 2,217 (January 15, 2015).
[37] AM. LUNG ASSN., *State of the Air 2021* 37, *available at* https://www.lung.org/getmedia/17c6cb6c-8a38-42a7-a3b0-6744011da370/sota-2021.pdf.
38 *Id.* at 38.
[39] 75 FED. REG. 24409 (May 5, 2010); 77 FED. REG. 30088, 30092 (May 21, 2012).
[40] AM. LUNG ASSN., *supra* note 37 at 36.
[41] Del Real, J.A., *They Grow the Nation's Food, but They Can't Drink the Water*, N.Y. TIMES (May 21, 2019), https://www.nytimes.com/2019/05/21/us/california-central-valley-tainted-water.html.
[42] Eli Moore, et al., *The Human Costs of Nitrate-contaminated Drinking Water in the San Joaquin Valley*, PAC. INST., 11 (2011), https://pacinst.org/publication/human-costs-of-nitrate-contaminated-drinking-water-in-the-san-joaquin-valley/.
[43] The COVID-19 pandemic has made exposure to particulate matter even more dangerous, further highlighting the health risks associated with air pollution from factory farm dairies and factory farm gas. Xiao Wu et al., *Air pollution and COVID-19 mortality in the United States: Strengths and limitations of an ecological regression analysis*, 6 SCI. ADVANCES 1 at 1-2 (Nov. 4, 2020), https://advances.sciencemag.org/content/6/45/eabd4049.
[44] AM. LUNG ASSN., *supra* note 37 at 37-38.

exposure can cause asthma and decreased lung function in children, increased risk of death from cardiovascular disease, and increased risk of death from heart attacks.[45] Nitrates in drinking water can cause serious illness and death in infants ("blue baby syndrome") and are linked to pregnancy complications and birth defects, Sudden Infant Death Syndrome, and respiratory tract infections and a number of different cancers in adults and children.[46]

CARB has acknowledged that $PM_{2.5}$ exposure alone "is responsible for about 1,200 cases of premature death in the Valley each year."[47] San Joaquin Valley residents, who CalEnviroScreen designate a "sensitive population," experience higher rates of asthma, low birth weight, and cardiovascular disease compared to state incidence rates.[48] The California Institute for Rural Studies estimates that the costs of these air quality-related health harms total over $6 billion per year in the San Joaquin Valley.[49] This pollution also impacts residents' quality of life. For example, children in the San Joaquin Valley suffer from lack of access to outdoor recreation – on days with especially poor air quality, which occurred 40 days in Kern County in 2018, local authorities recommend that schools hold recess indoors.[50]

## III. CARB MUST EXCLUDE BIOMETHANE FROM DAIRY AND SWINE MANURE FROM THE LCFS OR IN THE ALTERNATIVE AMEND THE REGULATION TO ACCURATELY ACCOUNT FOR THE FULL CARBON INTENSITY OF THESE FUELS AND PROHIBIT CREDITS FROM NON-ADDITIONAL REDUCTIONS.

The LCFS violates sections 38560.5, 38562(b), 38562(d)(2), 38562.5 of the Health & Safety Code because it fails to achieve the maximum technologically feasible and cost-effective emissions reductions, fails to maximize additional environmental benefits, fails to ensure additionality of reductions, and exacerbates harms associated with industrial animal agriculture, including toxic air contaminants and dangerous water pollution. These failures prevent the state from maximizing greenhouse gas emissions reductions from transportation fuels and constitute a failure to use best scientific practices, as required by section 38562(e). Moreover, they harm San

[45] *Id*. at 38-39.
[46] WIS. DEP'T OF HEALTH SERV., *Infant Methemoglobinemia (Blue Baby Syndrome)*, https://www.dhs.wisconsin.gov/water/blue-baby-syndrome.htm (last updated Mar. 12, 2021).
[47] CAL. AIR RES. BD., *Clean-air plan for San Joaquin Valley first to meet all federal standards for fine particle pollution* (Jan. 24, 2019), https://ww2.arb.ca.gov/news/clean-air-plan-san-joaquin-valley-first-meet-all-federal-standards-fine-particle-pollution.
[48] *Indicators Overview*, CAL. OFFICE OF ENV'T HEALTH HAZARD ASSESSMENT, https://oehha.ca.gov/calenviroscreen/indicators#:~:text=Sensitive%20population%20indicators%20measure%20the,of%20their%20age%20or%20health (last visited Oct. 21, 2021); *see* AM. LUNG ASSN., *supra* note 37 at 23; Ashley E. Larsen et al., *Agricultural pesticide use and adverse birth outcomes in the San Joaquin Valley of California*, 6 NATURE COMMC'N 1, AT 4-8 (2007); Amy M. Padula et al., *Traffic-Related Air Pollution and Risk of Preterm Birth in the San Joaquin Valley of California*, 24(12) ANN EPIDEMIOL 1, 6-9; *see also* Robbin Marks, Nat. Res. Def. Council, *Cesspools of Shame: How Factory Farm Lagoons and Sprayfields Threaten Environmental and Public Health* (2001), https://www.nrdc.org/sites/default/files/cesspools.pdf.
[49] Lisa Kresge and Ron Strochlic, *Clearing the Air: Mitigating the Impact of Dairies on Fresno County's Air Quality and Public Health*, CAL. INST. FOR RURAL STUDIES 8, (Jul. 2007).
[50] Brendan Borrell, *California's Fertile Valley is Awash with Air Pollution*, MOTHERJONES (Dec. 10, 2018), https://www.motherjones.com/environment/2018/12/californias-fertile-valley-is-awash-in-air-pollution/. *See also Policies and Procedures for Poor Outdoor Air Quality Days*, SAN JOAQUIN VALLEY AIR POLLUTION CONTROL DIST., http://www.valleyair.org/programs/ActiveIndoorRecess/intro.htm (last visited Oct. 12, 2021).

Joaquin Valley communities with increased air and water pollution from factory farm dairies subsidized by the LCFS – harms the Legislature sought to address when it enacted AB 32 and AB 197.[51] For all of these reasons, CARB should amend the LCFS to exclude all fuels derived from biomethane from swine and dairy manure.[52] If CARB fails to do so, it must at a minimum amend the regulation to capture the full life cycle of associated greenhouse gas emissions in both the established Tier 1 pathway and the customized Tier 2 pathways and amend the regulation to ensure credited reductions are additional.[53]

### A. The fuel pathways for biomethane from dairy and swine manure fail to achieve the maximum technologically feasible and cost-effective emissions reductions.

AB 32 mandates that the early action measure regulations adopted by CARB "shall achieve the maximum technologically feasible and cost-effective reductions in greenhouse gas emissions from those sources or categories of sources, in furtherance of achieving the statewide greenhouse gas emissions limit."[54] CARB explicitly premised the adoption of the LCFS regulation on this mandate.[55] As written and in practice, however, the LCFS regulation does not incentivize, let alone achieve, the maximum emissions reductions in this sector due to the program's inflation of carbon intensity values for factory farm gas. These inflated credit values are the result of CARB's narrow interpretation of the life cycle emissions for factory farm gas. Moreover, CARB's failure to ensure that credited emissions reductions are additional to what otherwise would have occurred inject invalid credits into the overall market and allow fuel producers to emit more pollution.

By setting overly narrow system boundaries for the life cycle analysis of factory farm gas, the LCFS fails to account for emissions associated with a true "well-to-wheels" analysis, exaggerating the emissions reductions attributed to this fuel. AB 32 requires that market-based compliance mechanisms only credit "additional" emissions reductions, and thus exclude reductions already required by law or that otherwise would occur.[56] However, CARB has allowed the LCFS program to award credits generated from non-additional reductions at factory farms. Factory farm gas projects rely on multiple sources of revenue from grant programs, federal programs, and the Aliso Canyon settlement – all of this supplementary revenue renders reductions from factory farm gas projects either partially or fully non-additional, yet CARB has made no effort to prevent these non-additional credits from entering the market.

Because CARB has allowed grossly inflated carbon intensity scores to distort the market, and allowed non-additional reductions to generate credits, the LCFS perversely incentivizes bigger dairy and pig operations to generate more methane. As a result, credit revenue from dairy factory

[51] CAL. HEALTH & SAFETY CODE § 38501 (the Legislature named the "exacerbation of air quality problems, a reduction in the quality and supply of water to the state from the Sierra snowpack, a rise in sea levels resulting in the displacement of thousands of coastal businesses and residences, damage to marine ecosystems and the natural environment, and an increase in the incidences of infectious diseases, asthma, and other human health-related problems" as potential adverse impacts of climate change.)
[52] CAL. CODE REGS. TIT. 17 § 95488.3; CAL. CODE REGS. TIT. 17 § 95488.9(f)(1). *See* proposed amendments in Appendix A.
[53] *See* proposed amendments in Appendix B.
[54] CAL. HEALTH & SAFETY CODE § 38560.5.
[55] CAL. AIR RES. BD., RES. 19-27, (Nov. 21, 2019).
[56] CAL. HEALTH & SAFETY CODE § 38562(d)(2).

farm gas can be a more reliable income stream than milk revenue, propping up this high-emissions industry and further polluting nearby communities. Additionally, the financial windfall from these over-valued credits is traded to offset emissions from LCFS deficit holders. Together and separately, each of these violations undermines the LCFS program and constitutes a failure to achieve the maximum technologically feasible and cost-effective emissions reductions from transportation fuels in violation of AB 32.

### 1. The fuel pathways for biomethane from dairy and swine manure fail to incorporate life-cycle emissions, leading to inflated credits.

The LCFS over-values credits awarded to factory farm gas operations because the program omits significant emissions from the factory farm gas life cycle. Neither the established Tier 1 nor the customized Tier 2 pathways for biomethane from dairy and swine manure capture the greenhouse gas emissions associated with the full life cycle of factory farm gas. The pathways ignore both upstream and downstream emissions. In addition to setting overly narrow system boundaries, the factory farm gas life cycle analyses fail to properly account for the fact that the methane purportedly captured in the production of factory farm gas is intentionally created, resulting in an even more misleading accounting of associated climate harms. When the resulting inflated credits are traded, they allow LCFS deficit holders to achieve less than the required maximum technologically feasible and cost-effective reductions.

The LCFS requires a full "well-to-wheels" life cycle analysis to account for all emissions associated with a given fuel.[57] Such well-to-wheels accounting requires Tier 2 pathways to include "a description of all fuel production feedstocks used, including all pre-processing to which feedstocks are subject."[58] Likewise, applicants must provide:

> a detailed description of the calculation of the pathway CI. This description must provide clear, detailed, and quantitative information on process inputs and outputs, energy consumption, greenhouse gas emissions generation, and the final pathway carbon intensity, as calculated using CA-GREET3.0. Important intermediate values in each of the primary life cycle stages shall be shown. *Those stages include but are not limited to feedstock production and transport*; fuel production, fuel transport, and dispensing; co-product production, transport and use; waste generation, treatment and disposal; and fuel use in a vehicle.[59]

Feedstocks are the raw materials processed into fuel. The feedstock for factory farm gas is manure. Therefore, emissions from manure production and "pre-processing" must be included in the life cycle analysis for Tier 2 applicants. But the LCFS and CARB's implementation does not require their inclusion. For example, CalBioGas Kern Cluster's recent application begins the data-listing portion of its lifecycle analysis with the Dairy Livestock Input Data table.[60] This table does not provide an adequate analysis of the feedstock production energy input. In fact, this lifecycle

[57] CAL. CODE REGS. TIT. 17 § 95481(a)(66).
[58] CAL. CODE REGS. TIT. 17 § 95488.7(a)(2)(A)(2).
[59] CAL. CODE REGS. TIT. 17 § 95488.7(a)(2)(B) (emphasis added).
[60] CAL. AIR RES. BD., Low Carbon Fuel Standard Tier 2 Pathway Application B0198, *available at* https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0198_cover.pdf.

analysis contains no analysis pertaining to the emissions from the generation and processing of manure to produce the feedstock.

Accounting for the greenhouse gas emissions from the production and "pre-processing" of dairy or pig manure must include the inputs and infrastructure necessary to sustain a dairy cow or a pig: its food and water, the methane animals produce through enteric fermentation, the construction and maintenance of the lagoons required to hold manure, trucking livestock and other inputs, combustion of fuels at the dairy facility for electricity, and more. But the LCFS factory farm gas pathways only begin after the production of the manure itself, leaving out all upstream emissions generated formulating that manure.[61]

The regulation further enumerates that, "for fuels utilizing agricultural crops for feedstocks, the description [of feedstocks in the life cycle analysis report] shall include the agricultural practices used to produce those crops. This discussion shall cover energy and chemical use, typical crop yields, feedstock harvesting, transport modes and distances, storage, and pre-process (such as drying or oil extraction)."[62] In the Tier 2 pathways for ethanol production, this provision has been interpreted to include production and pre-processing of corn, the feedstock for ethanol. Similarly, the LCFS requires pathways that utilize organic material to "demonstrate that emissions are not significant beyond the system boundary of the fuel pathway," upon request.[63] Yet in the case of factory farm gas, none of the production and pre-processing of the feedstock is considered, making it an outlier in the LCFS program and out of compliance with section 95488.7.

The failure to include production and pre-processing of manure when calculating life cycle emissions is even more problematic because a common feed for dairy cows in California is distillers grains, a "co-product" of ethanol production. The designation of distillers grains as a "co-product" allows ethanol producers to split the emissions from corn production between the ethanol and distillers grains by weight, decreasing ethanol's carbon intensity in the LCFS analysis.[64] One ethanol industry blog noted that "the biggest factor for most of the low-CI scoring [ethanol] plants is the proportion of wet distillers grains sold locally."[65] Distillers grains are granted the "co-product" designation by virtue of the revenue they generate when sold as animal feed but because LCFS factory farm gas pathways do not account for production and pre-processing of manure, the emissions associated with distillers grains are never accounted for by the LCFS at all despite its

[61] CAL. AIR RES. BD., *Compliance Offset Protocol Livestock Projects* (Nov. 14, 2014), Table 4.1, Description of all GHG Sources, GHG Sinks, and GHG Reservoirs; *see also* CAL. AIR RES. BD., Response to Animal Defense Legal Fund Comment, https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/new_temp_carb_response.pdf (CARB arguing that "Emissions from existing CAFO operations are accounted for, but do not include emissions associated with enteric methane and animal feed use because these emissions should more appropriately be allocated to and associated with the preexisting underlying, non-fuel product stream, and are thus excluded from the system boundary in the Board approved Tier 1 Calculator.")

[62] CAL. CODE REGS. TIT. 17 § 95488.7(a)(2)(A)(2).

[63] CAL. CODE REGS. TIT. 17 § 95488.9(f)(2)(B).

[64] CAL. AIR RES. BD., *Tier 1 Simplified CI Calculator Instruction Manual: Starch and Fiber Ethano*l (Aug. 13, 2018), *available at* https://ww2.arb.ca.gov/resources/documents/lcfs-life-cycle-analysis-models-and-documentation.

[65] Susanne Retka Schill, *Meeting the California Low Carbon Challenge*, ETHANOL PROD. MAGAZINE (Feb. 8, 2016), http://ethanolproducer.com/articles/13000/meeting-the-california-low-carbon-challenge.

role in two transportation fuel life cycles.[66] Some ethanol plants also incorporate factory farm gas from dairies as a process fuel, further lowering the ethanol's carbon intensity.[67] These "negative" upstream emissions from factory farm gas and negative downstream emissions from the use of distillers grains as dairy feed both reduce the LCFS carbon intensity of ethanol, which would likely not receive credits otherwise.

While downstream emissions from distillers grains in ethanol production are accounted for by excluding them from that fuel's carbon intensity calculation, the by-product of dairy and swine factory farm gas, digestate – which would *increase* the carbon intensity of factory farm gas – remains largely unaccounted for, even though the LCFS requires all Tier 2 pathway application lifecycle analyses to include:

> a description of all co-products, byproducts, and waste products associated with production of the fuel. That description shall extend to all processing, such as drying of distiller's grains, applied to these materials after they leave the fuel production process, including processing that occurs after ownership of the materials passes to other parties.[68]

Demonstrably, any storage, land-application, or composting of digestate falls within the meaning of the term 'process,' but the LCFS does not require, and no factory farm gas lifecycle analyses include emissions from digestate.

The process of anaerobic digestion can result in "changes in the manure composition" that alter ammonia ($NH_3$) and nitrous oxide ($N_2O$) emissions, depending upon the management strategy used.[69] In the United States, liquid effluent from factory farm gas production is primarily applied to land as fertilizer and digestate solids are composted and then land applied or used for bedding on-farm (See Figure 4 in Appendix C).[70] Digestate land application and composting result in emissions of nitrous oxide, which has a global warming potential 265 to 298 times that of carbon dioxide.[71] A recent study found that digested solids that were composted released such significant

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[66] Somerville, Scott, Daniel A. Sumner, James Fadel, Ziyang Fu, Jarrett D. Hart, and Jennifer Heguy, *By-Product Use in California Dairy Feed Has Vital Sustainability Implications*, ARE UPDATE 24(2) (2020) 5, University of California Giannini Foundation of Agricultural Economics.

[67] For example, a Tier 2 ethanol pathway for a plant in Pixley, California uses biomethane from dairies as a process fuel to transform starch from corn into ethanol. *GFP Ethanol, LLC dba Calgren Renewable Fuels GREET Pathway for the Production of Ethanol from Corn and Fueled by NG and Biogas from Two Local Dairy Digesters* (Sept. 20, 2018), https://ww2.arb.ca.gov/sites/default/files/classic//fuels/lcfs/fuelpathways/comments/tier2/t2n-1279_report.pdf.

[68] CAL. CODE REGS. TIT. 17 § 95488.7(a)(2)(A)(8).

[69] Michael A. Holly et al., *Greenhouse gas and ammonia emissions from digested and separated dairy manure during storage and after land application Agriculture*, 239 ECOSYSTEMS AND ENV'T 410, 418 (Feb. 15, 2017), https://doi.org/10.1016/j.agee.2017.02.007.

[70] Ron Alexander, *Digestate Utilization in The U.S.*, 53 BIO CYCLE 56 (Jan. 2012), https://www.biocycle.net/digestate-utilization-in-the-u-s/. Mohanakrishnan Logan & Chettiyappan Visvanathan, *Management strategies for anaerobic digestate of organic fraction of municipal solid waste: Current status and future prospects*, 37 WASTE MGT. & RES. 27, 27 (Jan. 28, 2019), https://doi.org/10.1177/0734242X18816793.

[71] Holly, *supra* note 69 at 411. Alun Scott & Richard Blanchard, *The Role of Anaerobic Digestion in Reducing Dairy Farm Greenhouse Gas Emissions*, 13 SUSTAINABILITY 2 (Mar. 1, 2021) https://doi.org/10.3390/su13052612; *Understanding Global Warming Potentials*, ENV'T PROT. AGENCY, https://www.epa.gov/ghgemissions/understanding-global-warming-potentials (last visited Oct. 21, 2021).

nitrous oxide emissions relative to undigested manure solids that the climate benefits of the captured methane from the digestion process were cancelled out.[72] Additionally, many operators choose to store digestate in open-air lagoons. Open-air storage can release methane, potentially negating methane captured during digestion, as well as ammonia, which is harmful to nearby communities in the San Joaquin Valley and a $PM_{2.5}$ precursor.[73]

Despite the significant emissions associated with digestate and the high global warming potential of methane and nitrous oxide, the LCFS fails to fully account for this inevitable by-product of factory farm gas production. Digestate treatment and storage is within the Tier 1 system boundary for anaerobic digestion of dairy and swine manure (described as "effluent"), but the pathway does not contemplate emissions associated with effluent after storage.[74] In contrast to Tier 1, the Tier 2 system boundary in the CA GREET3.0 calculator includes emissions from "AD Residue Applied to Soil," in other words, digestate that is land applied.[75] In practice, however, digestate is not mentioned in several recent Tier 2 applications for cluster projects.[76] Further, in responding to a comment criticizing a project's lack of accounting for digestate emissions, the applicant responded in a letter to CARB that "land application of effluent is outside of the scope of the project."[77] These contradictory descriptions of the system boundary as related to digestate highlight an inconsistent approach to the quantification of emissions from digestate. Moreover, neither the pathways nor the project application materials seem to account for digestate uses other than land application. This excludes any emissions associated with the solids composting. By failing to account for downstream emissions associated with land application and the massive nitrous oxide emissions from solids composting, CARB's life cycle analysis omits significant greenhouse gas emissions from factory farm gas production and further inflates the factory farm gas credit value.

The factory farm gas life cycle analyses also fail to include downstream emissions associated with transport. The LCFS factory farm gas pathways mention, but do not require reporting of inputs to calculate emissions generated from the refining and transport of factory farm gas. For example, the Tier 1 Calculator for factory farm gas *can* quantify emissions leaked or

[72] Holly, *supra* note 69 at 414, 418.
[73] *See generally* Yun Li et al., *Manure digestate storage under different conditions: Chemical characteristics and contaminant residuals*, 639 SCI. OF THE TOTAL ENV'T 19 (Oct. 15, 2018), https://doi.org/10.1016/j.scitotenv.2018.05.128 (discussing the impacts of open storage).
[74] CAL. AIR RES. BD., Tier 1 Simplified CI Calculator Instruction Manual: Biomethane from Anaerobic Digestion of Dairy and Swine Manure (Aug. 13, 2018), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/ca-greet/tier1-dsm-im.pdf?_ga=2.63225775.1254208748.1633995805-239480191.1598055085.
[75] *LCFS Life Cycle Analysis Models and Documentation: California GREET3.0 Model,* CAL. AIR RES. BD., https://ww2.arb.ca.gov/resources/documents/lcfs-life-cycle-analysis-models-and-documentation (last visited July 29, 2021).
[76] *See* CAL. AIR RES. BD., *Fuel Pathway Table: Current Fuel Pathways*, *available at* https://ww2.arb.ca.gov/resources/documents/lcfs-pathway-certified-carbon-intensities (last visited Oct. 19, 2021).
[77] Letter from Michael D. Gallo, Gallo Cattle Company Regarding "Tier 2 Pathway Application: Application No. B0089" (June 26, 2020), on file with CAL. AIR RES. BD., https://ww2.arb.ca.gov/sites/default/files/classic//fuels/lcfs/fuelpathways/comments/tier2/b0089_response.pdf.

vented from the digester and associated pipeline infrastructure—but the applicant is not *required* to calculate it.[78]

In addition to the failure to account for various upstream and downstream emissions from factory farm gas production, the LCFS life cycle analyses do not address the fact that these emissions are associated with *intentionally created* methane. LCFS factory farm gas pathways are intended to credit "reduction[s] of greenhouse gas emissions achieved by the voluntary capture of methane" or "avoided methane emissions."[79] This structure is premised on the idea that the manure used to produce the gas is unavoidable waste, whose emissions would not otherwise be diverted. But the massive quantity of manure methane emissions that CARB seeks to mitigate is the result of the intentional liquification of the manure, one of multiple manure management methods. While necessary to produce factory farm gas, the production of vast quantities of liquified manure is by no means an inevitable result of dairy or pig farming.[80] Alternative manure management techniques are available. Techniques such as solid-liquid separation, scrape and vacuum collection of manure, composting, and pasture-based practices are all viable methods of manure management that would avoid the methane emissions caused by open-air lagoons of liquid manure. Preliminary findings from CARB's Dairy and Livestock Greenhouse Gas Emissions Working Group indicate that these methods of manure management may offer more cost-effective methane emissions reductions than anaerobic digestion and may deliver additional environmental and health benefits, such as reduced impact on water quality.[81] Avoiding manure generation and reducing the amount of manure that has to be managed is the best way to protect human and animal health, along with the environment (see Figure 3 in Appendix C on Waste Management Hierarchy).[82] But the LCFS program does the opposite of promoting dairy manure avoidance or even lower-emissions manure management practices. Instead, the LCFS program has created a new revenue stream for factory farms based on the manure itself – the source of the methane the program seeks to reduce – incentivizing the production and liquification of manure as though it were a cash crop.

Additionally, "even RNG from waste methane can have negative climate impacts relative to the most likely alternative of flaring, not venting, the methane."[83] Flaring, like other forms of combustion, converts methane to carbon dioxide, reducing the net emissions impact. Flaring is a ubiquitous, low cost means of reducing methane. Though flaring is not a sustainable means to

[78] CAL. AIR RES. BD., *Tier 1 Simplified CI Calculator Instruction Manual: Biomethane from Anaerobic Digestion of Dairy and Swine Manure* 1, 8–9, 13–14 (Aug. 13, 2018), https://ww2.arb.ca.gov/sites/default/files/classic//fuels/lcfs/ca-greet/tier1-dsm-im.pdf?_ga=2.153600376.1744114239.1608082460-1114251839.1598731081.

[79] CAL. CODE REGS. TIT. 17 § 95488.9(f).

[80] *Animal Agriculture in the U.S. – Trends in Production and Manure Management*, LIVESTOCK AND POULTRY ENV'T LEARNING CMTY. (Mar. 5, 2019), https://lpelc.org/animal-agriculture-in-the-u-s-trends-in-production-and-manure-management/.

[81] CAL. AIR RES. BD., *Findings and Recommendations: Subgroup 1: Fostering Markets for Non-digester Projects, Senate Bill 1383 Dairy and Livestock Working Group* 3 (Oct. 12, 2018), https://ww2.arb.ca.gov/sites/default/files/2020-11/dsg1_final_recommendations_11-26-18.pdf.

[82] A reduction of waste is the preferred management method in the Environmental Protection Agency's waste management hierarchy for decision-making. *Waste Management Hierarchy and Homeland Security Incidents,* ENV'T PROT. AGENCY, https://www.epa.gov/homeland-security-waste/waste-management-hierarchy-and-homeland-security-incidents (last visited Oct. 12, 2021).

[83] Emily Grubert, *At Scale, Renewable Natural Gas Systems Could be Climate Intensive: The Influence of Methane Feedstock and Leakage Rates*, 15 084041 ENV'T RES. LETTERS Aug. 2020, 2.

reduce emissions, it should be the baseline to which any emissions reductions associated with anaerobic digestion are compared.

Moreover, because factory farm gas can be sold as a fuel and used to generate significant supplemental revenue from LCFS credits, over time "it is not only possible but expected…to increase methane production beyond what would have happened anyway."[84] Any manure production that has been incentivized by LCFS credit revenue will also result in intentionally created methane, which according to one recent study, *is always GHG-positive*.[85]

Finally, the Agro-Ecological Zone Emissions Factor (AEZ-EF) used to measure emissions from land-use change by CA-GREET3.0, and therefore by Tier 2 applicants, fails to account for the full impacts from the industrial dairy and pig facilities producing factory farm gas.[86] CARB's Executive Officer may require fuel producers to include six specific "feedstock/finished biofuel combinations," in their calculations.[87] These feedstocks include corn, sugarcane, sorghum grain ethanol, soy, canola, and palm biomass-based diesel.[88] Apart from land-use change related to livestock grazing (which is rarely relevant to industrial livestock operations), the AEZ-EF model does not address the land-use change associated with industrial dairy farming which are required for the production of factory farm gas.[89]

The overly narrow life cycle analysis in the factory farm gas pathways not only undermines the program's capacity to incentivize reductions, but violates AB 32's mandate that "[T]he state board shall rely upon the best available economic and scientific information and its assessment of existing and projected technological capabilities when adopting the regulations required by this section."[90] Scientific literature provides a more complete account of greenhouse gases emitted during the life cycle of factory farm gas produced from dairy and pig facilities. These analyses incorporate emissions from feed production, enteric fermentation, farm management and operations, and the treatment, use, or disposal of digestate residues produced during anaerobic digestion in addition to manure management emissions.[91] Omitting these essential stages from the LCFS factory farm gas pathways neglects a significant portion of emissions involved in producing

[84] *Id.* at 5.
[85] *Id*. at 4.
[86] CAL. CODE REGS. TIT. 17 § 95488.3.
[87] CAL. CODE REGS. TIT. 17 § 95488.3(d).
[88] *Id*.
[89] Richard J. Pelvin et al., *Agro-ecological Zone Emission Factor (AEZ-F Model): A model of greenhouse gas emissions from land-use change for use with AEZ-based economic models* 3, 31 (Feb. 21, 2014), https://ww2.arb.ca.gov/sites/default/files/classic//fuels/lcfs/lcfs_meetings/aezef-report.pdf.
[90] CAL. HEALTH & SAFETY CODE § 38562 (e). In Resolution 19-27, CARB itself stated that the LCFS "was developed using the best available economic and scientific information and will achieve the maximum technologically feasible and cost-effective reductions in GHG emissions from transportation fuel used in California." CAL. AIR RES. BD., RES. 19-27, *supra* note 55.
[91] *See, e.g.,* E. M. Esteves et al., *Life cycle assessment of manure biogas production: A review,* 218 J. CLEAN PROD. 411–423 (2019), https://doi.org/10.1016/j.jclepro.2019.02.091; E. Cherubini et al., *Life cycle assessment of swine production in Brazil: a comparison of four manure management systems*, 87 J. CLEAN PROD. 68–77 (2015), https://doi.org/10.1016/j.jclepro.2014.10.035; V. Paolini et al., *Environmental impact of biogas: A short review of current knowledge*, 53, J. ENV'T SCI. HEALTH A 899–906 (2018), https://doi.org/10.1080/10934529.2018.1459076.

manure and, as a result, the pathway treats manure as if it is produced from thin air or as if lagoons of liquid manure occur naturally in the San Joaquin Valley. [92]

The LCFS regulation mandates a full accounting of the aggregate life cycle emissions from a given fuel. In CARB Resolution 19-27, the agency reiterated that the "[d]etermination of a fuel's energy demand and carbon intensity value is based on a "well-to-wheel" analysis, which includes production and processing, distribution, and vehicle operation.[93] And yet the factory farm gas pathways leave glaring gaps in the life cycle analysis beyond the narrow system boundaries. The premise that manure originates in manure lagoons ready for capture with no attendant emissions defies logic, yet CARB has embraced this to create an absurdly low carbon intensity value and inflated credit generating industry.

### 2. The fuel pathways for biomethane from dairy and swine manure fail to ensure that credited emissions reductions are additional to reductions that would have otherwise occurred.

The LCFS prohibits awarding credits for emissions reductions that are already required by law.[94] As a market-based compliance mechanism, however, the LCFS must also prohibit the award of credits for "any other greenhouse gas emission reduction that otherwise would occur."[95] While CARB promulgated the LCFS as an early action measure, CARB designed and implemented the LCFS as a market-based compliance mechanism. CARB itself described the LCFS as a market-based mechanism when promulgating amendments to the LCFS:

> The LCFS is a market-based approach designed to reduce the carbon intensity of transportation fuels by 10 percent by 2020, from a 2010 baseline. It is important to note that the Cap-and-Trade Program and the LCFS program have complementary, but not identical programmatic goals: Cap-and-Trade is designed to reduce greenhouse gasses from multiple sources by setting a firm limit on GHGs; the LCFS is designed to reduce the carbon intensity of transportation fuels. As a market-based, fuel-neutral program, the LCFS provides regulated parties with flexibility to achieve the most cost-effective approach for reducing transportation fuels' carbon intensity. . . .

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[92] A Naranjo et al., *Greenhouse Gas, Water, and Land Footprint Per Unit of Production of the California Dairy Industry Over 50 Years*, 103 J. DAIRY SCI. 3760–3773 (2020), https://www.journalofdairyscience.org/article/S0022-0302(20)30074-6/pdf; C. Alan Rotz et. al., *The Carbon Footprint of Dairy Production Systems Through Partial Life Cycle Assessment*, 93 J. DAIRY SCI. 1266–1282 (2010), https://doi.org/10.3168/jds.2009-2162; C. Alan Rotz, *Modeling Greenhouse Gas Emissions from Dairy Farms*, 101 J. DAIRY SCI. 6675–6690 (2018) https://www.sciencedirect.com/science/article/pii/S002203021731069X.

[93] CAL. AIR RES. BD., RES. 19-27, *supra* note 55; *see also* CAL. AIR RES. BD., *Appendix D: Draft Environmental Analysis* (Jan. 2, 2015), https://ww2.arb.ca.gov/sites/default/files/classic/regact/2015/lcfs2015/lcfs15appd.pdf.

[94] *See* CAL. CODE REGS. TIT. 17 § 95488.9(f)(1)(B) ("A fuel pathway that utilizes biomethane from dairy cattle or swine manure digestion may be certified with a CI that reflects the reduction of greenhouse gas emissions achieved by the voluntary capture of methane, provided that… the baseline quantity of avoided methane reflected in the CI calculation is additional to any legal requirement for the capture and destruction of biomethane.")

[95] CAL. HEALTH & SAFETY CODE § 38562(d)(2).

> ARB staff disagrees that the LCFS is fundamentally a command-and-control system. The LCFS is a fuel-neutral, market-based program that does not give preference to specific transportation fuels and instead bases compliance on a system of credits and deficits based on each fuel's carbon intensity. Carbon intensity (CI) is a measure of the GHG emissions associated with the various production, distribution, and consumption steps in the "life cycle" of a transportation fuel. It is difficult to respond with depth to this assertion because the commenter provides no specifics to support the claim that the LCFS is not market-based. Notably, the commenter does not describe what components of the program could be considered command-and-control.[96]

Additionally, CARB's descriptions of the LCFS program closely parallel the statute's definition of "market-based compliance mechanism." The defintion states in relevant part that a market-based compliance mechanism is: "A system of market-based declining annual aggregate emissions limitations for sources or categories of sources that emit greenhouse gases."[97] CARB explains that the LCFS has a "market for credit transactions," where "entities with credits to sell can opt to pledge credits into the market and entities needing credits must purchase their pro-rata share of these pledged credits."[98] CARB explains that credits are generated relative "to a declining CI benchmark for each year."[99] The LCFS exhibits many if not most of the features of a market-based compliance mechanism, including a Cap-and-Trade allowance-like system with yearly declinations,[100] transaction rules,[101] recordkeeping and auditing requirements,[102] an account system to manage credit transfers – the LCFS Reporting Tool and Credit Bank & Transfer System (LRT-CBTS),[103] and a portal that applicants must use to demonstrate compliance,[104] among others. In addition to CARB's interpretation, designation, and treatment of the program as a market-based

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[96] CAL. AIR RES. BD., *Final Statement of Reasons for Rulemaking, Including Summary of Comments and Agency Response* 679-681 (2015), *available at* https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2015/lcfs2015/fsorlcfs.pdf. *See also* CAL. AIR RES. BD., *Responses to Comments on the Draft Environmental Analysis for the Amendments to the Low Carbon Fuel Standard and Alternative Diesel Fuel Regulations* at B4-42 (2018), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2018/lcfs18/rtcea.pdf (CARB responding, "Because the LCFS is a market-based mechanism…"); CAL. AIR RES. BD., *Staff Discussion paper: Renewable Natural Gas from Dairy and Livestock Manure 6* (April 13, 2017), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/lcfs_meetings/041717discussionpaper_livestock.pdf (in which CARB staff note in 2017 discussion paper that additionality requirements for the LCFS *are* intended to be identical to those of the compliance offset protocol, "ensure any crediting is for GHG reductions resulting from actions not required by law or beyond business as usual").

[97] CAL. HEALTH & SAFETY CODE § 38505(k). Note that this is one of two definitions provided.

[98] CAL. AIR RES. BD., *LCFS Basics* (2019), *available at* https://ww2.arb.ca.gov/sites/default/files/2020-09/basics-notes.pdf (last visited Oct. 12, 2021).

[99] *Low Carbon Fuel Standard: About*, CAL. AIR RES. BD., https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/about (last visited Oct. 12, 2021).

[100] *See* CAL. CODE REGS. TIT. 17 §§ 95482 – 95486.

[101] *See* CAL. CODE REGS. TIT. 17 § 95491.

[102] *See* CAL. CODE REGS. TIT. 17 § 95491.1.

[103] CAL. CODE REGS. TIT. 17 § 95483.2(b). ("The LRT-CBTS is designed to support fuel transaction reporting, compliance demonstration, credit generation, banking, and transfers.").

[104] *See* CAL. AIR RES. BOARD, *Low Carbon Fuel Standard – Annual Reporting and Verification User Guide* 3-4 (Aug. 9, 2021), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/guidance/Reporting_and_Verification_User_Guide.pdf.

mechanism and the overall structure of the regulation evincing the same, the designation of California's LCFS as a market-based mechanism is ubiquitous in academic and technical literature.[105]

Because the LCFS is a market-based compliance mechanism, section 38562(d)(2) of the Health & Safety Code requires that CARB ensure greenhouse gas emissions reductions in the LCFS are "in addition to any greenhouse gas emission reduction otherwise required by law or regulation, and any other greenhouse gas emission reduction that otherwise would occur."[106] Additionality requirements are essential for market-based programs that operate with a declining emissions benchmark, like the LCFS. Because regulated parties are permitted to emit above the benchmark so long as they offset these emissions with the purchase of credits, the LCFS must ensure that credits reflect reductions that are additional to claim a net reduction. The additionality requirement enumerated in the LCFS currently is far too narrow. It requires only that reductions are "additional to any legal requirement for the capture and destruction of biomethane."[107] This weak language incorporates only one of the two prongs required by AB 32 and does not ensure that reductions are additional to those from other LCFS incentives. CARB should grant this petition and amend the LCFS to include the broader additionality requirement.

As implemented to date, the LCFS program allows generation, sale, and use of factory farm gas credits that are plainly not additional when the methane reductions attributed to these LCFS credits result from, and are attibuted to, other programs and revenue sources. The LCFS 1) allows the same emissions reductions to be counted and credited by multiple emission reductions programs; and 2) awards credits to facilities receiving public funding for anaerobic digesters and related infrastructure, even when that funding is contingent on the construction of this equipment.

Numerous state and federal funding opportunities, incentives, and other subsidies are available for anaerobic digestors at factory farms. The Aliso Canyon Mitigation Agreement that CARB negotiated with Southern California Gas Company (SoCalGas) legally requires SoCalGas to pay for methane reductions at factory farm dairies in California.[108] The parties intended the agreement to mitigate the harms from the most damaging man-made greenhouse gas leak in United States history – SoCalGas' ruptured well that released at least 109,000 metric tons of methane before it was sealed.[109] SoCalGas funds the construction of digesters, which are intended to mitigate the leaked methane, and receives "mitigation credits" for the associated emissions reductions. The conditions of the agreement legally require changes intended to reduce emissions

[105] *See, e.g.,* CENTER FOR CLIMATE AND ENERGY SOLUTIONS, *Policy Considerations for Emerging Carbon Programs* 2 (June 2016), https://www.c2es.org/wp-content/uploads/2016/06/emerging-carbon-programs.pdf (describing Low Carbon Fuel Standards as an example of a market-based policy option, specifically of a baseline-and-credit program); *Regional Activities*, NATIONAL LOW CARBON FUEL STANDARD PROJECT, https://nationallcfsproject.ucdavis.edu/regional-activities/ (stating California's "LCFS is a market-based mechanism") (last visited Oct. 12, 2021).
[106] CAL. HEALTH & SAFETY CODE § 38562(d)(2).
[107] CAL. CODE REGS. TIT. 17 § 95488.9(f)(1).
[108] *People v. Southern California Gas Company,* Case Nos. BC602973 & BC628120, Appendix A to Consent Decree, Mitigation Agreement, *available at* https://www.arb.ca.gov/html/aliso-canyon/aliso-canyon-mitigation-agreement.pdf?_ga=2.146452402.708596706.1633463951-1172357510.1559256345.
[109] CAL. AIR RES. BD., *Responses to Frequently Asked Questions: Aliso Canyon Litigation Mitigation Settlement*, https://ww3.arb.ca.gov/html/aliso-canyon/aliso-canyon-faqs.pdf?_ga=2.67705041.1139070712.1533833674-1489205872.1532954259.

and yet at least eight facilities that receive this funding have also applied for LCFS credits for biomethane production. California Bioenergy sought LCFS credits for the S&S, Moonlight, Hamstra, Trilogy, Maple, T&W, BV Dairy, and Western Sky dairies.[110] These eight dairies are among seventeen that participate in the Aliso Canyon Mitigation Agreement.[111] Under no circumstances should mitigation for the Aliso Canyon disaster simultaneously qualify for credits generated and used in the LCFS.

Furthermore, the Legislature has appropriated public funds from the Greenhouse Gas Reduction Fund (GGRF) for several years to secure climate benefits. The California DDRDP, funded through the GGRF, provides funding for factory farm gas infrastructure. The California Department of Food and Agriculture describes the DDRDP as "financial assistance for the installation of dairy digesters in California, which will result in reduced greenhouse gas emissions."[112] Since 2015, the DDRDP has funded 117 dairy projects through the DDRDP, for a total of $195,025,884, and for which the CDFA claims 21,023,793 MTCO2e of methane reductions.[113] CARB also claims these reductions in a report to the Legislature on the climate benefits from these grants.[114] At least eight of these dairy projects, and likely many more, have received DDRDP grants and sought LCFS credits. For instance, California Bioenergy sought LCFS credits for the S&S, Moonlight, Hamstra, Trilogy, Maple, T&W, BV Dairy, and Western Sky dairies, all of which received DDRDP grants.[115] Importantly, the DDRDP purports to limit how grant monies may be used, but it does not prohibit a project from generating LCFS credits.[116]

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[110] *See* CAL. AIR RES. BD., Low Carbon Fuel Standard Tier 2 Pathway Application B0185, *available at* https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0185_cover.pdf; CAL. AIR RES. BD., Low Carbon Fuel Standard Tier 2 Pathway Application B0198, *available at* https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0198_cover.pdf.

[111] CAL. AIR RES. BD., *Aliso Canyon Natural Gas Leak, List of dairies involved in the mitigation agreement*, https://www.arb.ca.gov/html/aliso-canyon/aliso-canyon-mitigation-project-dairy-sites.pdf?_ga=2.216890962.535652136.1632321175-1949797088.1632171356.

[112] *Dairy Digester Research & Development Program*, CAL. DEPT. OF FOOD & AG., https://www.cdfa.ca.gov/oefi/ddrdp/ (last visited Oct. 19, 2021).

[113] CAL. DEPT. OF FOOD & AG., *CDFA Dairy Digester Research and Development Program Flyer (Sept. 2021)*, *available at* https://www.cdfa.ca.gov/oefi/ddrdp/docs/DDRDP_flyer_2021.pdf. (A list of all project recipients can be found at CAL. DEPT. OF FOOD & AG., *Dairy Digester Research and Development Program Project-Level Data (Sept. 17, 2021),* https://www.cdfa.ca.gov/oefi/DDRDP/docs/DDRDP_Project_Level_Data.pdf.)

[114] CAL. CLIMATE INVESTMENTS, *2021 California Climate Investments Annual Report*, Table 2 (2021), *available at* http://ww2.arb.ca.gov/sites/default/files/cap-and-trade/auctionproceeds/2021_cci_annual_report.pdf.

[115] *See* CAL. AIR RES. BD., Low Carbon Fuel Standard Tier 2 Pathway Application B0185 *available at* https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0185_cover.pdf; CAL. AIR RES. BD., Low Carbon Fuel Standard Tier 2 Pathway Application B0198, *available at* https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0198_cover.pdf.

[116] *See 2020 DDRDP Request for Grant Applications,* CAL. DEPT. OF FOOD & AG., https://www.cdfa.ca.gov/oefi/DDRDP/docs/2020_DDRDP_RGA_Public_Comments.pdf (last visited Oct. 5, 2021) ("Once a project has been awarded funds, the project may not: • Change or alter their biogas end-use during the project term. • Change the herd size beyond the limits established by the existing dairy operation's permits during the project term. • Change ownership of the dairy and/or partnership entities… • Duplicate equipment or activities that will receive funding from the California Public Utilities Commission (CPUC) pilot project authorized by California Health and Safety Code Section 39730.7(d)(2) (e.g., interconnection costs). *Note: Biogas conditioning and clean-up costs are allowable under the DDRDP.* • Commercial dairy operations that have already accepted, or plan to accept a grant award by CDFA's Alternative Manure Management Program (AMMP).") (emphasis added). Note that by allowing DDRDP funds to cover upgrade costs and other costs that the CPUC incentives program cannot, the CDFA has ensured that factory farm gas projects can benefit from multiple funding sources.

Other public funds authorized by the Legislature subsidize factory farm gas projects seeking to interconnect with utility natural gas pipelines.[117] This additional source of funds quickly became oversubscribed, prompting the California Public Utilities Commission to double the size of the program, all paid for with proceeds from sales of Cap-and-Trade allowances.[118] The California Public Utilities Commission went a step further, proposing in 2017 that participants in the SB1383 dairy biomethane Pilot Program could avoid the costs associated with gas production equipment, specifically gathering lines and "treatment equipment."[119] In what would be a major break with California energy precedent, ratepayers got to foot the bill.[120]

Projects receiving public funds should not, under the principles of additionality, also generate LCFS credits that allow emissions elsewhere; in this situation public funds essentially allow a transportation fuel deficit holder to emit more greenhouse gases and allow the factory farm gas project to generate a financial windfall. Under no circumstances did the Legislature intend for this perverse result to occur.

This is not a hypothetical concern: CARB recently proposed approval of Tier 2 Pathway applications B0185 and B0198 for eight dairy digester projects that have received both Dairy

[117] *See* CAL. PUB. UTILITIES COMM'N, Decision Adopting the Standard Renewable Gas Interconnection and Operating Agreement, R.13-02-008 COM/CR6/jnf at 12 (Dec. 17, 2020), *available at* https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M356/K244/356244030.PDF ("D.15-06-029 created a $40 million monetary incentive program "to encourage potential biomethane producers to build and operate biomethane projects within California that interconnect with the utilities" in accordance with AB 1900 (Gatto, 2012). This monetary incentive program was subsequently codified by AB 2313 (Williams, 2016)…The $40 million approved by the CPUC for the monetary incentive program is currently fully subscribed and there is a wait list for an additional $38.5 million worth of project funding.").

[118] *See Id.* at 14 ("After weighing the benefit of increased biomethane capture and use against the modest reduction in the California Climate Credit necessary to fully fund all existing biomethane projects, including those on the waitlist, we find it appropriate to provide an additional $40 million in funding from Cap-and-Trade allowance proceeds for the monetary incentive program to fund the biomethane projects that are currently on the wait list, bringing total funding to $80 million.").

[119] Decision establishing the implementation and selection framework to implement the dairy biomethane pilots required by Senate Bill 1383 at 7-8 (Dec. 18, 2017), *available at* https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M201/K352/201352373.PDF (". . . [T]he biomethane producers should own and operate the digesters and the biogas collection lines and treatment equipment to remove hydrogen sulfide and water from the raw biogas. Although we do not allow utilities to own these facilities, the costs associated with the biogas collection lines and treatment equipment will be recovered from the transmission rates of utility ratepayers through a reimbursement to the dairy biomethane producer. Natural gas utilities will own and operate all facilities downstream of the biogas conditioning and upgrading facilities, including pipeline laterals from such facilities, to the point of receipt and any pipeline extensions.").

[120] *Id.* ("Historically the costs of gathering, gas conversion to pipeline quality specifications, transportation from a gas production site to a conversion facility, transportation from the conversion facility to the pipeline, and pipeline interconnection costs have been borne by California natural gas producers as part of the commodity cost of gas since the late 1980s, as 'gathering costs' that the CPUC has ruled should be assigned to gas producers . . . . For the purposes of the Dairy Pilots, and consistent with the language of SB 1383, we are allowing cost recovery of the biogas collection lines owned by dairy biomethane producers, and allowing utilities to own and operate pipelines that carry biomethane from biogas conditioning and upgrading facilities to existing utility transmission systems and the interconnection facilities, without changing the requirements of D.89-12-016 for non-renewable natural gas producers . . . .").

Digester Research Development Program (DDRDP) and Aliso Canyon settlement funds.[121] Both programs claim credit for the methane reductions associated with the digester projects. If the LCFS system grants credits for these same reductions and allows a deficit holder to use those credits to demonstrate compliance with the LCFS, the reductions will be without question not additional. This absurd result allows excessive emissions and CARB must grant this petition to ensure LCFS program integrity.[122]

A wide range of other state and federal financial assistance is available to factory farms to support the construction and implementation of factory farm gas systems. This public financing comes in the form of grants, "production incentive payments, low-interest financing, tax exemptions and incentives, and permitting assistance."[123] The California Energy Commission provides funding for factory farm gas development through its Natural Gas Research and Development program.[124] The program provides $100 million annually to various fuel transportation projects, including factory farm gas.[125] The Environmental Quality Incentives Program (EQIP) is a federal program that provides matching funds for agricultural operations to contract with Natural Resources Conservation Service to develop technology or infrastructure with environmental benefits, including the construction of anaerobic digestion infrastructure.[126] The Rural Energy for America Program also provides federal funds to develop factory farm gas systems. *See* 7 U.S.C. § 8107.

The LCFS is demonstrably and avowedly a market-based compliance mechanism and is thus properly subject to the requirements of section 38562(d)(2). As the forgoing demonstrates,

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[121] These dairy digester projects also may participate in the California Public Utilities Commission pilot projects, as California Bioenergy projects, which would confer additional public funds. *See* CAL. PUB. UTILITIES COMM'N, Press Release: CPUC, CARB, and Department of Food and Agriculture Select Dairy Biomethane Proejcts to Demonstrate Connection to Gas Pipelines (December 3, 2018), *available at* https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M246/K748/246748640.PDF.

[122] This has caused confusion in Tier 2 application comments. For example, in comments on several applications, the Chair of the Board for the Kings County Board of Supervisors commented to ask how these applicants could participate in the LCFS without double counting reductions, given that they also participated in bioMAT. CARB did not respond to the comments. *See* CAL. AIR RES. BD., Comment Log Display, Doug Verboon, Comment 61 for Public Comments for LCFS Pathway Applications (tier2lcfspathways-ws) - 2nd Workshop (Nov. 25, 2020), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0106_verboon_comments.pdf (commenting on Tier 2 Application B0106); CAL. AIR RES. BD., Comment Log Display, Doug Verboon, Comment 60 for Public Comments for LCFS Pathway Applications (tier2lcfspathways-ws) - 2nd Workshop (Nov. 25, 2020), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0105_verboon_comments.pdf (commenting on Tier 2 Application B0105); CAL. AIR RES. BD., Comment Log Display, Doug Verboon, Comment 59 for Public Comments for LCFS Pathway Applications (tier2lcfspathways-ws) - 2nd Workshop (Nov. 25, 2020), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b104_verboon_comments.pdf (commenting on Tier 2 Application B0104).

[123] CAL. DAIRY CAMPAIGN, *Economic Feasibility of Dairy Digester Clusters in California: A Case Study* 45, (June 2013) https://archive.epa.gov/region9/organics/web/pdf/cba-session2-econ-feas-dairy-digester-clusters.pdf.

[124] *Natural Gas Research and Development Program*, CAL. ENERGY. COMM'N., https://www.energy.ca.gov/sites/default/files/2019-05/naturalgas_faq.pdf (last visited Oct. 18, 2021).

[125] *Clean Transportation Program*, CAL. ENERGY. COMM'N., https://www.energy.ca.gov/programs-and-topics/programs/clean-transportation-program (last visited Oct. 18, 2021).

[126] Environmental Quality Incentives Program, NAT'L RES. CONS. SERVICE, https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/.

private and public funding either have been or could be used to reduce methane emissions from pig and dairy facilities.[127] The LCFS should not allow fuel producers to generate credits from such non-additional reductions that deficit holders then use to justify their excess emissions, undermining the integrity of the LCFS program.

### 3. CARB's crediting of non-additional reductions and the inflated credit value from CARB's failure to account for the full quantity of life-cycle emissions both incentivize increased manure generation and manure liquification and constitute a failure to achieve the maximum technologically feasible and cost-effective greenhouse gas emissions.

Including inflated credits and credits for non-additional reductions contravenes the fundamental purpose of the LCFS: to reduce greenhouse gas emissions associated with transportation fuels. Inflated credits and credits for non-additional reductions have the effect of increasing manure generation and liquification, and its associated greenhouse gas emissions. Additionally, by purchasing inflated credits, deficit generators can more easily meet their compliance obligations without reducing their emissions. As a result of these deficiencies, the LCFS fails to achieve the maximum technologically feasible and cost-effective emissions reductions.

The factory farm gas industry is currently made profitable by the LCFS and similar programs. In fact, "[w]ell over 50% of the revenue from most projects generating credits comes from the [LCFS and Federal RIN] credits."[128] A recent report by a private investment firm on the promising growth prospects for factory farm gas concluded that "operators are not in the business of producing RNG, they are in the business of monetizing RNG's environmental attributes through various federal and state programs."[129] This is by design: the goal of the LCFS factory farm gas pathways is to incentivize the development of factory farm gas as an alternative fuel. This goal assumes incentivizing development of factory farm gas will result in a net decrease in manure methane emissions. But this assumption – the result of the deficient life cycle analysis and inclusion of non-additional reductions – is mistaken.

Increased profitability and growth of the factory farm gas industry does not necessarily entail a reduction in manure methane emissions from participating factory farms. Due to the poor design of the LCFS pathways for factory farm gas, the program encourages not only capture of manure methane, as intended, but increased production of that methane. Revenue from LCFS credits is an increasingly enticing source of potential profit for many factory farms. In the case of

[127] For this reason, LCFS credits also should not be issued to facilities that already operate digesters to produce low-CI electricity but seek to convert to producing biomethane, as no truly additional emissions reductions occur upon switching fuel production pathways.

[128] Annie AcMoody & Paul Sousa, *Western United Dairies, Interest in California Dairy Manure Methane Digesters Follows the Money*, CoBANK, at 4, (Aug. 2020), https://www.cobank.com/documents/7714906/7715329/Interest-in-California-Dairy-Manure-Methane-Digesters-Follows-the-Money-Aug2020.pdf/be11d7d6-80df-7a7e-0cbd-9f4ebe730b25?t=1603745079998.

[129] STIFEL EQUITY RESEARCH, *Energy & Power – Biofuels: Renewable Natural Gas, A Game-Change in the Race for Net-Zero* (March 8, 2021), *available at* https://static1.squarespace.com/static/53a09c47e4b050b5ad5bf4f5/t/60ad5a8802a04b71ca252414/1621973643907/Stifel+RNG+Analysis.pdf.

industrial dairy operations, these inflated credits provide certainty for operators seeking to maintain or expand herd sizes by providing significant additional income to supplement volatile milk revenue.[130] In 2017, CARB itself "assume[d] that California's LCFS credits [would] contribute revenue of $865,000" (assuming $100 per metric ton of $CO_2$).[131] The average LCFS credit price has increased significantly since this estimate was made, with 2020 prices hovering around $200 per metric ton of $CO_2$ (see Figure 5 in Appendix C). As a result, LCFS credits can be a more reliable income stream than milk. The LCFS not only encourages the development of factory farm gas systems but entrenches the underlying factory farms and even incentives expansion of these operations – the very sources of manure methane the factory farm gas credits are intended to reduce.

LCFS credits derive their value from recipients' ability to sell these credits to LCFS participants that generate deficits. Deficit-generating facilities include producers of conventional, high carbon intensity fuels such as gasoline and diesel fuels. This means that the life cycle analysis deficiencies and granting of credits for non-additional reductions not only incentivize increased emissions from factory farms, but also function to allow emissions in other transportation fuel industries.

Additionally, because economies of scale for anaerobic digesters favor larger herd sizes, factory farm gas producers have an incentive to produce more liquid manure, by either increasing herd size or participating in a digester cluster. This is the case for factory farm gas from both cows and pigs. In California, where most digesters use manure from lagoons to produce gas for pipeline transport, the technology requires a minimum of 2,000 cows to be economically feasible.[132] Scale is central to making the technology investment profitable, and "each additional 1,000 cows reduce the cost per cow of digester projects by 15-20%."[133] EPA AgSTAR admits that most methane digesters "are not economically viable until greater than 10,000 hogs are incorporated."[134]

The programmatic distortions described in parts III(A)(1) and (2) will drive the expansion of factory farms to supply factory farm gas, intentionally creating greenhouse gas emissions and localized pollution. CARB should rescind the factory farm gas pathways and preclude factory farm

[130] The milk price that dairy farmers receive has fluctuated considerably over the past two decades while costs have remained relatively constant. In 2015 and 2016, dairies experienced negative average residuals (see Table 2 in Appendix C). In 2017, annual milk revenue from "a farm with 2,000 cows producing 230 hundredweight per cow per year (the average in the San Joaquin Valley)" totaled nearly $7.6 million based on the milk price of $16.50 per hundredweight. After factoring in 2017 cost estimates by the California Department of Food and Agriculture (CDFA), the "net revenue at the typical dairy in the southern San Joaquin Valley amounted to zero." *See* Justin Ellerby, CAL. CENTER FOR COOP. DEV., *Challenges and Opportunities for California's Dairy Economy* 5 (2010); William Matthews and Daniel Sumner, *Contributions of the California Dairy Industry to the California Economy in 2018*, UNIV. OF CAL. AGRIC. ISSUES CENTER 17-18 (2019), https://aic.ucdavis.edu/wp-content/uploads/2019/07/CMAB-Economic-Impact-Report_final.pdf; Hyunok Lee. & Daniel A. Sumner, *Dependence on policy revenue poses risks for investments in dairy digester,* 72 CAL. AG. 226-235, 231 (2018), https://doi.org/10.3733/ca.2018a0037.

[131] Hyunok Lee & Daniel A. Sumner, *supra* note 130 at 232.

[132] GLOBAL DATA POINT, *California Incentives Spur Dairy Manure Methane Digester Developments*, GALE: BUSINESS INSIGHTS (Doc. No. A631672444) (Aug. 6, 2020).

[133] *Id*.

[134] ENV'T PROT. AGENCY, *AgSTAR, Project Development Handbook: A Handbook for Developing Anaerobic Digestion/Biogas Systems on Farms in the United States* 7-2, n. 58, https://www.epa.gov/sites/default/files/2014-12/documents/agstar-handbook.pdf (3rd Ed.).

gas from the LCFS program. In the alternative, CARB must amend the regulation to ensure that the carbon intensity values account for the full life cycle of dairy and pig facility emissions, including production and pre-processing of manure feedstock and downstream emissions associated with digestate land application and composting, and prohibit credits from non-additional reductions.

### B. The fuel pathways for biomethane from dairy and swine manure fail to maximize additional environmental benefits and interfere with efforts to improve air quality.

The California Legislature directed CARB to design regulations in a manner that considers overall societal benefits, including other benefits to the environment and public health, and ensure that activities taken pursuant to the regulations do not interfere with the state's efforts to improve air quality.[135] The Legislature also declared, in enacting AB 32, that it intended that CARB design reduction measures in a manner that "maximizes additional environmental and economic cobenefits for California, and complements the state's efforts to improve air quality."[136] But so long as the LCFS program includes factory farm gas and incentivizes factory farm expansions and the resulting air pollution, it cannot maximize environmental benefits or improve air quality. Moreover, given these impacts, CARB has not adequately considered overall societal costs in the regulation's design.

Monetizing a waste stream, like manure, does not eliminate that waste. The material impacts of manure (and later digestate) remain, whether or not it generates revenue for confined animal feeding operations. Nearby communities must still contend with the harms from the production, transportation, storage, and processing of this waste. If anything, monetizing a waste stream like manure exacerbates these harms by disincentivizing waste reduction. Incentivizing larger herd sizes and the liquification of more manure exacerbates existing pollution to air, water, and land, and the associated public health harms from industrial dairy and pig facilities, in addition to increased greenhouse gas emissions.[137] Additionally, factory farm gas technology creates new and additional environmental and public health harms, including through the storage, composting, and land application of digestate.

The 3.9 million residents of the San Joaquin Valley face increased health risks from breathing polluted air.[138] Industrial dairy operations emit the ammonia that contributes to the some

[135] CAL. HEALTH & SAFETY CODE § 38562(b)(4) ("Ensure that activities undertaken pursuant to the regulations complement, and do not interfere with, efforts to achieve and maintain federal and state ambient air quality standards and to reduce toxic air contaminant emissions."); CAL. HEALTH & SAFETY CODE § 38562(b)*(*6) ("Consider overall societal benefits, including reductions in other air pollutants, diversification of energy sources, and other benefits to the economy, environment, and public health."). *See also* CAL. HEALTH & SAFETY CODE § 38562.5 (making section 38562(b) applicable to regulations adopted to achieve reductions beyond the statewide greenhouse gas emissions limit).

[136] CAL. HEALTH & SAFETY CODE § 38501.

[137] *EPA Activities for Cleaner Air - San Joaquin Valley,* U.S. ENV'T PROT. AGENCY, https://www.epa.gov/sanjoaquinvalley/epa-activities-cleaner-air (last updated Mar. 6, 2019).

[138] Rory Carroll, *Life in San Joaquin valley, the place with the worst air pollution in America*, THE GUARDIAN (May 13, 2016), https://www.theguardian.com/us-news/2016/may/13/california-san-joaquin-valley-porterville-pollution-poverty.

of the worst long-term and short-term $PM_{2.5}$ pollution in the United States, which causes health problems such as asthma and has been linked to premature death as described *supra* in part II.[139] Industrial dairies are also the largest source of volatile organic compounds (VOCs), which contribute to the Valley's ozone (smog) air pollution crisis.[140] The digestate from factory farm gas production can emit even more hazardous VOCs during storage. An analysis of digestate from pig manure identified nearly 50 VOCs, 22 of which are labeled hazardous by the EPA.[141] Of these 22 hazardous VOCs, "8 were identified to be or likely to be carcinogenic, and 14 were identified to be harmful to other human organs or systems."[142]

Biogenic and anthropogenic emissions of VOCs and nitrogen oxides (NOx) both form ground-level ozone, the concentration of which is "directly affected by temperature, solar radiation, wind speed and other meteorological factors."[143] VOCs from corn silage at dairies alone would be the largest source in the Valley, with such emissions forming more ozone than the VOCs emitted by passenger vehicles.[144] Breathing in ground-level ozone can trigger a variety of dangerous health problems like throat irritation, chest pain, and congestion. It can also lead to severe lung damage, making infants and the elderly more vulnerable to health effects.[145] Ozone causes respiratory inflammation, increased hospital admissions for respiratory illness, decreased lung function, enhanced respiratory symptoms for people with asthma, increased school absenteeism, and premature mortality.[146] Evidence indicates that "adverse public health effects occur following exposure to elevated levels of ozone, particularly in children and adults with lung disease."[147] The San Joaquin Valley is classified as an extreme ozone nonattainment area for the 1997 and 2008 8-hour ozone standards.[148]

Industrial dairies are also the largest source of ammonia.[149] Factory farm gas production adds even more ammonia to San Joaquin Valley air: ammonia emissions from digestate increased 81% relative to raw manure.[150] Anaerobic digestion causes this increase in ammonia emissions, "due to an increased concentration of ammoniacal nitrogen."[151] In addition to its unpleasant odor,

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[139] *Id*.
[140] *See* SAN JOAQUIN VALLEY AIR POLLUTION CONTROL DIST., *2016 Plan for the 2008 8-Hour Ozone Standard, Appendix B*, *available at* http://valleyair.org/Air_Quality_Plans/Ozone-Plan-2016/b.pdf.
[141] Yu Zhang et al., *Characterization of Volatile Organic Compound (VOC) Emissions from Swine Manure Biogas Digestate Storage*, 10 ATMOSPHERE 1, 7 (2019), https://doi.org/10.3390/atmos10070411.
[142] *Id.* at 8.
[143] 73 FED. REG. 16436, 16437 (March 27, 2008).
[144] *See* Cody J. Howard, et al., *Reactive Organic Gas Emissions from Livestock Feed Contribute Significantly to Ozone production in Central California*, 44 ENV'T SCI. TECHNOL. 7 2309–2314 (2010), https://pubs.acs.org/doi/abs/10.1021/es902864u.
[145] *Id*.
[146] 73 Fed. Reg. 16436, 16440 (March 27, 2008).
[147] 83 FED. REG. 61346, 61347 (November 29, 2018).
[148] 75 FED. REG. 24409 (May 5, 2010); 77 FED. REG. 30088, 30092 (May 21, 2012).
[149] SAN JOAQUIN VALLEY AIR CONTROL DIST., 2018 Plan for the 1997, 2006, and 2012 PM2.5 Standards, Appendix B and Appendix G, *available at* http://valleyair.org/pmplans/documents/2018/pm-plan-adopted/B.pdf and http://valleyair.org/pmplans/documents/2018/pm-plan-adopted/G.pdf.
150 *See* Holly, et al., *Greenhouse gas and ammonia emissions from digested and separated dairy manure during storage and after land disposal*, AG., ECOSYSTEMS AND ENV'T 239 (2017) 410–419, https://www.researchgate.net/publication/313731233_Greenhouse_gas_and_ammonia_emissions_from_digested_and_separated_dairy_manure_during_storage_and_after_land_application.
[151] *Id.*

which degrades quality of life for nearby residents, ammonia "is corrosive and can be a powerful irritant to skin, eyes, and digestive and respiratory tissues."[152] Ammonia also reacts with oxides of nitrogen to form ammonium nitrate, the most significant component of the San Joaquin Valley's $PM_{2.5}$ pollution problem.[153] Homes located within a quarter mile of a dairy confined animal feeding operation have experienced higher concentrations of both ammonia and particulate matter.[154] In addition to the harms of PM2.5 describes above, larger particles of dust pollution from factory farm dairies also carry harmful allergens and endotoxins to nearby homes.[155] Endotoxins are a "powerful inflammatory agent" that can interact with other components and lead to respiratory issues, and allergens can worsen asthma symptoms.[156] A study in rural Washington found that higher exposure to pollution from confined animal feeding operations was associated with degraded lung function in children with asthma living nearby.[157]

Depending on the physical characteristics (temperature, pH, total solid content) and the speed and frequency of the mixing process used to treat it, digestate from factory farm gas production can release dangerous concentrations of hydrogen sulfide.[158] High hydrogen sulfide emission levels are associated with a total solid content of seven percent, "which is the most appropriate for pumping and mixing of dairy manure."[159] Increasing the speed and frequency of mixing while in storage can also contribute to higher hydrogen sulfide emissions from digestate.[160] These emissions can have severe impacts on human health, particularly farm workers, and can even lead to death.[161] Furthermore, hydrogen sulfide may be detected on fields where manure is sprayed for fertilizer, and the gaseous substance can be dispersed by the wind.[162] Hydrogen sulfide gas is a respiratory tract irritant and in higher concentrations or with longer exposure, it can cause a pulmonary edema.[163] The acute symptoms of hydrogen sulfide exposure include nausea, headaches, delirium, disturbed equilibrium, tremors, convulsions, and skin and eye irritation.[164]

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[152] D'Ann L. Williams et al., *Airborne cow allergen, ammonia and particulate matter at homes vary with distance to industrial scale dairy operations: an exposure assessment*, 10 ENV'T HEALTH 1, 3 (2011), https://doi.org/10.1186/1476-069X-10-72.
[153] SAN JOAQUIN VALLEY AIR CONTROL DIST., *2018 Plan for the 1997, 2006, and 2012 PM2.5 Standards*, Appendix B and Appendix G, *available at* http://valleyair.org/pmplans/documents/2018/pm-plan-adopted/B.pdf and http://valleyair.org/pmplans/documents/2018/pm-plan-adopted/G.pdf.
[154] D'Ann Williams et al., *Cow allergen (Bos d2) and endotoxin concentrations are higher in the settled dust of homes proximate to industrial-scale dairy operations*, 26 J. EXPOSURE SCI. ENV'T EPIDEMIOLOGY 42, 46 (2016) https://doi.org/10.1038/jes.2014.57.
[155] *Id.*
[156] *Id.* at 42.
[157] Christine Loftus et al., *Estimated time-varying exposures to air emissions from animal feeding operations and childhood asthm*a, 223 INT. J. OF HYGIENE AND ENV'T HEALTH 192 (2020) https://doi.org/10.1016/j.ijheh.2019.09.003.
[158] Fetra J. Andriamanohiarisoamanana et al., *Effects of handling parameters on hydrogen sulfide emission from stored dairy manure*, 154 J. ENV'T MGMT. 110, 112-115 (2011), https://doi.org/10.1016/j.jenvman.2015.02.003.
[159] *Id.* at 115.
[160] *Id.* at 114.
[161] *Id.* at 110.
[162] *See* Agency for Toxic Substances and Disease Registry, Toxicological Profile for Hydrogen Sulfide and Carbonyl Sulfide, DEP'T OF HEALTH AND HUMAN SERVICES 27-138 (2016), https://www.atsdr.cdc.gov/toxprofiles/tp114.pdf; *See also* Amy Schultz et al., *Residential proximity to concentrated animal feeding operations and allergic and respiratory disease*, 130 ENV'T INT. 104911, 1 (2019), https://doi.org/10.1016/j.envint.2019.104911.
[163] *See* Agency for Toxic Substances and Disease Registry, *supra* note 162 at 27-138.
[164] *Id.*

Finally, inhalation of high concentrations or long-term exposure to hydrogen sulfide can result in extremely rapid unconsciousness and eventual death.[165]

Factory farm dairies also pollute the San Joaquin Valley's groundwater, primarily through the disposal of manure by land application on crops, which causes severe public health impacts to nearby communities. The Valley contains about half of California's 300 public water systems that currently serve unsafe drinking water.[166] This number does not include private wells and water systems serving fewer than 15 households. Unsafe water systems are concentrated in small towns and unincorporated communities.[167] Common pollutants in water from factory farm runoff include nitrogen, phosphorus, heavy metals, and pharmaceuticals.[168]

Nitrate contamination of water resources is one of the most widely documented environmental impacts in California's dairy-producing regions. Most nitrate contamination comes from chemical fertilizers and animal manure applied to fields.[169] Nitrogen application often far exceeds the crops' rate of nutrient intake and the soil's ability to absorb nutrients, which then leach into groundwater.[170] A study by University of California Davis found that 96% of nitrate pollution in the region comes from nitrogen applied to cropland, a third of which is in the form of animal manure.[171] The 2019 Central Valley Dairy Representative Monitoring Program reported that nitrate concentrations exceeded the maximum contaminant level in groundwater at all of the 42 dairy facilities.[172] The program identified the application of manure to crop fields as the main source of groundwater contamination, while finding other unaccounted nitrogen sources – too many cows – at the dairy facilities contributing to the excessive nitrate contamination.[173]

Between 1999 and 2008, seven out of eight counties in the San Joaquin Valley had above-average rates of Sudden Infant Death Syndrome which can be caused by nitrate contamination. 70% of San Joaquin Valley households believed their tap water to be unsafe when surveyed in 2011, and nitrate pollution still appears to be rising.[174] A 2016 study that mapped out the mass flows of nitrogen in the San Joaquin Valley, estimated that the health costs of total nitrate leaching to groundwater caused $500 million per year in health damages.[175] Application of biogas digestate, either as a liquid or composted solids,[176] will continue the trend in nitrate contamination in the San

[165] *Id.*
[166] J.A. Del Real, *They Grow the Nation's Food, but They Can't Drink the Water*, N.Y. TIMES (May 21, 2019), https://www.nytimes.com/2019/05/21/us/california-central-valley-tainted-water.html.
[167] *Id*.
[168] JoAnn Burkholder et al., *Impacts from Waste from Concentrated Animal Feeding Operations on Water Quality*, 115 ENV'T HEALTH PERSPECTIVES 308, 308 (2007), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1817674/.
[169] *The Sources and Solutions: Agriculture*, U.S. ENV'T PROT. AGENCY, https://www.epa.gov/nutrientpollution/sources-and-solutions-agriculture (last updated July 30, 2020).
[170] *Id.*
[171] Harter et al., *Addressing Nitrate in California's Drinking Water with a Focus on Tulare Lake Basin and Salinas Valley Groundwater*, CENTER FOR WATERSHED SCI., UNIV. CAL., DAVIS, 17 (2012).
[172] CENTRAL VALLEY DAIRY REP. MONITORING PROG., *Summary Representative Monitoring Report* at 8 (Revised 2020).
[173] *Id*.
[174] *Id*. at 28.
[175] Ariel I. Horowitz et al., *A multiple metrics approach to prioritizing strategies for measuring and managing reactive nitrogen in the San Joaquin Valley of California*, 11 ENV'T RES. LETTERS 1, 11 (2016).
[176] Roger Nkoa, *Agricultural benefits and environmental risks of soil fertilization with anaerobic digestates: A review*, 34 AGRON. SUSTAIN. DEV. 473, 473–492 (2014).

Joaquin Valley in particular, compounding the increase from the LCFS's subsidizing increased manure production.

In addition to the emissions from digestate storage and land application, certain Tier 2 anaerobic digester facilities generate additional air pollutants using factory farm gas to power internal combustion engines that generate electricity onsite.[177] According to a 2015 study commissioned by CARB, this form of electricity generation produces criteria air pollutants, like NOx and particulate matter.[178] Furthermore, the study found this technology would increase NOx emissions by 10 percent, exacerbating air quality in the Valley, in violation of CARB's duty to ensure that its programs do not interfere with efforts to reduce air pollution.[179] The San Joaquin Valley Unified Air Pollution Control District also documents criteria pollutant emissions from electricity generation from factory farm gas.

For example, the Lakeview Dairy Biogas project in Kern County uses two internal combustion engines to produce over 1,000 kW of electricity on-site.[180] And this project, as permitted by the Air District with required pollution control technology, still emits 4.58 tons/year of NOx, 1.98 tons/year of PM10, and 3.18 tons/year of VOC.[181] Compared to a natural gas combined cycle plant in Avenal permitted by the Air District, the Lakeview digester project produces much higher levels of NOx, SOx, and VOC emissions per unit of electricity generated.[182] However, unlike the natural gas plant, Lakeview Dairy Biogas is not required to purchase offset emission reduction credits for the toxic air pollution emitted.[183] This facility *increases* air pollution. But California Bioenergy also sought for LCFS credits under a Tier 2 pathway application for the Lakeview Dairy project.[184] By allowing polluting facilities like Lakeview Dairy to generate credits for "renewable" natural gas, despite the harmful health impacts associated with emissions from the use of factory farm gas to generate electricity, CARB ignores its statutory obligation not to "interfere with, efforts to achieve and maintain federal and state ambient air quality standards and to reduce toxic air contaminant emissions."[185]

Because the LCFS has resulted in and will continue to incentivize an increase in dangerous pollution to the air, water, and land of the San Joaquin Valley, it fails to comply with section

[177] Arnaud Marjollet, *District Notice of Preliminary Decision*, San Joaquin Valley: Air Pollution Control (Mar. 22, 2016), http://www.valleyair.org/notiCes/Docs/2016/03-22-16_(S-1143770)/S-1143770.pdf; *see also* CAL. AIR RES. BD., Staff Summary, Tier 2 Pathway Application B0104, Lakeview Dairy, https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0104_summary.pdf.
[178] Marc Carreras-Sospedra et al., *Assessment of the Emissions and Energy Impacts of Biomass and Biogas Use in California* at 9-10 (Feb. 2015), https://ww2.arb.ca.gov/sites/default/files/classic//research/apr/past/11-307.pdf.
[179] *Id*. at 4, 13.
[180] Arnaud Marjollet, *supra* note 177.
[181] *Id*. at 14.
[182] Brent Newell, *Comments filed to California Energy Commission*, 4 (July 11, 2017), *available at* https://efiling.energy.ca.gov/GetDocument.aspx?tn=220110&DocumentContentId=29811; Arnaud Marjollet, *supra* note 177 at 20.
[183] *Id*.
[184] CAL. AIR RES. BD., Staff Summary, Tier 2 Pathway Application B0104, Lakeview Dairy, https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0104_summary.pdf.
[185] CAL. HEALTH & SAFETY CODE § 38562 (b).

38562(b) (4) and (6) of the Health and Safety Code. Additionally, the LCFS program violates the Legislature's intent, expressed in section 38501(h) of the Health and Safety Code, to maximize additional environmental benefits. CARB should grant this petition and exclude factory farm gas from the program to address these violations.

## IV. CARB MUST EVALUATE AND AMEND THE LCFS TO REMEDY ITS DISPROPORTIONATE ADVERSE AND CUMULATIVE IMPACTS ON LOW-INCOME AND LATINA/O/E COMMUNITIES IN VIOLATION OF STATE AND FEDERAL LAW.

CA 11135 and Title VI of the Civil Rights Act impose an affirmative duty on CARB to ensure that its policies and practices do not have a discriminatory impact on the basis of race.[186] CA 12955 additionally prohibits any practice or program that has a discriminatory effect on members of protected classes with respect to housing opportunities, including with respect to the use and enjoyment of dwellings.[187] AB 32 requires CARB to ensure any activities undertaken in compliance with the statute do not disproportionately impact low-income populations, consider the social costs of greenhouse gas emissions, and design regulations in a manner that is equitable. CARB must assess and prevent the disparate impacts imposed by the LCFS to avoid further harm to communities and to comply with California and federal law.

### A. LCFS credits and the subsequent trading of those credits incentivize activities that result in public health and environmental harms in disproportionately low-income and Latina/o/e communities, particularly in the San Joaquin Valley.

The LCFS harms communities that are disproportionately Latina/o/e and low-income. These harms stem from (1) the generation of revenue for factory farms in proportion to the amount of manure they produce, (2) the encouragement of anaerobic digestion resulting in additional environmental harms related to digestate, and (3) allowing credits to offset emissions and toxic air pollutants elsewhere in California. Each of these harms impact disproportionately low-income and Black, Indigenous, or People of Color communities.

In California, the award of LCFS credits for factory farm gas and the harms these credits incentivize are concentrated in the San Joaquin Valley.[188] Part III(A)(3) shows how the LCFS has the effect of exacerbating existing adverse impacts from factory farms by incentivizing increased production and liquification of manure. Part III(B) describes the extensive environmental and public health harms associated with the increase in liquified manure, as well as the new harms

[186] CAL. GOV'T CODE § 11135; 42 U.S.C. § 2000d.
[187] CAL. GOV'T CODE § 12955.8; CAL. CODE REGS. TIT. 2 § 12161.
[188] The San Joaquin Valley hosts 89% of the state's dairy cow population, and all but one of its counties are ranked nationally for milk sales (See Table 3, Appendix C). CAL. DEP'T OF FOOD AND AGRIC., Small Dairy Climate Action Plan 1 (2018), https://www.cdfa.ca.gov/oefi/research/docs/CDFA_Summary_of_Final_Report.pdf; *See* Lori Pottinger, *California's Dairy Industry Faces Water Quality Challenges*, Public Institute of California (May 20, 2019), https://www.ppic.org/blog/californias-dairy-industry-faces-water-quality-challenges/ (all 117 DDRDP projects are in the Valley).

from digestate. Incentivizing expansion of factory farms may also negatively affect community and economic growth.[189] Part II shows that San Joaquin Valley communities impacted by these new and exacerbated harms are disproportionately Latina/o/e and disproportionately low-income. Part II also describes the preexisting cumulative harms impacting these communities: San Joaquin Valley residents experience "the worst" air pollution nationally, and high levels of drinking water and groundwater contamination, largely due to agricultural runoff.[190]

The LCFS's market-based structure shapes the distribution of adverse impacts imposed by its incentives. In addition to the harmful activities incentivized at credit-generating factory farm gas facilities, the LCFS facilitates harm by the deficit-generating facilities that purchase credits. In order to provide for the trading of credits and deficits, LCFS treats greenhouse gas emissions as fungible. This approach allows CARB to justify the greenhouse gas emissions from gasoline and diesel, for example, in excess of the program's benchmark when the producers of these fuels purchase the equivalent credits. This is viewed by CARB as a positive attribute of the LCFS program because it "lets the market decide" how to achieve the targeted emissions reductions. But treating emissions as fungible ignores the localized impacts of co-pollutants associated with the production, transport, and combustion of various transportation fuels. These harms do not disappear simply because a gasoline producer pays to justify its polluting practices. The sale of factory farm gas credits to LCFS deficit generators prolongs their ability to pollute, rather than make direct emissions reductions.

Given that LCFS deficit generators include producers of conventional fuels, such as gasoline, diesel, and compressed natural gas, there is good reason to believe that LCFS deficit generating industries may disproportionately harm low-income and Black, Indigenous, and People of Color – specifically Latina/o/e – communities. The vast majority of California oil and gas production is concentrated in the San Joaquin Valley and around Los Angeles.[191] California communities living in proximity to oil and gas extraction are known to be disproportionately low income and Latina/o/e.[192] In the San Joaquin Valley, the oil and gas industries are concentrated in Kern County, where residents are subject to the cumulative harms of petrochemical extraction in

[189] Research indicates that "concentration and industrialization of agricultural production removes more money from the community of which the farm is located than when smaller farms operate in the area." CHELSEA MACMULLAN, HUMANE SOC'Y OF THE U.S., DAIRY CAFOS IN CALIFORNIA'S SAN JOAQUIN VALLEY at 26 (2007), https://www.humanesociety.org/sites/default/files/archive/assets/pdfs/farm/macmullan_apa-2007_final.pdf. The ratio of payroll versus emissions produced by concentrated factory farm dairies ranks worse than the petroleum industry. *Id*. at 27. Additionally, factory farm dairy employees face greater health risks because of their proximity to air pollutants and bacteria. Working in the industry has been associated with respiratory diseases such as Chronic Bronchitis, Occupational Asthma, and Pharyngitis. *Id*. at 29. Lack of access to healthcare due to language barriers or undocumented status likely exacerbates these harms. *Id*.

[190] *See* Carroll, *supra* note 138; *see also* Burkholder, *supra* note 168 at 308.

[191] Judith Lewis Mernit, *The Oil Well Next Door: California's Silent Health Hazard*, YALE ENV'T 360 (March 31, 2021), https://e360.yale.edu/features/the-oil-well-next-door-californias-silent-health-hazard ("Kern County, as the southern end of the San Joaquin Valley, produces 70 percent of California' oil; the bulk of the rest comes out of Los Angeles.")

[192] *See, e.g.* Kyle Ferrar, *People and Production: Reducing Risk in California Extraction,* FRACTRACKER ALLIANCE, (Dec. 17, 2020), https://www.fractracker.org/2020/12/people-and-production/; John C. Fleming et al., *Disproportionate Impacts of Oil and Gas Extraction on Already "Disadvantaged" California Communities: How State Data Reveals Underlying Environmental Injustice*, https://www.essoar.org/doi/pdf/10.1002/essoar.10501675.1 (concluding that 77% of permits for oil and gas wells were issued in "communities with a higher-than-average percentage of residents living in poverty and/or communities with a majority non-white population").

addition to those of factory farm dairies. As noted in part II, Kern County has seen a recent increase in LCFS applications for factory farm gas pathways. Residents of Kern County already experience higher than average rates of Chronic Lower Respiratory Disease (CLRD), asthma, and respiratory system cancers.[193] The death rate from CLRD in Kern County from 2013 to 2016 was twelve times higher than the state's CLRD death rate during the same time period.[194] Exacerbation of CLRD cases is a primary reason for CLRD-related deaths.[195] In 2015 to 2016, 31.1% of children in Kern County had been diagnosed with asthma at some point in their life, compared to 15.2% of children statewide and 13.7% and 10.3% in Los Angeles County and Sacramento County, respectively.[196]

In addition to emissions from extraction and refining of these polluting fuels, LCFS credits can also be used to offset emissions from the combustion. The co-pollutants from these emissions likely impose disproportionate adverse impacts on low-income and Black, Indigenous, and People of Color communities in California. A 2014 analysis found that exposure to $PM_{2.5}$ from cars, trucks, and buses "is not equally distributed" across California.[197] More specifically, the analysis concluded that on average, "African American, Latino, and Asian Californians are exposed to more $PM_{2.5}$ pollution from cars, trucks, and buses than white Californians. These groups are exposed to $PM_{2.5}$ pollution 43, 39, and 21 percent higher, respectively, than white Californians."[198] Additionally, "[T]he lowest-income households in the state live where $PM_{2.5}$ pollution is 10 percent higher than the state average, while those with the highest incomes live where PM2.5 pollution is 13 percent below the state average."[199] Given that California's major diesel trucking corridors, Interstate 5 and State Highway 99, both run north-south directly through the San Joaquin Valley,[200] emissions from combustion of deficit-generating transportation fuels may well impose additional cumulative impacts on the same communities impacted by dairy factory farms as well as fossil fuel extraction and refining.

[193] Yongping Hao et al., *Ozone, Fine Particulate Matter, and Chronic Lower Respiratory Disease Mortality in the United States*, 192(3) AM. J. OF RESPIRATORY AND CRITICAL CARE MED. 337, 337–341, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4937454/.
[194] Nick Perez, *Despite decades of cleanup, respiratory disease deaths plague California county*, ENV'T HEALTH NEWS (Dec. 4, 2018) https://www.ehn.org/chronic-respiratory-disease-california-2621765230/pollution-persists.
[195] Elizabeth Oelsner et al., *Classifying Chronic Lower Respiratory Disease Events in Epidemiologic Cohort Studies*, 13 ANNALS OF THE AM. THORACIC SOC'Y 1057, 1057 (July 2016) https://doi.org/10.1513/AnnalsATS.201601-063OC.
[196] *Summary: Asthma*, KIDSDATA, https://www.kidsdata.org/topic/45/asthma/summary?gclid=Cj0KCQiAst2BBhDJARIsAGo2ldWxDuxZNs3gzxS4Qj3s048YVqkp4LWQ_nwYs7DSID4FDRTTdSsgq1waAgyxEALw_wcB (last visited Oct. 21, 2021).
[197] UNION OF CONCERNED SCI., *Inequitable Exposure to Air Pollution from Vehicles in California 1 (Feb. 2019)*, https://www.ucsusa.org/sites/default/files/attach/2019/02/cv-air-pollution-CA-web.pdf
[198] *Id.*
[199] *Id.* at 2.
[200] David Lighthall and John Capitman, *The Long Road to Clean Air in the San Joaquin Valley: Facing the Challenge of Public Engagement* 8 (Dec. 2007), CENTRAL VALLEY HEALTH POL'Y INST., https://chhs.fresnostate.edu/cvhpi/documents/cvhpi-air-quality-report07.pdf

### B. CARB must amend the LCFS regulation to come into compliance with CA 11135, CA 12955, and Title VI of the Civil Rights Act of 1964 and to prevent further discrimination.

CARB has an affirmative duty under CA 11135 to ensure that its policies and practices do not disproportionately impact residents on the basis of race, color, national origin, or ethnic group identification.[201] CA 11135's prohibition on discrimination applies to the LCFS because it meets the criteria of a program that is "conducted, operated, or administered" by CARB, a California state agency.[202] CA 12955 prohibits activities that limit housing opportunities for members of protected classes, including activities and programs that interfere with the use and enjoyment of one's dwelling or that results in the location of toxic, polluting, and/or hazardous land uses in a manner that adversely impacts the enjoyment of residence, land ownership, tenancy, or any other land use benefit related to residential use. The state is subject to the prohibitions included in the Fair Employment and Housing Act.[203] Title VI of the Civil Rights Act of 1964 and implementing regulations prohibit disparate impact discrimination on the basis of race by recipients of federal funds.[204] As a recipient of federal funding, CARB is subject to Title VI.[205]

As described above, the LCFS exacerbates harms in some San Joaquin Valley communities twice over: once when it incentives the expansion of factory farm dairies and anaerobic digestion, and again when the resulting credits are sold to justify the pollution from conventional transportation fuel production, distribution, and combustion. Some (and likely all) of these harms are imposed on communities that are disproportionately Latina/o/e. Additionally, the LCFS has the effect of defeating one of the objectives of AB 32 on a discriminatory basis: to maximize additional environmental benefits and complement efforts to reduce air pollution.

Not only are there "equally effective alternative practices" to achieve the goal of reducing transportation emissions, there are alternative practices that are demonstrably both more effective and less discriminatory.[206] Reducing net greenhouse gas emissions from transportation fuels is an important and legitimate goal. Sadly, the LCFS factory farm gas pathways fail to accomplish it. Therefore, California's greenhouse gas emissions targets provide no credible justification for the LCFS's discriminatory impacts. Moreover, there are other, less harmful agricultural practices that CARB could encourage to reduce net emissions. Rather than monetize the source of greenhouse gas emissions and related co-pollutants, CARB could encourage the direct reduction of emissions at their source by supporting practices such as solid-liquid separation, scrape and vacuum

[201] CAL. GOV'T CODE § 11135.
[202] *Id*.
[203] CA Legis. 352 (2021), CAL. LEGIS. SERV. CH. 352 (A.B. 948), amending CAL. GOVT CODE 12955; 2 CCR 12005(v); 2 CCR 12060.
[204] 42 U.S.C. §2000d; 40 C.F.R. §7.
[205] CARB has received funds EPA, including, for example, over $11.8 million in 2020 to administer the Diesel Emissions Reduction Act. Soledad Calvino, *U.S. EPA awards over $11.8 million for clean diesel projects in California*, U.S. ENV'T PROT. AGENCY (San Francisco), Aug. 30, 2020, News Release, https://www.epa.gov/newsreleases/us-epa- awards-over-118-million-clean-diesel-projects-california.
[206] *See, e.g., Elston v. Talladega Count.*, 997 F. 2d at 1413.

collection of manure, composting, and pasture-based practices. Similarly, there are less harmful policy tools that could be used to produce these reductions.[207]

CARB bears the duty to evaluate the potentially discriminatory impacts of its policies and practices and to prevent these harms in the first place, which it failed to do in the design of the LCFS regulation and fails to do on an ongoing basis. To bring the LCFS into compliance with its civil right obligations, CARB must cease and desist from operating the LCFS program in such a way that results in unlawful, discriminatory impacts as proscribed by CA Gov't Code Sections 11135 and 12955, et seq., and Title VI of the Civil Rights Act of 1964. To this end, CARB must a) conduct a disparity analysis to evaluate the program and b) amend the LCFS regulation to ensure that it does not continue to disproportionately harm low-income and Latina/o/e communities. A disparity analysis must include an evaluation of the distribution of impacts from incentives created by credit generation, direct emissions from deficit generators facilitated by the trading of LCFS credits, and the distribution of emissions from the combustion of these fuels.[208]

### C. CARB failed to design the LCFS regulation in a manner that is equitable and fails on an ongoing basis to consider the social costs of greenhouse gas emissions and ensure that the LCFS does not disproportionately impact low-income communities.

AB 32 mandated several safeguards to ensure equity and protect low-income communities in California from potential adverse impacts associated with the act's implementation. Section 38562(b)(2) of California Health and Safety Code requires that CARB design regulations "in a manner that is equitable" and "[ensure] that activities undertaken to comply with the regulations do not disproportionately impact low-income communities" to the extent feasible.[209] Section 38562(b)(2) also mandates that CARB "consider overall societal benefits, including reductions in other air pollutants, diversification of energy sources, and other benefits to the economy, environment, and public health."[210] Section 38562.5 further mandates that, "when adopting rules and regulations pursuant to this division to achieve emissions reductions beyond the state greenhouse gas emissions limit and to protect the state's most impacted and disadvantaged

[207] Environmental justice critiques of pollution trading schemes for their tendency to result in localized pollution that disproportionately impacts low-income and people of color communities are longstanding. *See, e.g., Environmental Justice Advocates Blast Emissions Trading Guide*, 10 INSIDE EPA'S CLEAN AIR REPORT 9, 6-7 (April 29, 1999), *available at* https://www.jstor.org/stable/48520963; Lily N. Chinn, *Can the Market Be Fair and Efficient? An Environmental Justice Critique of Emissions Trading*, 26 *Ecol. L. Quart.* 1 (1999), http://www.jstor.org/stable/24114004; Letter to the Biden-Harris Transition Team Re: EPA Administrator Appointment from Over 70 Environmental Justice Groups (December 2, 2020), *available at* https://1bps6437gg8c169i0y1drtgz-wpengine.netdna-ssl.com/wp-content/uploads/2020/12/2020-12-2-Nichols-letter.pdf.

[208] LCFS fuels originating from factory dairy farms include electricity, renewable natural gas, hydrogen, bio-compressed natural gas, bio-liquefied natural gas, and bio-liquefied-regasified-and recompressed (Bio-L-CNG). CAL. CODE REGS. TIT. 17, § 95481 (defining biogas, biomethane, and all LCFS fuels produced from biomethane).

[209] CAL. HEALTH & SAFETY CODE § 38562(b)(2). See also *Ass'n of Irritated Residents v. State Air Res. Bd.*, 206 Cal. App. 4th 1487, 1489 (2012).

[210] CAL. HEALTH & SAFETY CODE § 38562.

communities," the state board shall consider social costs.[211] CARB is currently out of compliance with each of these mandates and, accordingly, must cease and desist operation of the LCFS factory farm gas pathways unless and until it comes into compliance.

Section 38562(b)(2)'s charge to protect "low-income communities" includes "persons and families whose income does not exceed 120 percent of the area median income, adjusted for family size [...] in accordance with adjustment factors adopted and amended from time to time by the United States Department of Housing and Urban Development pursuant to Section 8 of the United States Housing Act of 1937."[212] Area median income covers "the median family income of a geographic area of the state."[213] The residents of the San Joaquin Valley are precisely the low-income communities Sections 38562 seek to protect. As demonstrated above, the LCFS factory farm gas pathways have a disproportionate adverse impact on the basis of race and income, demonstrating CARB's failure to have designed the regulations in a manner that is equitable.

Finally, 38562(b)(2) requires consideration of overall societal benefits. CARB must amend the LCFS regulation to account for this and remedy these violations to come into compliance with AB 32. In Section 38562.5 of California Health and Safety Code, social costs means "an estimate of the economic damages, including, but not limited to, changes in net agricultural productivity; impacts to public health; climate adaptation impacts, such as property damages from increased flood risk; and changes in energy system costs, per metric ton of greenhouse gas emission per year."[214] The greenhouse gas emissions and associated co-pollutants from the production of factory farm gas has significant socials costs to public health, as discussed extensively in parts III and IV(B). Amending the LCFS to account for a serious consideration of the social costs of the emissions associated with both factory farm gas and the conventional fuels that generate deficits would not only bring CARB into compliance with Section 38562.5, but it would assist CARB in understanding and evaluating the inequitable distribution of adverse impacts in a manner that supports civil rights compliance, a described above.

## V. CARB'S LACK OF TRANSPARENCY DENIES THE PUBLIC THE ABILITY TO REVIEW AND CHALLENGE EXISTING REGULATIONS, INCLUDING THE LCFS PATHWAYS FOR BIOMETHANE FROM DAIRY AND SWINE MANURE.

Meaningful public participation and advocacy regarding the impacts of the LCFS program have been hindered by CARB's lack of transparency. Locations of facilities purchasing the credits generated by factory farm dairies in the San Joaquin Valley are unknown to the public and attempts to obtain trading data through the California Public Records Act has produced only heavily redacted records. Without readily available trading data, it is difficult to determine potential disparate impacts caused by both the incentives produced by credit generation and the offsetting role of credit trading within the LCFS program. Community groups and advocates should not have

[211] CAL. HEALTH & SAFETY CODE § 38562.5. Note that the 2018 amendments made the LCFS generate reductions beyond the statewide limit.
[212] CAL. HEALTH & SAFETY CODE § 50093.
[213] *Id*.
[214] CAL. HEALTH & SAFETY CODE § 38506.

to seek out this information to conduct their own analyses of CARB's potentially discriminatory policies. CARB's control over the trading data places the agency in the best position to assess the disparate impact produced by the LCFS. Moreover, CARB has a clear, affirmative duty to comply with AB 32, CA 11135, and Title VI and prevent a disparate impact from its policies and practices.

## VI. CONCLUSION

Since the Legislature enacted AB 32 in 2006, both the predicted and actual climate change-related harms have become more dire.[215] The methane generated by factory farm dairies in California alone accounts for approximately 45 percent of the state's total methane emissions that contribute to these harms.[216] And the Intergovernmental Panel on Climate Change recently declared a climate code red when it called for strong, sustained, and rapid methane reductions to stabilize our climate.[217]

CARB must grant this petition and reform the LCFS. Rather than allow factory farm gas reductions to substitute for emissions increases from the transportation sector, CARB should amend the LCFS to exclude factory farm gas from this pollution trading scheme.[218] If CARB instead decides to continue allowing Big Oil & Gas to offset their transportation fuel emissions with factory farm gas, then CARB must (1) ensure that the LCFS does not inflict disparate impacts in violation of CA 11135, CA 12955, and Title VI of the Civil Rights Act; and (2) adopt all alternative LCFS amendments requested here to ensure LCFS integrity and protections for rural communities.

CARB must take this opportunity to reform a pollution trading scheme that has gone off the rails. The LCFS incentivizes more of that which it purports to control, allows inflated and illusory credits from factory farm gas to authorize more emissions from transportation fuel, refuses to acknowledge the truth that liquefied manure is intentionally created and not somehow naturally occurring awaiting only abatement, and authorizes non-additional credits generated at projects receiving massive incentives from public funds and the Aliso Canyon settlement agreement. This pollution trading scheme merely shifts emissions; it benefits Big Oil & Gas to allow more pollution from their transportation fuels. It benefits, entrenches, and expands the industrial dairy and pig industry with a revenue stream more valuable than milk. And it benefits the gas utilities that

[215] *See, e.g.*, Thomas Fuller and Christopher Flavelle, *A Climate Reckoning in Fire-Stricken California*, N.Y. TIMES (Sept. 10, 2020), https://www.nytimes.com/2020/09/10/us/climate-change-california-wildfires.html; Christopher Flavelle, *How California Became Ground Zero for Climate Disasters*, N.Y. TIMES (Sept. 20, 2020), https://www.nytimes.com/2020/09/20/climate/california-climate-change-fires.html; Nadja Popovich, *How Severe Is the Western Drought? See For Yourself.*, N.Y. TIMES (Sept. 20, 2020), https://www.nytimes.com/interactive/2021/06/11/climate/california-western-drought-map.html.

[216] CAL. AIR RES. BD., Short-Lived Climate Pollutant Reduction Strategy 56, Figure 4 (March 2017), https://ww2.arb.ca.gov/sites/default/files/2020-07/final_SLCP_strategy.pdf.

[217] IPCC, *Climate Change 2021: the Physical Science Basis, which represents the findings of Working Group I and its contribution to the Sixth Assessment Report*, *available at* https://www.ipcc.ch/report/ar6/wg1/.

[218] Petitioners do not suggest that methane from industrial dairy and pig facilities should be unabated. CARB has authority to adopt mandatory regulations to achieve up to a 40 percent reduction from manure methane emissions pursuant to Health & Safety Code § 39730.5.

desperately attempt to perpetuate the combustion of gas in the face of a future where electrified buildings and transportation are the only routes to achieve California's climate goals. San Joaquin Valley communities should not suffer the discriminatory effects of CARB's pollution trading scheme, and CARB should grant this petition and deliver environmental justice.

Respectfully Submitted this 27th of October, 2021,

Ruthie Lazenby
Vermont Law School
Environmental Justice Clinic

Brent Newell
Public Justice

Phoebe Seaton
Leadership Counsel for
Justice & Accountability

Tom Frantz
Association of Irritated Residents

Tarah Heinzen
Tyler Lobdell
Food & Water Watch

Cristina Stella
Christine Ball-Blakely
Animal Legal Defense Fund

# I. APPENDICES

## A. APPENDIX A: PROPOSED AMENDMENTS TO THE LCFS TO REMOVE ALL FUELS DERIVED FROM BIOMETHANE FROM DAIRY AND SWINE MANURE

§ 95488.3. Calculation of Fuel Pathway Carbon Intensities

(a) Calculating Carbon Intensities. Fuel pathway applicants and the Executive Officer will evaluate all pathways based on life cycle greenhouse gas emissions per unit of fuel energy, or carbon intensity, expressed in gCO2e/MJ. For this analysis, the fuel pathway applicant must use CA-GREET3.0 model (including the Simplified CI Calculators derived from that model) or another model determined by the Executive Officer to be equivalent or superior to CA-GREET3.0.

(b) CA-GREET3.0. The CA-GREET3.0 model (August 13, 2018) contains emission factors for calculating greenhouse gas emissions from site-specific inputs to fuel pathways and standard values for parts of the life cycle not included in applicant-specific data submission. The model is open source and publicly available at http://www.arb.ca.gov/fuels/lcfs/lcfs.htm and is incorporated herein by reference. CA-GREET3.0 includes contributions from the Oil Production Greenhouse Gas Estimator (OPGEE2.0) model (for emissions from crude extraction) and Global Trade Analysis Project (GTAP-BIO) together with the Agro-Ecological Zone Emissions Factor (AEZ-EF) model for land use change (LUC).

Tier 1 Simplified CI Calculators, which incorporate emission factors and life cycle inventory data from the CA-GREET3.0 model, are used to calculate carbon intensities for Tier 1 pathways. The eight Simplified CI Calculators listed below are publicly available at http://www.arb.ca.gov/fuels/lcfs/lcfs.htm and are incorporated herein by reference:

(1) Tier 1 Simplified CI Calculator for Starch and Fiber* Ethanol (August 13, 2018)

(2) Tier 1 Simplified CI Calculator for Sugarcane-derived Ethanol (August 13, 2018)

(3) Tier 1 Simplified CI Calculator for Biodiesel and Renewable Diesel (August 13, 2018)

(4) Tier 1 Simplified CI Calculator for LNG and L-CNG from North American Natural Gas (August 13, 2018)

(5) Tier 1 Simplified CI Calculator for Biomethane from North American Landfills (August 13, 2018)

(6) Tier 1 Simplified CI Calculator for Biomethane from Anaerobic Digestion of Wastewater Sludge (August 13, 2018)

~~(7) Tier 1 Simplified CI Calculator for Biomethane from Anaerobic Digestion of Organic Waste (August 13, 2018)~~

© OPGEE2.0. The OPGEE2.0 model is used to generate carbon intensities for crude oil used in the production of ultra-low sulfur diesel (ULSD) and California Reformulated Gasoline Blendstock for Oxygenate Blending (CARBOB).

(d) Accounting for Land Use Change. The Executive Officer calculates LUC effects for certain crop-based biofuels using the GTAP model (modified to include agricultural data and termed GTAP-BIO) and the AEZ-EF model. LUC values for six feedstock/finished biofuel combinations are provided in Table 6 below. The Executive Officer may use the same modeling framework to assess LUC values for other fuel or feedstock combinations, not currently found in Table 6, as part of processing a pathway application. Alternatively, the Executive Officer may require a fuel pathway applicant to use one of the values in Table 6, if the Executive Officer deems that value appropriate to use for a fuel or feedstock combination not currently listed in Table 6.

Table 6. Land Use Change Values for Use in CI Determination

| Biofuel | LUC (gCO<2>/MJ |
|---|---|
| Corn Ethanol | 19.8 |
| Sugarcane Ethanol | 11.8 |
| Soy Biomass-Based Diesel | 29.1 |
| Canola Biomass-Based Diesel | 14.5 |
| Grain Sorghum Ethanol | 19.4 |
| Palm Biomass-Based Diesel | 71.4 |

* Fiber in this case refers to corn and grain sorghum fiber exclusively.

§ 95488.9. Special Circumstances for Fuel Pathway Applications.

(f) Carbon Intensities that Reflect Avoided Methane Emissions from Dairy and Swine Manure or Organic Waste Diverted from Landfill Disposal.

(1) A fuel pathway that utilizes biomethane from dairy cattle or swine manure digestion ~~may~~ shall not be certified. ~~With a CI that reflects the reduction of greenhouse gas emissions achieved by the voluntary capture of methane, provided that:~~

~~(A) A biogas control system, or digester, is used to capture biomethane from manure management on **dairy** cattle and swine farms that would otherwise be vented to the atmosphere as a result of livestock operations from those farms.~~

~~(B) The baseline quantity of avoided methane reflected in the CI calculation is additional to any legal requirement for the capture and destruction of biomethane.~~

## B. APPENDIX B: PROPOSED AMENDMENTS TO REFORM THE LCFS PATHWAYS FOR BIOMETHANE FROM DAIRY AND SWINE MANURE

§ 95488.3. Calculation of Fuel Pathway Carbon Intensities

(a) Calculating Carbon Intensities. Fuel pathway applicants and the Executive Officer will evaluate all pathways based on life cycle greenhouse gas emissions per unit of fuel energy, or carbon intensity, expressed in gCO2e/MJ. For this analysis, the fuel pathway applicant must use CA-GREET3.0 model (including the Simplified CI Calculators derived from that model) or another model determined by the Executive Officer to be equivalent or superior to CA-GREET3.0.

(b) CA-GREET3.0. The CA-GREET3.0 model (August 13, 2018) contains emission factors for calculating greenhouse gas emissions from site-specific inputs to fuel pathways and standard values for parts of the life cycle not included in applicant-specific data submission. The model is open source and publicly available at http://www.arb.ca.gov/fuels/lcfs/lcfs.htm and is incorporated herein by reference. CA-GREET3.0 includes contributions from the Oil Production Greenhouse Gas Estimator (OPGEE2.0) model (for emissions from crude extraction) and Global Trade Analysis Project (GTAP-BIO) together with the Agro-Ecological Zone Emissions Factor (AEZ-EF) model for land use change (LUC).

Tier 1 Simplified CI Calculators, which incorporate emission factors and life cycle inventory data from the CA-GREET3.0 model, are used to calculate carbon intensities for Tier 1 pathways. The eight Simplified CI Calculators listed below are publicly available at http://www.arb.ca.gov/fuels/lcfs/lcfs.htm and are incorporated herein by reference:

(1) Tier 1 Simplified CI Calculator for Starch and Fiber* Ethanol (August 13, 2018)

(2) Tier 1 Simplified CI Calculator for Sugarcane-derived Ethanol (August 13, 2018)

(3) Tier 1 Simplified CI Calculator for Biodiesel and Renewable Diesel (August 13, 2018)

(4) Tier 1 Simplified CI Calculator for LNG and L-CNG from North American Natural Gas (August 13, 2018)

(5) Tier 1 Simplified CI Calculator for Biomethane from North American Landfills (August 13, 2018)

(6) Tier 1 Simplified CI Calculator for Biomethane from Anaerobic Digestion of Wastewater Sludge (August 13, 2018)

(7) Tier 1 Simplified CI Calculator for Biomethane from Anaerobic Digestion of Organic Waste (August 13, 2018)

(c) OPGEE2.0. The OPGEE2.0 model is used to generate carbon intensities for crude oil used in the production of ultra-low sulfur diesel (ULSD) and California Reformulated Gasoline Blendstock for Oxygenate Blending (CARBOB).

(d) Accounting for Land Use Change. The Executive Officer calculates LUC effects for certain crop-based biofuels using the GTAP model (modified to include agricultural data and termed GTAP-BIO) and the AEZ-EF model. LUC values for six feedstock/finished biofuel combinations are provided in Table 6 below. The Executive Officer may use the same modeling framework to assess LUC values for other fuel or feedstock combinations, not currently found in Table 6, as part of processing a pathway application. Alternatively, the Executive Officer may require a fuel pathway applicant to use one of the values in Table 6, if the Executive Officer deems that value appropriate to use for a fuel or feedstock combination not currently listed in Table 6.

Table 6. Land Use Change Values for Use in CI Determination

| Biofuel | LUC (gCO<2>/MJ |
|---|---|

| | |
|---|---|
| Corn Ethanol | 19.8 |
| Sugarcane Ethanol | 11.8 |
| Soy Biomass-Based Diesel | 29.1 |
| Canola Biomass-Based Diesel | 14.5 |
| Grain Sorghum Ethanol | 19.4 |
| Palm Biomass-Based Diesel | 71.4 |

* Fiber in this case refers to corn and grain sorghum fiber exclusively.

(e) Accounting for life cycle emissions for all fuel pathways from manure feedstock. In calculating the carbon intensity of any fuel derived from manure feedstock, the Executive Officer shall include all upstream and downstream greenhouse gas emissions from all activities associated with manure production, including but not limited to feed emissions, mobile and stationary source combustion emissions, enteric emissions, emissions from composting digestate solids, emissions following land application, and indirect source emissions.

§ 95488.9. Special Circumstances for Fuel Pathway Applications.

(f) Carbon Intensities that Reflect Avoided Methane Emissions from Dairy and Swine Manure or Organic Waste Diverted from Landfill Disposal.

(1) A fuel pathway that utilizes biomethane from dairy cattle or swine manure digestion may be certified with a CI that reflects the reduction of greenhouse gas emissions achieved by the voluntary capture of methane, provided that:

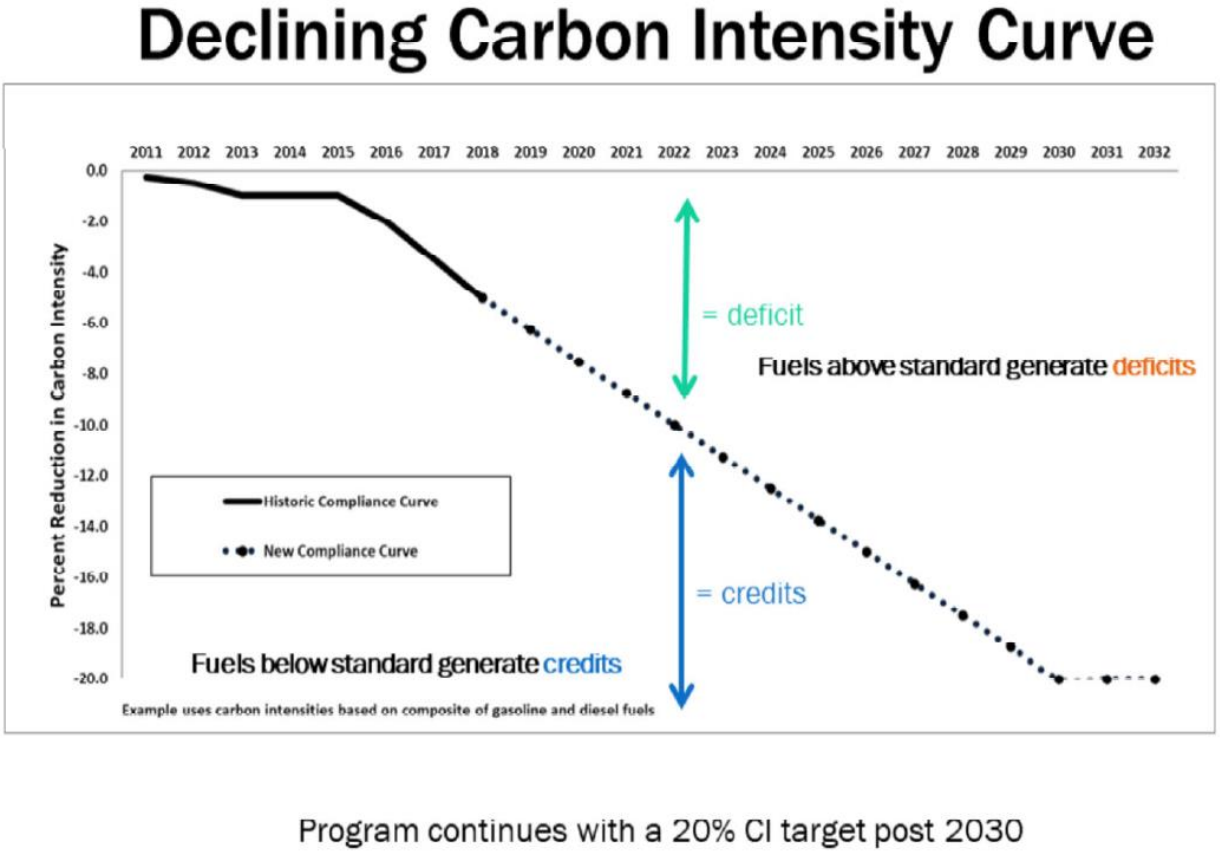
(A) A biogas control system, or digester, is used to capture biomethane from manure management on dairy cattle and swine farms that would otherwise be vented to the atmosphere as a result of livestock operations from those farms.

(B) The baseline quantity of avoided methane reflected in the CI calculation is additional to any legal requirement for the capture and destruction of biomethane, and any other greenhouse gas emission reduction that otherwise would occur.

(C) The fuel pathway derived from biomethane from dairy cattle or swine manure digestion pursuant to section 95488.3(e) does not (1) contribute any amount of nitrogen oxides, volatile organic compounds, sulfur oxides, ammonia, or particulate matter with an aerodynamic diameter of ten microns or less into the ambient air; (2) cause or contribute to groundwater or surface water pollution or degradation; (3) intensify water demand in areas medium and high priority water basins; or (4) intensify or exacerbate any negative local impacts including but not limited to odor and insects.

## C. APPENDIX C: TABLES AND FIGURES

**Figure 1:** Declining Annual Benchmark for the LCFS program.[219]




[219] CAL. AIR RES. BD., *LCFS Basics* (2019), *available at* https://ww2.arb.ca.gov/sites/default/files/2020-09/basics-notes.pdf (last visited Oct. 12, 2021).

**Table 1.** Credit Value Calculator from LCFS Data Dashboard.[220]

**Credit Value Calculator:**
**Estimated LCFS Premium at Sample LCFS Credit Prices**

**Alternative Fuel Premiums at Sample LCFS Credit Prices**
**($/gal gasoline-equivalent for fuels used as gasoline substitutes)**

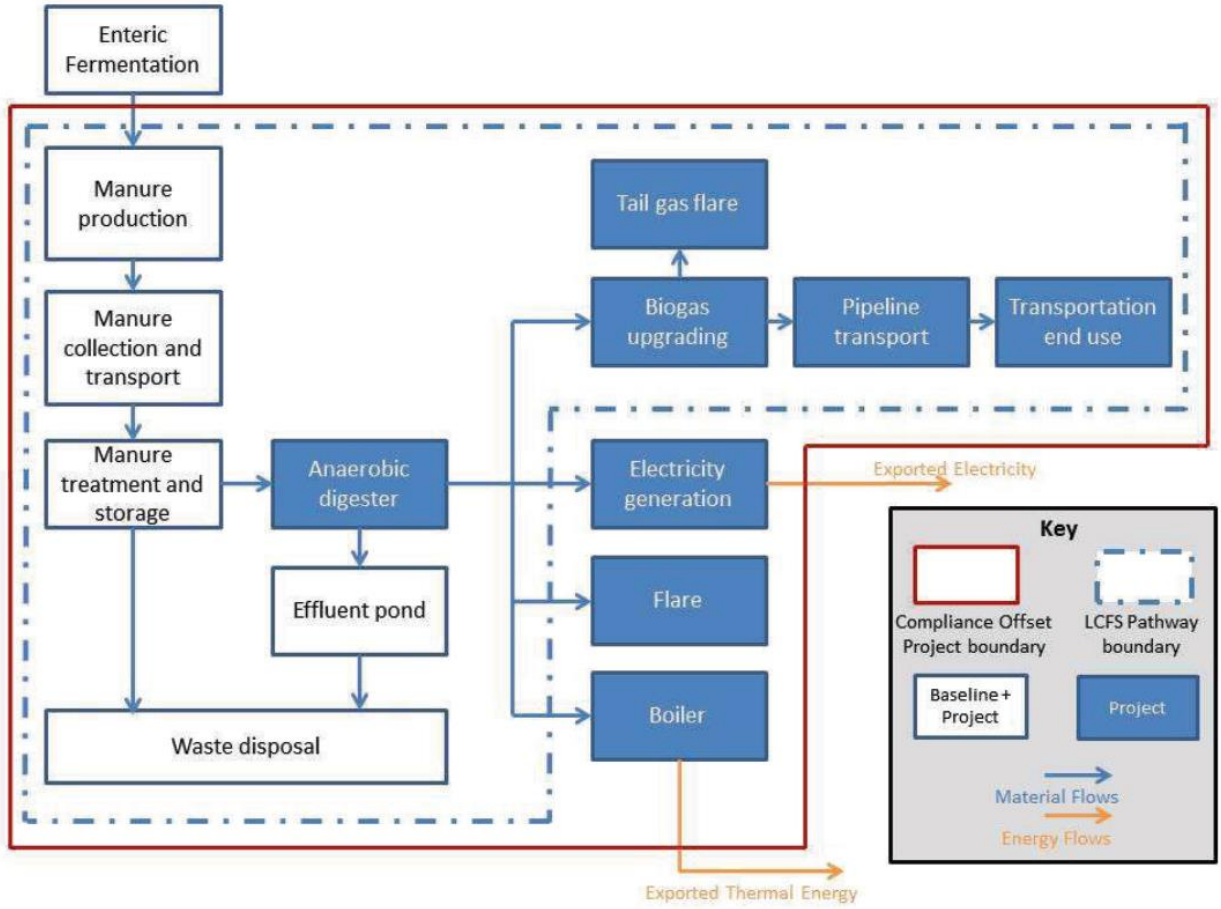
| CI Score (gCO2e/MJ) | Credit Price $196 | $80 | $100 | $120 | $160 | $200 |
|---|---|---|---|---|---|---|
| -273 | $8.31 | $3.39 | $4.24 | $5.09 | $6.79 | $8.48 |
| 10 | $1.89 | $0.77 | $0.96 | $1.16 | $1.54 | $1.93 |
| 20 | $1.66 | $0.68 | $0.85 | $1.02 | $1.36 | $1.70 |
| 30 | $1.44 | $0.59 | $0.73 | $0.88 | $1.17 | $1.46 |
| 40 | $1.21 | $0.49 | $0.62 | $0.74 | $0.99 | $1.23 |
| 50 | $0.98 | $0.40 | $0.50 | $0.60 | $0.80 | $1.00 |
| 60 | $0.75 | $0.31 | $0.38 | $0.46 | $0.62 | $0.77 |
| 70 | $0.53 | $0.22 | $0.27 | $0.32 | $0.43 | $0.54 |
| 80 | $0.30 | $0.12 | $0.15 | $0.18 | $0.25 | $0.31 |
| 90 | $0.07 | $0.03 | $0.04 | $0.04 | $0.06 | $0.07 |
| 100 | -$0.15 | -$0.06 | -$0.08 | -$0.09 | -$0.13 | -$0.16 |
| 110 | -$0.38 | -$0.16 | -$0.19 | -$0.23 | -$0.31 | -$0.39 |
| 120 | -$0.61 | -$0.25 | -$0.31 | -$0.37 | -$0.50 | -$0.62 |
| 130 | -$0.83 | -$0.34 | -$0.43 | -$0.51 | -$0.68 | -$0.85 |
| 140 | -$1.06 | -$0.43 | -$0.54 | -$0.65 | -$0.87 | -$1.08 |
| 150 | -$1.29 | -$0.53 | -$0.66 | -$0.79 | -$1.05 | -$1.32 |
| CaRFG* ($/gallon) 100.82 | -$0.139 | -$0.057 | -$0.071 | -$0.085 | -$0.113 | -$0.142 |

* Maximum pass-through cost for gasoline. Assumes a blend of CARBOB with 10 volume percent ethanol at a CI of 79.9 g/MJ. Ethanol at 79.9 g/MJ is assumed to receive no LCFS premium.

*Last Modified 05/31/2019*

[220] Data Dashboard, CAL. AIR RES. BD. Figure 7, *https://ww3.arb.ca.gov/fuels/lcfs/dashboard/dashboard.htm* (last visited Oct. 20, 2021).

**Figure 2.** CARB schematic of the system boundaries for upgraded biogas (biomethane) from Anaerobic digestion of Dairy Manure.[221]



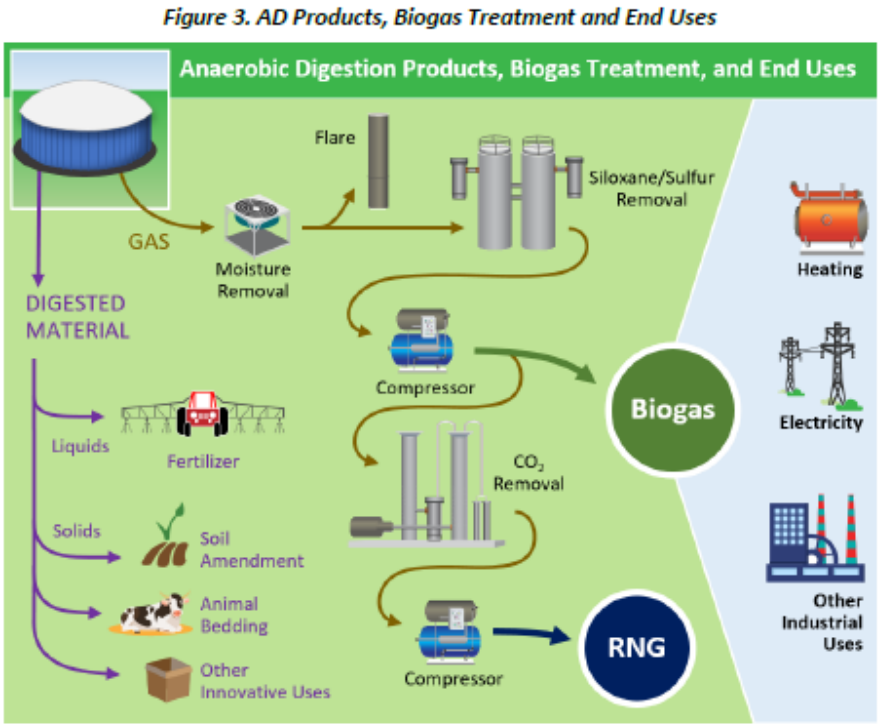

[221] CAL. AIR RES. BD., *supra* note 96 at 13.

**Figure 3.** Waste Management Hierarchy chart for manure management.[222]

| Waste Management Hierarchy | Attribute | Applicability in animal manure management |
|---|---|---|
| Avoidance | Most preferred option. Preventive. Use of less hazardous materials in the design and manufacture of products. Develop strategies for cleaner and environmentally friendly production | While the production of wastes cannot be completely eliminated in animal production, the production can be made cleaner and environmentally friendly |
| Reduction of wastes | Second most preferred option. Preventive. Actions to make changes in the type of materials being used for specific products. This approach contributes to effective savings of natural resources | Applicable |
| Reuse | Predominantly ameliorative and partly preventive. The waste is collected during the production phase and fed back into the production process. Reduce the amount of wastes generated and the cost of production. Desirable. | Applicable |
| Recycle | Predominantly ameliorative and partly preventive. The waste materials are collected and processed, and used in the production of new products. The process prevents pollution. Desirable. | Applicable |
| Energy recovery | Predominantly assimilative and partly ameliorative. This is also called waste to energy conversion. Wastes are converted to usable energy forms such as heat, light, electricity, etc. Desirable. | Applicable |
| Treatment | Predominantly assimilative and partly ameliorative. Desirable. | Applicable |
| Sustainable disposal | Disposal is the least preferred option in the waste management hierarchy and should be avoided. | Possible but not preferred |

[222] Gabriel Adebayo Malomo et al., *Sustainable Animal Manure Management Strategies and Practices*, 9 (Aug. 29, 2018) https://www.intechopen.com/books/agricultural-waste-and-residues/sustainable-animal-manure-management-strategies-and-practices.

**Figure 4.** Diagram of downstream uses of digested materials.[223]




[223] ENV'T. PROT. AGENCY, *An Overview of Renewable Natural Gas from Biogas* 4 (July 2020) https://www.epa.gov/sites/production/files/2020-07/documents/lmop_rng_document.pdf.

**Figure 5.** Rise in Average Monthly Credit Price since 2013.[224]




**Table 2.** The California dairy industry experienced negative average residuals in 2015 and 2016, indicating a lack of profit in these years.[225]

**Table 1.6:** California Dairy Farm Annual Unit Costs of Production by Category 2014-2017

| Dairy Input | 2014 $/cwt | 2015 $/cwt | 2016 $/cwt | 2017 $/cwt |
|---|---|---|---|---|
| Feed | $11.05 | $10.46 | $9.22 | $8.77 |
| Hired Labor | $1.56 | $1.70 | $1.74 | $1.87 |
| Herd Replacement | $1.37 | $2.12 | $2.10 | $1.88 |
| Operating Costs | $2.88 | $2.93 | $2.92 | $3.06 |
| Milk Marketing | $0.56 | $0.56 | $0.55 | $0.55 |
| **Total Costs** | **$17.42** | **$17.77** | **$16.53** | **$16.13** |
| **Average Mailbox Price** | **$22.37** | **$15.94** | **$15.56** | **$16.99** |
| **Price – Costs (Residual)** | **$4.95** | **-$1.83** | **-$0.97** | **$0.86** |

Source: CDFA California Dairy Cost of Production Annuals
https://www.cdfa.ca.gov/dairy/dairycop_annual.html

[224] AcMoody, *supra* note 128 at 4.
[225] Matthews, *supra* note 130 at 20.

**Figure 6.** Groundwater contamination sites in Kern County.[226]

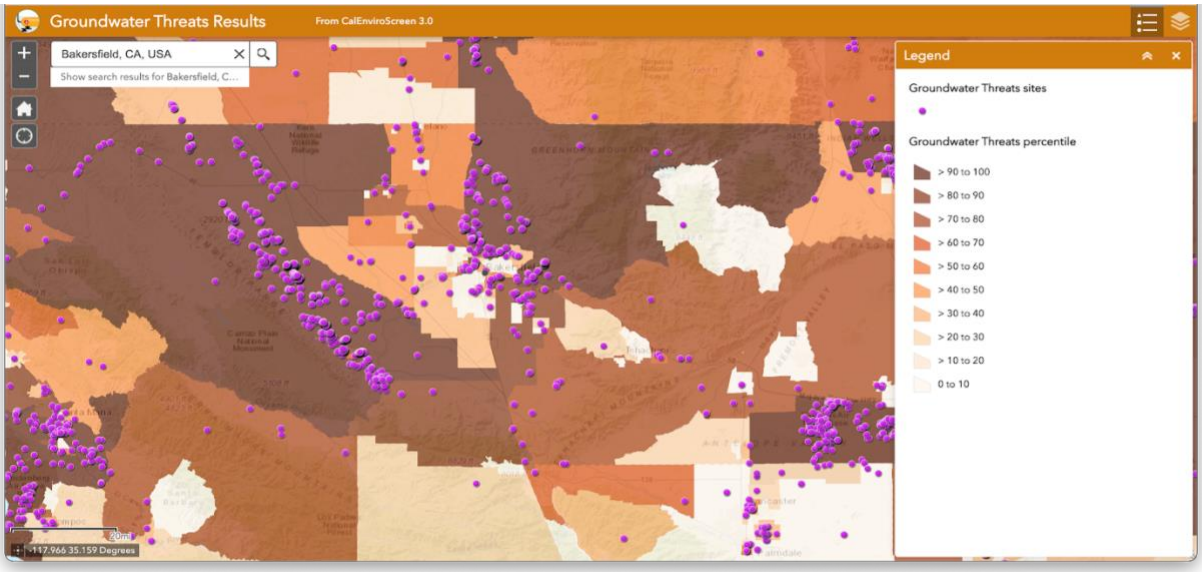
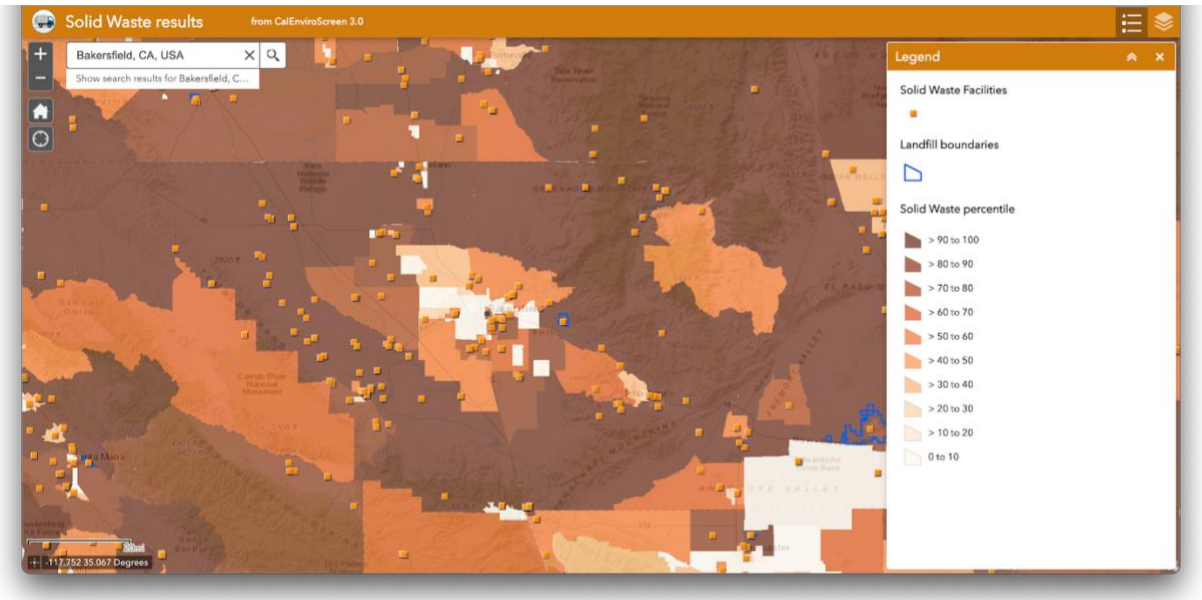
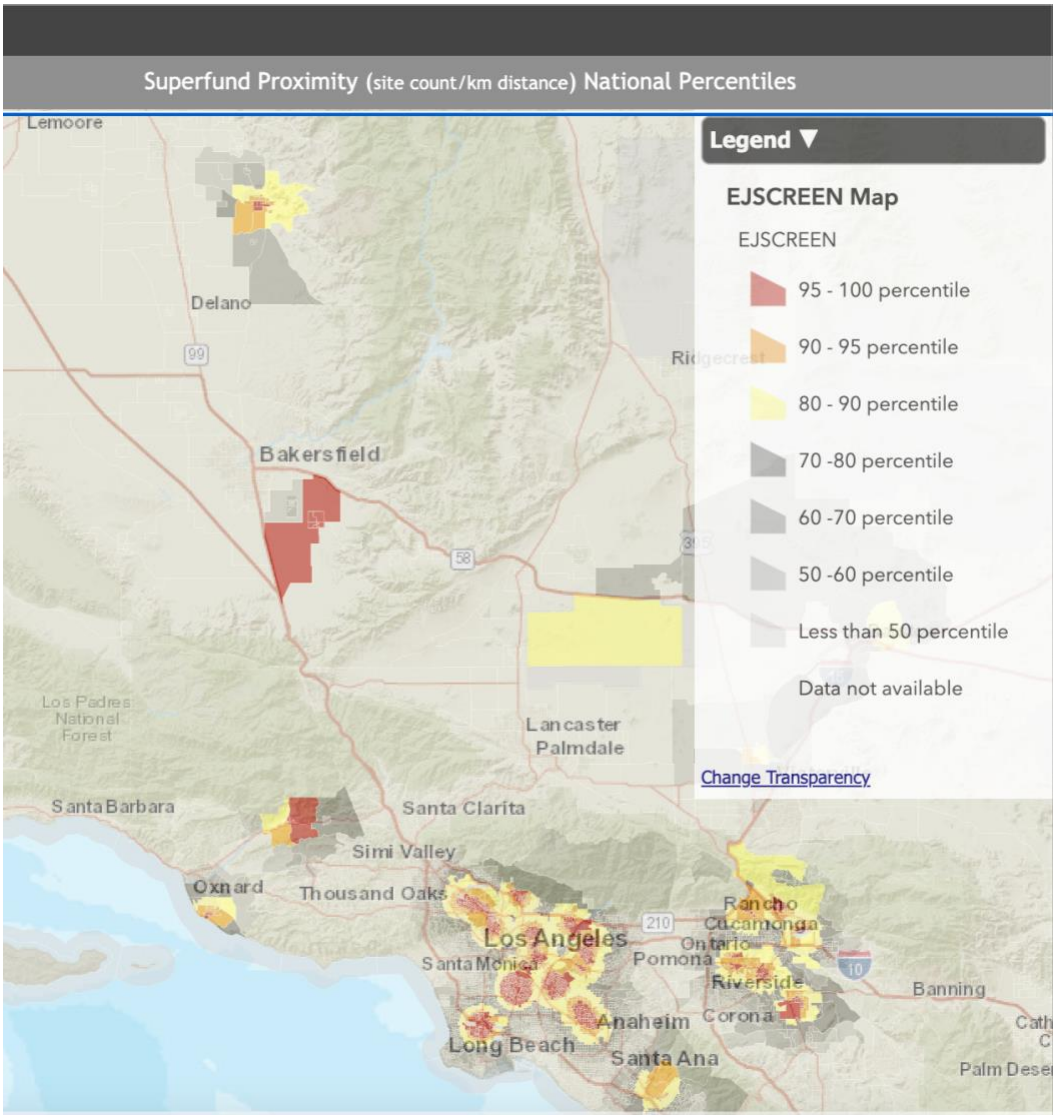



**Figure 7.** Solid waste contamination in Kern County.[227]




[226] CAL. OFFICE OF ENV'T HEALTH HAZARD ASSESSMENT, *supra* note 29.
[227] *Id.*

**Figure 8.** Superfund site near Bakersfield, CA.[228]




[228] *EJScreen*, ENV'T. PROT. AGENCY, https://www.epa.gov/ejscreen (last accessed Apr. 10, 2021).

**Table 3.** A list of the top counties that sell cow's milk ($ billions), the majority of which are in California.[229]

| Top Counties in Cow's Milk Sales ($ billions) | |
|---|---|
| Tulare, CA | 1.8 |
| Merced, CA | 1.1 |
| Gooding, ID | 0.7 |
| Stanislaus, CA | 0.7 |
| Kings, CA | 0.6 |
| Kern, CA | 0.5 |
| Yakima, WA | 0.4 |
| Lancaster, PA | 0.4 |
| Fresno, CA | 0.4 |
| San Joaquin, CA | 0.4 |

*Does not include counties withheld to avoid disclosing individual data.*

[229] U.S. DEP'T OF AGRIC., *Dairy Cattle and Milk Production* at 2 (Oct. 2014) https://www.nass.usda.gov/Publications/Highlights/2014/Dairy_Cattle_and_Milk_Production_Highlights.pdf.

**Table 4.** Demographic data on Kern, Kings, Madera, and San Joaquin Counties.[230]

| Fact | Kern County, California | Kings County, California | Madera County, California | San Joaquin County, California |
|---|---|---|---|---|
| Population estimates, July 1, 2019, (V2019) | 900,202 | 152,940 | 157,327 | 762,148 |
| Population estimates base, April 1, 2010, (V2019) | 839,621 | 152,974 | 150,834 | 685,306 |
| Population, percent change - April 1, 2010 (estimates base) to | 7.20% | 0.00% | 4.30% | 11.20% |
| Population, Census, April 1, 2010 | 839,631 | 152,982 | 150,865 | 685,306 |
| Persons under 5 years, percent | 7.60% | 7.60% | 7.30% | 6.90% |
| Persons under 18 years, percent | 28.80% | 27.00% | 27.40% | 26.80% |
| Persons 65 years and over, | 11.20% | 10.50% | 14.30% | 13.10% |
| Female persons, percent | 48.80% | 44.90% | 51.80% | 50.10% |
| White alone, percent | 82.30% | 80.80% | 85.90% | 66.10% |
| Black or African American alone, | 6.30% | 7.50% | 4.20% | 8.30% |
| American Indian and Alaska Native alone, percent | 2.60% | 3.20% | 4.40% | 2.00% |
| Asian alone, percent | 5.40% | 4.40% | 2.60% | 17.40% |
| Native Hawaiian and Other Pacific Islander alone, percent | 0.30% | 0.40% | 0.30% | 0.80% |
| Two or More Races, percent | 3.20% | 3.70% | 2.60% | 5.50% |
| Hispanic or Latino, percent | 54.60% | 55.30% | 58.80% | 42.00% |
| White alone, not Hispanic or Latino, percent | 32.80% | 31.30% | 33.20% | 30.50% |
| Veterans, 2015-2019 | 35,594 | 9,684 | 6,317 | 29,013 |
| Foreign born persons, percent, | 19.90% | 18.90% | 20.20% | 23.30% |
| Housing units, July 1, 2019, | 302,898 | 46,965 | 51,438 | 248,636 |
| Owner-occupied housing unit rate, 2015-2019 | 58.30% | 52.30% | 64.10% | 56.60% |
| Median value of owner-occupied housing units, 2015-2019 | 213,900 | 215,900 | 251,200 | 342,100 |
| Median selected monthly owner costs -with a mortgage, 2015-2019 | $1,527 | $1,459 | $1,551 | $1,907 |
| Median selected monthly owner costs -without a mortgage, 2015- | $452 | $446 | $478 | $523 |
| Median gross rent, 2015-2019 | $978 | $990 | $1,014 | $1,208 |
| Building permits, 2019 | 2,261 | 409 | 644 | 3,499 |
| Households, 2015-2019 | 270,282 | 43,452 | 44,881 | 228,567 |
| Persons per household, 2015- | 3.17 | 3.13 | 3.28 | 3.17 |
| Living in same house 1 year ago, percent of persons age 1 year+, | 86.10% | 81.90% | 87.90% | 86.80% |
| Language other than English spoken at home, percent of persons age 5 years+, 2015-2019 | 44.20% | 41.50% | 45.30% | 40.90% |
| High school graduate or higher, percent of persons age 25 years+, | 74.10% | 73.40% | 71.90% | 79.30% |
| Bachelor's degree or higher, percent of persons age 25 years+, | 16.40% | 14.70% | 14.60% | 18.80% |
| With a disability, under age 65 years, percent, 2015-2019 | 7.80% | 8.60% | 8.70% | 8.70% |
| Persons without health insurance, under age 65 years, | 9.00% | 8.50% | 10.70% | 7.80% |
| In civilian labor force, total, percent of population age 16 | 58.00% | 51.80% | 54.30% | 60.30% |
| In civilian labor force, female, percent of population age 16 | 52.40% | 51.50% | 47.90% | 53.60% |
| Total accommodation and food services sales, 2012 ($1,000) | 1,092,151 | 378,595 | 150,065 | 808,606 |
| Total health care and social assistance receipts/revenue, | 3,675,000 | 587,818 | 760,956 | 3,447,722 |
| Median household income (in 2019 dollars), 2015-2019 | $53,350.00 | $57,848.00 | $57,585.00 | $64,432.00 |
| Per capita income in past 12 months (in 2019 dollars), 2015- | $23,326.00 | $22,373.00 | $22,853.00 | $27,521.00 |
| Persons in poverty, percent | 19.00% | 16.00% | 17.60% | 13.60% |

[230] *Quick Facts*, U.S. CENSUS, https://www.census.gov/quickfacts/fact/table/US/PST045219 (last visited Apr. 10, 2021).

**Table 5.** Demographic data on Merced, Tulare, Fresno, and Stanislaus Counties.[231]

| Fact | Merced County, California | Tulare County, California | Fresno County, California | Stanislaus County, California |
|---|---|---|---|---|
| Population estimates, July 1, 2019, (V2019) | 277,680 | 466,195 | 999,101 | 550,660 |
| Population estimates base, April 1, 2010, (V2019) | 255,796 | 442,182 | 930,507 | 514,450 |
| Population, percent change - April 1, 2010 (estimates base) to July 1, 2019, (V2019) | 8.60% | 5.40% | 7.40% | 7.00% |
| Population, Census, April 1, 2010 | 255,793 | 442,179 | 930,450 | 514,453 |
| Persons under 5 years, percent | 7.70% | 7.80% | 7.60% | 7.10% |
| Persons under 18 years, percent | 29.30% | 30.50% | 28.20% | 27.00% |
| Persons 65 years and over, percent | 11.40% | 11.60% | 12.60% | 13.40% |
| Female persons, percent | 49.50% | 50.00% | 50.10% | 50.40% |
| White alone, percent | 82.20% | 88.20% | 76.60% | 83.30% |
| Black or African American alone, percent | 3.90% | 2.20% | 5.80% | 3.50% |
| American Indian and Alaska Native alone, percent | 2.50% | 2.80% | 3.00% | 2.00% |
| Asian alone, percent | 7.80% | 4.00% | 11.10% | 6.10% |
| Native Hawaiian and Other Pacific Islander alone, percent | 0.40% | 0.20% | 0.30% | 0.90% |
| Two or More Races, percent | 3.20% | 2.70% | 3.20% | 4.20% |
| Hispanic or Latino, percent | 61.00% | 65.60% | 53.80% | 47.60% |
| White alone, not Hispanic or Latino, percent | 26.50% | 27.70% | 28.60% | 40.40% |
| Veterans, 2015-2019 | 9,225 | 14,633 | 36,125 | 21,051 |
| Foreign born persons, percent, 2015-2019 | 26.30% | 21.80% | 21.20% | 20.30% |
| Housing units, July 1, 2019, (V2019) | 86388 | 151603 | 336473 | 182978 |
| Owner-occupied housing unit rate, 2015-2019 | 52.20% | 57.10% | 53.30% | 57.80% |
| Median value of owner-occupied housing units, 2015-2019 | 252,700 | 205,000 | 255,000 | 291,600 |
| Median selected monthly owner costs -with a mortgage, 2015-2019 | 1,493 | 1,420 | 1,631 | 1,702 |
| Median selected monthly owner costs -without a mortgage, 2015-2019 | $460.00 | $421.00 | $484.00 | $503.00 |
| Median gross rent, 2015-2019 | $1,021.00 | $942.00 | $998.00 | $1,155.00 |
| Building permits, 2019 | 918 | 1,872 | 3,393 | 699 |
| Households, 2015-2019 | 80,008 | 138,238 | 307,906 | 173,898 |
| Persons per household, 2015-2019 | 3.32 | 3.3 | 3.14 | 3.09 |
| Living in same house 1 year ago, percent of persons age 1 year+, 2015-2019 | 86.60% | 88.60% | 85.80% | 87.90% |
| Language other than English spoken at home, percent of persons age 5 years+, 2015-2019 | 53.30% | 51.30% | 44.60% | 42.90% |
| High school graduate or higher, percent of persons age 25 years+, 2015-2019 | 69.10% | 70.80% | 76.00% | 78.90% |
| Bachelor's degree or higher, percent of persons age 25 years+, 2015-2019 | 13.80% | 14.60% | 21.20% | 17.10% |
| With a disability, under age 65 years, percent, 2015-2019 | 9.10% | 8.20% | 9.20% | 9.00% |
| Persons without health insurance, under age 65 years, percent | 9.00% | 9.00% | 8.80% | 7.10% |
| In civilian labor force, total, percent of population age 16 years+, 2015-2019 | 59.60% | 59.00% | 60.90% | 60.90% |
| In civilian labor force, female, percent of population age 16 years+, 2015-2019 | 51.00% | 51.10% | 55.20% | 53.40% |
| Total accommodation and food services sales, 2012 ($1,000) | 232,910 | 451,880 | 1,226,169 | 705,698 |
| Total health care and social assistance receipts/revenue, 2012 ($1,000) | 788114 | 1610236 | 5325615 | 3634960 |
| Median household income (in 2019 dollars), 2015-2019 | $53,672.00 | $49,687.00 | $53,969.00 | $60,704.00 |
| Per capita income in past 12 months (in 2019 dollars), 2015-2019 | $23,011.00 | $21,380.00 | $24,422.00 | $26,258.00 |
| Persons in poverty, percent | 17.00% | 18.90% | 20.50% | 13.00% |

[231] *Id.*

**Table 6.** Quick facts on potential pathogens found in digestate and links for further information.[232]

| **Pathogen** | **Effects** | **For more information** |
|---|---|---|
| Cryptosporidium parvum | "[M]icroscopic parasite that causes the diarrheal disease cryptosporidiosis." | https://www.cdc.gov/parasites/crypto/index.html |
| Salmonella spp | "Most people with Salmonella infection have diarrhea, fever, and stomach cramps." | https://www.cdc.gov/salmonella/general/index.html |
| norovirus | "Norovirus is a very contagious virus that causes vomiting and diarrhea." | https://www.cdc.gov/norovirus/index.html |
| Streptococcus pyogenes | "[C]an cause both noninvasive and invasive disease, as well as nonsuppurative sequelae. " | https://www.cdc.gov/groupastrep/diseases-hcp/index.html |
| E. coli enteropathogenic (EPEC) | "[A]re gram-negative bacteria that inhabit the gastrointestinal tract. Most strains do not cause illness. Pathogenic E. coli are categorized into pathotypes on the basis of their virulence genes. Six pathotypes are associated with diarrhea | https://wwwnc.cdc.gov/travel/yellowbook/2020/travel-related-infectious-diseases/escherichia-coli-diarrheagenic |

[232] *Parasites – Cryptosporidium (also known as "Crypto")*, CDC, https://www.cdc.gov/parasites/crypto/index.html (last updated July 1, 2019); *Salmonella*, CDC, https://www.cdc.gov/salmonella/general/index.html (last updated Dec 5, 2019); *Norovirus*, CDC, https://www.cdc.gov/norovirus/index.html (last updated Mar. 5, 2021); *Group A Streptococcal (GAS) Disease*, CDC, https://www.cdc.gov/groupastrep/diseases-hcp/index.html (last updated May 7, 2020); Alison Winstead et al., *Escherichia coli, Diarrheagenic*, CDC, https://wwwnc.cdc.gov/travel/yellowbook/2020/travel-related-infectious-diseases/escherichia-coli-diarrheagenic (last updated July 1, 2021); J. L. Cloud et al., *Identification of Mycobacterium spp. by Using a Commercial 16S Ribosomal DNA Sequencing Kit and Additional Sequencing Libraries*, 40(2) J. Clinical Microbiology 400, 400 (Feb. 2002); *Typhoid Fever and Paratyphoid Fever*, CDC, https://www.cdc.gov/typhoid-fever/index.html (last updated Aug. 22, 2018); *Fact Sheet: Clostridium spp*, WickhamLaboratories, https://wickhamlabs.co.uk/technical-resource-centre/fact-sheet-clostridium-spp/ (last visited May 5, 2021); Listeria (Listeriosis), CDC, https://www.cdc.gov/listeria/symptoms.html (Dec. 12, 2016).

| | | |
|---|---|---|
| | (diarrheagenic) […] enteropathogenic E. coli (EPEC)" | |
| Mycobacterium spp. | "Mycobacterium species are a group of acid-fast, aerobic, slow-growing bacteria. The genus comprises more than 70 different species, of which about 30 have been associated with human disease (23)." | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC153382/#:~:text=Mycobacterium%20species%20are%20a%20group,the%20causative%20agent%20of%20tuberculosis |
| Salmonella typhi (followed by S. paratyphi) | "Typhoid fever and paratyphoid fever are life-threatening illnesses caused by Salmonella serotype Typhi and Salmonella serotype Paratyphi, respectively." | https://www.cdc.gov/typhoid-fever/index.html |
| Clostridium spp. | "Clostridia are one of the most commonly studied anaerobes that cause disease in humans". Some of the species of Clostridium can cause: botulism, overgrow in the intestine compromising the inherent gut flora (potentially leading to colitis), tetanus, gas gangrene (myonecrosis), and toxic shock syndrome. | https://wickhamlabs.co.uk/technical-resource-centre/fact-sheet-clostridium-spp/ |
| Listeria monocytogenes | "[C]an cause fever and diarrhea similar to other foodborne germs, but this type of Listeria infection is rarely diagnosed. Symptoms in people with invasive listeriosis, meaning the bacteria has spread beyond the gut, depend on whether the person is pregnant." | https://www.cdc.gov/listeria/symptoms.html |

# Exhibit B: Petition for Reconsideration

**BEFORE THE CALIFORNIA AIR RESOURCES BOARD**

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**PETITION FOR RECONSIDERATION OF THE DENIAL OF THE PETITION FOR RULEMAKING TO EXCLUDE ALL FUELS DERIVED FROM BIOMETHANE FROM DAIRY AND SWINE MANURE FROM THE LOW CARBON FUEL STANDARD PROGRAM**

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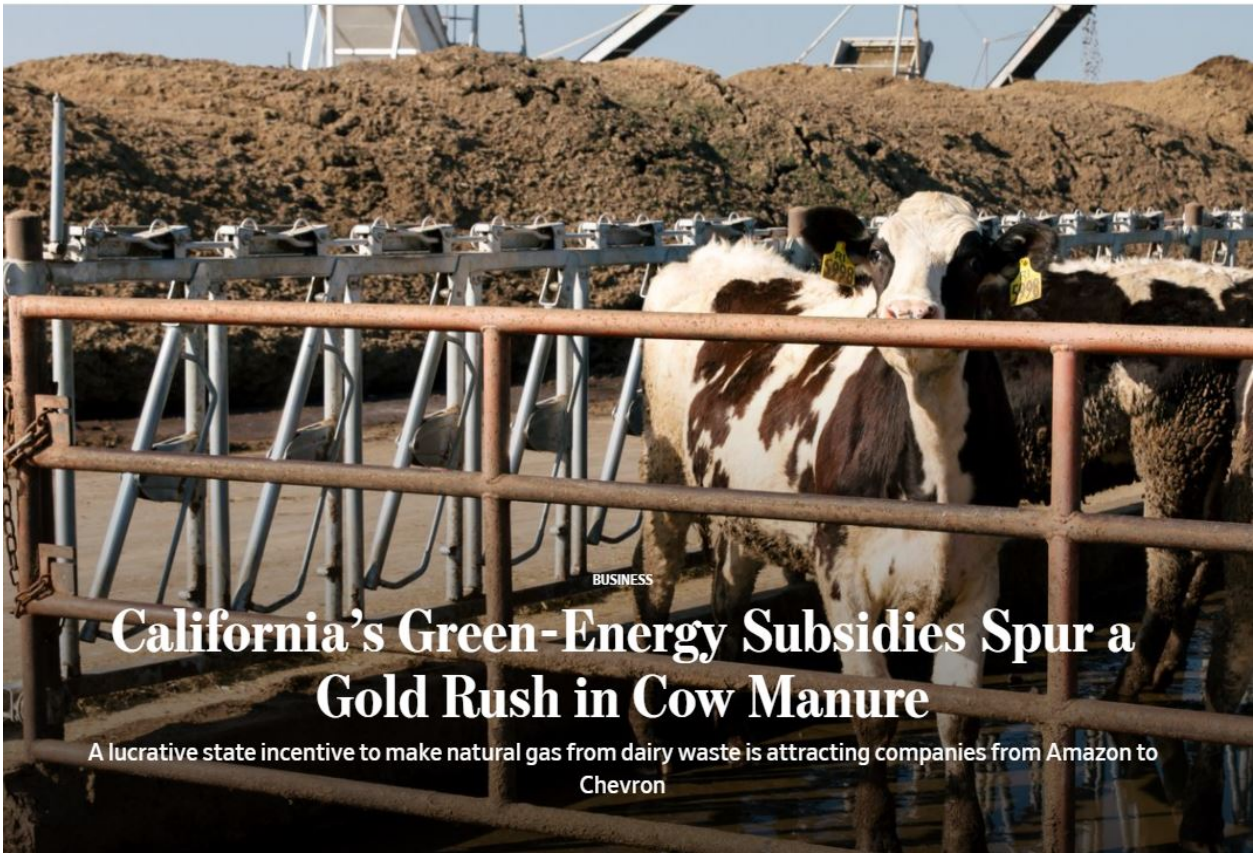
THE WALL STREET JOURNAL.



BUSINESS

# California's Green-Energy Subsidies Spur a Gold Rush in Cow Manure

A lucrative state incentive to make natural gas from dairy waste is attracting companies from Amazon to Chevron

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## I. BACKGROUND

On October 27, 2021, the Association of Irritated Residents, Leadership Counsel for Justice & Accountability, Food & Water Watch, and the Animal Legal Defense Fund ("Petitioners") filed a petition for rulemaking[1] ("Petition") with the California Air Resources Board (CARB) pursuant to Government Code section 11340.6.[2] The Petition asked CARB to amend the Low Carbon Fuel Standard (LCFS) to exclude all fuels derived from factory farm gas or, in the alternative, to reform the LCFS to account for the full life cycle of factory farm gas emissions—including all upstream and downstream emissions from activities and inputs at dairy and pig facilities—and exclude non-additional emission reductions that occur as a result of other methane reduction programs. As explained in more detail below, the Petition also highlighted LCFS transparency issues and that the LCFS has disproportionate adverse and cumulative impacts on low-income and Latina/o/e/ communities.

On November 29, 2021, Petitioners and CARB entered into a Tolling Agreement[3] providing that CARB would have until January 28, 2022, to respond to the Petition—an additional sixty days on top of the thirty days provided by statute.[4] In consideration of this extension, CARB agreed to "engage in good faith discussions" with Petitioners in the intervening months "in an effort to reach common ground with respect to the issues raised in the Petition."[5]

To effectuate the Tolling Agreement, Petitioners met with CARB members and staff, including the Executive Officer, numerous times. During the meetings, the parties discussed the issues raised in the Petition and asked CARB to grant interim relief by suspending pathway certifications for factory farm gas pending the rulemaking. Petitioners also requested this interim

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[1] Attach. 1, ASSOCIATION OF IRRITATED RESIDENTS ET AL., PETITION FOR RULEMAKING TO EXCLUDE ALL FUELS DERIVED FROM BIOMETHANE FROM DAIRY AND SWINE MANURE FROM THE LOW CARBON FUEL STANDARD PROGRAM (Oct. 27, 2021).

[2] The petition followed two years of Petitioners' comments in opposition to certifications of pathways for factory farm gas. To date, one or more of the petitioning organizations have submitted comments in opposition to thirty-three Tier 2 applications for pathways for factory farm gas—and CARB has certified all of them over Petitioners' objections. *LCFS Pathways Requiring Public Comments*, CARB, https://ww2.arb.ca.gov/resources/documents/lcfs-pathways-requiring-public-comments (last visited Mar. 25, 2022) (applications B0215, B0216, B0217, B0280); *2021 LCFS Pathways Requiring Public Comments*, CARB, https://ww2.arb.ca.gov/2021-lcfs-pathways-requiring-public-comments (last visited Mar. 25, 2022) (applications B0218, B0242, B0207, B0220, B0214, B0198, B0185, B0175, B0197, B0173, B0166, B0163, B0148); *2020 LCFS Pathways Requiring Public Comments*, CARB, https://ww2.arb.ca.gov/resources/documents/2020-lcfs-pathways-requiring-public-comments (last visited Mar. 25, 2022) (applications B0127, B0096, B0097, B0109, B0108, B0072, B0098, B0059, B0089); *2019 LCFS Pathways Requiring Public Comments*, CARB, https://ww2.arb.ca.gov/resources/documents/2019-lcfs-pathways-requiring-public-comments (last visited Mar. 25, 2022) (applications B0019, B0010, B0060, B0058, B0037, B0038, B0019). Many of the petitioning organizations also submitted comments in opposition to a new temporary pathway for factory farm gas, which it appears CARB never certified. *See 2020 LCFS Pathways Requiring Public Comments*, CARB, https://ww2.arb.ca.gov/resources/documents/2020-lcfs-pathways-requiring-public-comments (last visited Mar. 25, 2022) (notice documentation and comments); *LCFS Life Cycle Analysis Models and Documentation*, CARB, https://ww2.arb.ca.gov/resources/documents/lcfs-life-cycle-analysis-models-and-documentation (last visited Mar. 15, 2022) (not listing the proposed temporary pathway as certified).

[3] Attach. 2, TOLLING AGREEMENT (Nov. 29, 2021).

[4] Cal. Gov't Code § 11340.7(a).

[5] Tolling Agreement, *supra* note 3, at 1.

relief in comments in opposition to several proposed pathway certifications[6] and in comments on the LCFS workshop that took place on January 7, 2022.[7]

On January 26, 2022—two days ahead of the deadline in the Tolling Agreement and one day before a previously scheduled Board[8] meeting—the Executive Officer responded to the Petition ("Response"), granting it in part and denying it in part.[9] The Response denied the Petition "by declining to amend the LCFS regulation at this time in the manners suggested."[10] The Response purported to grant other relief "by affirming that CARB will continue to engage with petitioners on the programmatic and environmental justice and environmental integrity concerns raised in the petition through the ongoing AB 32 Climate Change Scoping Plan update process and upcoming informal workshops on LCFS throughout 2022, both of which will inform any future LCFS amendments."[11] The Executive Officer relied on two justifications for the Response. First, the Response declined near-term amendments because "it is premature to consider amending the LCFS regulation until the Scoping Plan update process" has been completed.[12] Second, the Response claimed that Senate Bill 1383 (SB 1383) "directs CARB to 'ensure' LCFS crediting for methane reductions" and thus CARB lacked authority to grant the relief sought by the Petition.[13]

CARB also denied Petitioners' request for interim relief on January 26, 2022.[14] Specifically, CARB explained that a petition for rulemaking "is not a proper legal mechanism to stop implementing the current version of the LCFS regulation."[15] CARB has continued certifying all pathways for factory farm gas presented to the agency—despite Petitioners' comments in opposition to such pathways[16] and notwithstanding concerns raised by Board members, as described below.

The next day, on January 27, 2022, Petitioners commented at the Board meeting and raised their concerns about the Response and the issues raised in the Petition. Several Board

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[6] *LCFS Pathways Requiring Public Comments*, CARB, https://ww2.arb.ca.gov/resources/documents/lcfs-pathways-requiring-public-comments (last visited Mar. 25, 2022) (showing Petitioners' comments in opposition to application B0280 while the Petition was pending); *2021 LCFS Pathways Requiring Public Comments*, CARB, https://ww2.arb.ca.gov/2021-lcfs-pathways-requiring-public-comments (last visited Mar. 25, 2022) (showing Petitioners' comments in opposition to applications B0218, B0242, B0207, and B0220 while the Petition was pending).

[7] Attach. 3, Coalition Comments on the Public Workshop Re: Potential Future Changes to the LCFS Program (Jan. 7, 2022), https://www.arb.ca.gov/lists/com-attach/108-lcfs-wkshp-dec21-ws-ADIHMV1uB2YBKVRk.pdf.

[8] "Board" refers to the members of the Board, rather CARB as an agency.

[9] Attach. 4, CAL. AIR RES. BD., RESPONSE TO PETITION FOR RULEMAKING TO EXCLUDE ALL FUELS DERIVED FROM BIOMETHANE FROM DAIRY AND SWINE MANURE FROM THE LOW CARBON FUEL STANDARD PROGRAM (Jan. 26, 2022).

[10] *Id.* at 7.

[11] *Id.*

[12] *Id.* at 4.

[13] *Id.* at 5 (quoting Cal. Health & Safety Code § 39730.7(e)).

[14] Attach. 5, CARB Letter to Petitioners Re: Requests to Deny or Delay Consideration of Low Carbon Fuel Standard (LCFS) Pathway Certifications (Jan. 26, 2022).

[15] *Id.*

[16] *2021 LCFS Pathways Requiring Public Comments*, CARB, https://ww2.arb.ca.gov/2021-lcfs-pathways-requiring-public-comments (last visited Mar. 25, 2022) (showing CARB certified applications B0218, B0242, B0207, and B0220 over Petitioners' comments in opposition while the Petition was pending).

members likewise raised concerns. Accordingly, the Board directed the Executive Officer to set a public workshop specifically on the issues raised in the Petition and share the findings and discussion at the workshop with the Board at a future Board meeting to "allow the Board to hear about the issues in more detail and provide guidance in terms of moving forward with a rulemaking process."[17]

> CHAIR RANDOLPH: All right. Thank you. That was a good discussion. All right. So I think the -- several Board members have raised kind of the same sort of concerns, intentions around recognizing that the dairy participation in LCFS is an important issue, is dairies do affect communities, but also recognizing that there's a lot of issues around that. There's a lot of factual issues, there's policy issues, and there's also kind of a learning curve that I think we want to make sure that all Board members have an opportunity to participate in with regard to LCFS generally and with regard to this issue specifically.
>
> So my suggestion to Executive Officer Corey is, recognizing the heavy lift that we're doing with the Scoping Plan and with the 23 Board meetings this year, and also recognizing that there -- you know, we have received this petition, but there hasn't been any sort of public process or discussion about that, my suggestion is that there be a -- and this kind of dovetails nicely with Exec -- the Executive Officer's concerns about making sure there's a robust opportunity for information sharing and engagement. *My suggestion is that we do a public workshop specifically on this issue,* ideally within the next few months, and then come back to the Board with an item after that public workshop, and -- where staff could share the findings and the discussion and really kind of allow the Board to hear about the issues in more detail and provide guidance in terms of moving forward with a rulemaking process.
>
> And so that would help kind of get some of the groundwork that we need to do before the formal process happening sooner rather than later with a recognition that opening the full formal process is going to be a big undertaking that's going to take a bit more time. I would like to get the -- Mr. Corey's thoughts on that.
>
> EXECUTIVE OFFICER COREY: Yes. Thanks, Chair and Board members for the discussion -- really thoughtful discussion. And to your suggestion, Chair, absolutely, I think that's on point within the next few months. We'll get going on the full conversation that -- including petitioners and others in a workshop setting that I think

[17] CAL. AIR RES. BD., VIDEOCONFERENCE MEETING, STATE OF CALIFORNIA, AIR RESOURCES BOARD, ZOOM PLATFORM 171–73 (Jan. 27, 2022), https://ww2.arb.ca.gov/sites/default/files/barcu/board/mt/2022/mt012722.pdf (transcript).

> will help and be part honestly a pre-rulemaking, because it will pull additional information together. So we'll develop a schedule over the next few months that would include the workshop that you just -- a public workshop that you just referred to as well as report back to the Board, how did the workshop go, what are the learnings, what's the process going forward. So we'll get going on that.[18]

## II. THE PETITION

The Petition asked CARB to amend LCFS to exclude all fuels derived from factory farm gas or, in the alternative, to reform the LCFS to account for the full life cycle of factory farm gas emissions—including all upstream and downstream emissions from activities and inputs at dairy and pig facilities—and exclude non-additional emission reductions that occur as a result of other factory farm gas incentives. The Petition provides three main reasons why CARB must grant this relief. First, factory farm gas pathways fail to achieve the maximum technologically feasible and cost-effective emissions reductions, as Assembly Bill 32 (AB 32) requires, because they fail to incorporate proper lifecycle analyses (LCAs), leading to inflated credit values. Second, the LCFS fails to ensure that credited emission reductions are additional to reductions that would have otherwise occurred as required by section 38562(d)(2) of the Health & Safety Code. The resulting combination of inflated credit values and credits for non-additional reductions incentivize increased manure generation, industry consolidation, and facility expansions that exacerbate localized pollution and disparate impacts. Thus, CARB fails to achieve the maximum technologically feasible and cost-effective greenhouse gas (GHG) emissions.[19] Third, factory farm gas pathways fail to maximize additional environmental benefits and interfere with efforts to improve air quality.[20]

The Petition also asked CARB to evaluate and amend the LCFS to remedy its disproportionate adverse and cumulative impacts on low-income and Latina/o/e/ communities in violation of state and federal law.[21] The Petition provides three main reasons why CARB must grant this relief. First, LCFS credits and the subsequent trading of those credits incentivize activities that result in public health and environmental harms in disproportionately low-income and Latina/o/e communities, particularly in the San Joaquin Valley.[22] Second, CARB must ensure that the LCFS complies with CA 11135, CA 12955, and Title VI of the Civil Rights Act of 1964 to prevent discrimination.[23] Third, CARB failed to design the LCFS in a manner that is equitable, and CARB fails on an ongoing basis to consider the social costs of GHG emissions and to ensure that the LCFS does not disproportionately impact low-income communities.[24]

Finally, the Petition asked CARB to address the lack of transparency as to pathways for factory farm gas.[25] Specifically, there is no way for the public to access trading data to determine

[18] *Id.* (emphasis added).
[19] Petition, *supra* note 1, at 10–26.
[20] *Id.* at 26–31.
[21] *Id.* at 31–36.
[22] *Id.* at 31–34.
[23] *Id.* at 34–35.
[24] *Id.* at 35–36.
[25] *Id.* at 36–37.

the location of facilities purchasing LCFS factory farm credits, and what records are available are heavily redacted.[26] This makes it difficult to determine potential disparate impacts.[27]

## III. CARB SHOULD RECONSIDER AND GRANT THE PETITION.

CARB has the authority—and the duty—to grant the Petition.[28] CARB may not deny the Petition and defer consideration of the issues for three primary reasons. First, the Response neither disputes nor responds to the evidence demonstrating that factory farm gas in the LCFS violates applicable law and undermines AB 32's purpose and goals by (1) grossly minimizing carbon intensity (CI), which inflates factory farm gas credit values; (2) perversely incentivizing the entrenchment, expansion, and consolidation of factory farms and methane-generating liquified manure management systems; (3) authorizing non-additional emission reductions achieved by other programs and credited to those programs, including the Dairy Digester Research and Development Program, the SB 1383 methane reduction mandate, and the Aliso Canyon Mitigation Agreement; and (4) causing adverse and disparate environmental impacts.

Second, SB 1383 does not justify denial of the Petition when it mandates neither the inclusion nor the overvaluation of factory farm gas in the LCFS.

Finally, San Joaquin Valley communities cannot wait until 2023 or later for CARB to address the issues raised in the Petition, which disproportionately harm them.

### A. CARB has neither disputed nor responded to evidence that including factory farm gas in the LCFS violates applicable law and undermines the purpose and goals of AB 32.

CARB has not responded to the substantive issues presented in the Petition—and these issues are both urgent and significant. CARB's decision to include and overvalue factory farm gas in the LCFS violates AB 32 and completely undermines its purpose and goals by causing an *increase* in pollution, especially in San Joaquin Valley communities and in communities where CARB admits that transportation fuels have racially disparate impacts.[29] CARB must begin rulemaking immediately to address these issues, as the damage intensifies and compounds with each passing day that CARB allows the LCFS to continue unreformed.

#### 1. Factory farm gas credits distort and undermine the LCFS.

The Petition explains that CARB's current administration of the LCFS violates AB 32 and the LCFS by artificially minimizing the CI of factory farm gas, which drastically inflates the

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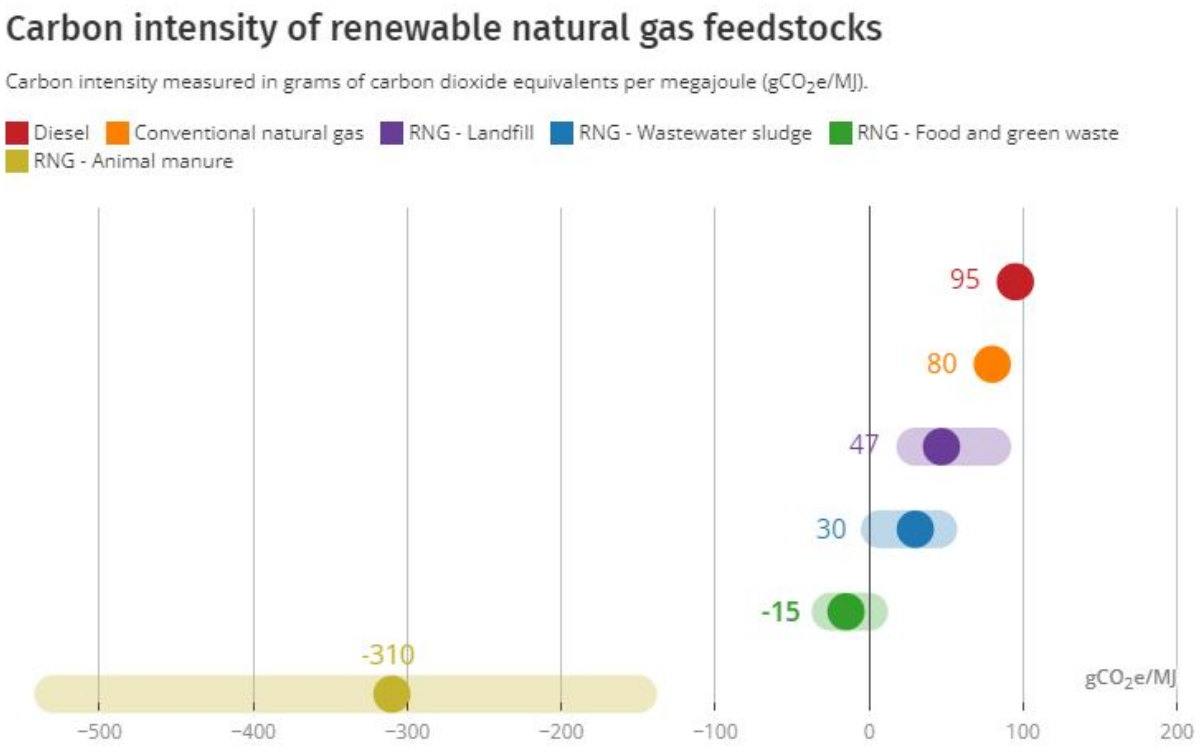
[26] *Id.*
[27] *Id.*
[28] *See* Cal. Gov't Code § 11340.7(c) ("Any interested person may request a reconsideration of any part or all of a decision of any agency on any petition submitted. The request shall be submitted in accordance with Section 11340.6 and include the reason or reasons why an agency should reconsider its previous decision no later than 60 days after the date of the decision involved.").
[29] *See* CAL. AIR RES. BD., 2020 MOBILE SOURCE STATEWIDE STRATEGY 25–28 (Oct. 28, 2021), https://ww2.arb.ca.gov/sites/default/files/2021-12/2020_Mobile_Source_Strategy.pdf.

value of credits for factory farm gas. AB 32 mandates that CARB "shall rely upon the best available economic and scientific information and its assessment of existing and projected technological capabilities when adopting the regulations required"[30] and that "any regulation adopted by [CARB] shall ensure [GHG] emission reductions achieved are real."[31] Accordingly, the LCFS requires all pathway application LCAs to include upstream and downstream GHG emissions, including direct and indirect GHG emissions from producing the feedstock—manure.[32] This "well to wheels" LCA determines the CI of the fuel, which quantifies emission reductions and determines the quantity of GHG emissions it purportedly can "offset," which in turn determines how much value those credits hold.[33]

But CARB's LCA minimizes factory farm gas CI by treating manure as a waste and factory farm gas as avoided methane emissions. CARB excludes emissions upstream and downstream in a narrow system boundary that treats the manure lagoon as the baseline—as if the lagoon occurs naturally, rather than as the result of the industry's deliberate choice to manage manure anaerobically in giant lagoons. As the Petition notes, alternative manure management techniques are available, including solid-liquid separation, scrape and vacuum collection, composting, and pasture-based practices, and evidence shows that these techniques may offer more cost-effective methane emission reductions than anaerobic digestion and may deliver additional environmental and health benefits, like reduced impact on water quality.[34]

CARB's LCA reflects an unscientific policy decision inconsistent with the reality that the industry creates manure methane intentionally and considers manure to be valuable fertilizer. As depicted below,[35] CARB's interpretation artificially minimizes the CI of fuels derived from manure methane, which artificially inflates the value of credits for those fuels, which results in a windfall to the animal agriculture and natural gas industries. But those are not the only industries that benefit—regulated entities (e.g., oil companies) holding deficits in the LCFS can keep emitting vast quantities of pollution under the guise that some those emissions are offset by factory farm gas credits purchased on the LCFS market.

[30] Cal. Health & Safety Code § 38562(e).
[31] § 38562(d)(1) (cleaned up).
[32] Cal. Code Regs. tit. 17, §§ 95488.7(a)(2)(B); 95488.7(a)(2)(A)(2); CAL. AIR RES. BD., LOW CARBON FUEL STANDARD BASICS 16, https://ww2.arb.ca.gov/sites/default/files/2020-09/basics-notes.pdf (last visited Mar. 25, 2022).
[33] *Low Carbon Fuel Standard*, CAL. AIR RES. BD., https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/about (last visited Mar. 25, 2022).
[34] Petition, *supra* note 1, at 16.
[35] Emily Chung, *Renewable natural gas could help slow climate change, but by how much?*, CBC NEWS (Feb. 13, 2022), https://www.cbc.ca/news/science/renewable-natural-gas-1.6346783 (based on raw data from CARB).




CARB effectuates this policy decision beginning with the Compliance Offset Protocol – Livestock Projects ("Livestock Protocol").[36] The Livestock Protocol was created for California's Cap & Trade scheme and is not mentioned in the LCFS, but CARB adopted some of its pieces for the LCFS.[37] One piece CARB adopted is the system boundary, which designates which parts of the factory farm gas production process will be considered in calculating the CI of fuels derived from that factory farm gas.[38] This system boundary is the primary reason that the value of credits for factory farm gas are inflated—it excludes numerous relevant emissions, including those related to producing and transporting the feed that the cows eat, enteric emissions from the cows, and emissions of nitrous oxide that result from digestate composting and land application.[39]

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[36] CAL. AIR RES. BD., COMPLIANCE OFFSET PROTOCOL LIVESTOCK PROJECTS, CAPTURING AND DESTROYING METHANE FROM MANURE MANAGEMENT SYSTEMS (Nov. 14, 2014), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2014/Capandtrade14/ctlivestockprotocol.pdf. CARB incorporates this system boundary from the Livestock Protocol into CA-GREET3.0 and the Tier 1 Simplified CI Calculator for Biomethane from Anaerobic Digestion of Dairy and Swine Manure, a version of CA-GREET3.0 specifically for fuels derived from factory farm gas. Both CA-GREET3.0 and the Tier 1 Simplified CI Calculator for Biomethane from Anaerobic Digestion of Dairy and Swine Manure are incorporated into the LCFS by reference. Petitioners note that guidance documents are not incorporated by reference, including Guidance 19-06, which is specific to determining the CI of factory farm gas to electricity pathways.

[37] CAL. AIR RES. BD., LOW CARBON FUEL STANDARD, FREQUENTLY ASKED QUESTIONS, CREDIT GENERATION FOR REDUCTION OF METHANE EMISSIONS FROM MANURE MANAGEMENT OPERATIONS (Sep. 16, 2020), https://ww2.arb.ca.gov/sites/default/files/2020-09/2020_dairy-swine-manure_crediting_faq.pdf.

[38] *Id.*; *see* Livestock Protocol, *supra* note 36, at 13–17 (offset project boundary).

[39] Livestock Protocol, *supra* note 36, at 15–17; Low Carbon Fuel Standard, Frequently Asked Questions, *supra* note 37, at 4–6.

The LCFS policy decision has the consequence of undermining the goals and purpose of AB 32 by increasing emissions. As mentioned in the Petition,[40] a recent study found that increased nitrous oxide emissions associated with composting digestate solids—which are the direct result of the ways in which digestion changes the chemical composition of manure—are enough to completely cancel out captured methane emissions.[41] But CARB excludes those emissions and emissions upstream of the lagoon to generate lucrative credits that distort the market and undermine the LCFS. The Union of Concerned Scientists also questions CARB's policy, noting in comments to CARB that:

> [T]he extremely large negative [CI] values for manure biomethane are the result of several assumptions and judgements made by CARB in the [LCA] that bear reconsideration. In particular, CARB should revisit the assumption that the methane from manure lagoons is purely a waste product with no value that would be emitted into the atmosphere absent the LCCFS support for use as a transportation fuel. . . . There are any number of alternative [LCAs] that may be appropriate in the development of the CI score, for example treating biomethane as a coproduct rather than a waste. . . . It may be appropriate to set a floor of zero on the CI scores for fuels absent compelling documentation of permanent carbon sequestration. . . .
> . . .
> The lifecycle basis of the LCFS is supposed to ensure that support for low carbon fuels is based on a comprehensive assessment of their climate benefits. However, in this instance, this structure is functioning as poorly designed offset program with transportation fuel users paying an extremely high price for manure methane mitigation. This is not good transportation fuel policy or good agricultural methane mitigation policy.[42]

CARB has a legal duty to address these issues and reform the LCFS to ensure that it supports and furthers the goals and purpose of AB 32 rather than undermining them.

### 2. The LCFS perversely incentivizes herd expansions, greater geographic concentration of factory farm pollution, and maximum methane generation at factory farms.

CARB's administration of the LCFS perversely incentivizes factory farms to expand to larger herd sizes and to geographically concentrate even more intensively near factory farm gas

[40] Petition, *supra* note 1, at 14–15.
[41] *See* Michael A. Holly et al., *Greenhouse gas and ammonia emissions from digested and separated dairy manure during storage and after land application Agriculture*, 239 AGRIC., ECOSYSTEMS & ENV'T 410, 418 (Feb. 15, 2017), https://doi.org/10.1016/j.agee.2017.02.007.
[42] Attach. 6, Letter from Jeremy Martin, Union of Concerned Scientists, to Cheryl Laskowski, CARB (Jan. 6, 2022) (cover letter for study, Attach. 7, urging CARB to reform the LCFS to remove perverse incentives and correct the lack of programmatic integrity caused by faulty LCAs); *see also* Attach. 7, UNION OF CONCERNED SCIENTISTS, QUANTIFICATION OF DAIRY FARM SUBSIDIES UNDER CALIFORNIA'S LOW CARBON FUEL STANDARD (Sep. 2021).

cluster projects or other utility grid access points necessary to monetize factory farm gas pollution under the LCFS. The LCFS also encourages and rewards maximum methane generation from animal manure, disincentivizing strategies that would *avoid* methane generation in the first place.[43] These perverse incentives and the attendant growth in animal numbers at deeply unsustainable factory farms undercut the methane emissions reductions associated with digesters and result in ever greater environmental harms and community health impacts from the plethora of co-pollutants at factory farm operations left unaddressed by anaerobic digesters. CARB cannot continue to bury its head in the sand, ignore the reality on the ground, and delay action on the Petition to reform these serious environmental injustice and program integrity issues.

### a. The LCFS causes factory farms to expand.

The LCFS has created a manure "gold rush," driving factory farms to expand their herds to maximize the windfall profits available in the inflated LCFS credit market. Rather than correct the market distortion, the Response instead claims without evidence that "the current LCFS crediting regime for biomethane derived from animal manure is delivering the significant benefits it was designed to achieve."[44] CARB staff invited more data from Petitioners to better establish the expansion problem, which Petitioners provide here.

Petitioners document below at least thirteen recent factory farm expansions undertaken in parallel with digester buildouts and LCFS applications or preparation for LCFS credit generation. This list is not exhaustive, and Petitioners proffer it as a set of examples emblematic of a broader trend. These expansions have occurred in California and other states where factory farming operators have identified the LCFS as a major new source of profit.

Aemetis Advanced Fuels Keyes ("Aemetis") develops dairy biogas cluster projects located in the San Joaquin Valley, and its Aemetis Central Dairy Digester Project[45] provides a case study showing the power of CARB's perverse incentive to expand factory farm herd sizes. CARB has already certified a pathway application from Aemetis to generate LCFS credits from factory farm gas used as a process fuel for ethanol production, and the Central Dairy Digester Project is Aemetis' latest plan to expand its LCFS credit generation.[46] Of the dairies currently identified by Aemetis as part of this cluster project and in various stages of installing anaerobic

[43] *See supra* note 34 and associated text.
[44] Response, *supra* note 9, at 6. CARB's position can only mean one of two things: either CARB accepts the perverse incentives Petitioners raise and the attendant environmental justice and program integrity issues (including a failure to comply with AB 32's "maximum technologically feasible and cost-effective greenhouse gas emissions reductions" mandate, Health & Safety Code § 38560) as acceptable collateral damage, or CARB has substantively denied Petitioners' claims without a consideration or discussion of the record evidence.
[45] *See Press Releases, Aemetis Receives LCFS Pathway Approval Utilizing Dairy Biogas for Production of Renewable Transportation Fuels,* AEMETIS (Mar. 31, 2021), https://www.aemetis.com/aemetis-receives-lcfs-pathway-approval-utilizing-dairy-biogas-for-production-of-renewable-transportation-fuel/.
[46] CALEPA & CAL. AIR RES. BD., LCFS TIER 2 PATHWAY APP. B0172 (certified MAR. 29, 2021), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0172_cover.pdf.

lagoon digesters,[47] the following seven dairies have recently expanded their herd or are in the process of expanding.

- Ahlem Farms Jerseys[48]
- Vierra Dairy[49]
- S&S Dairy[50]
- Trinkler Dairy[51]
- K&R Blount Dairy[52]
- AJ Borba Dairy[53]
- Oliveira Dairy[54]

As this single cluster project shows, herd expansion necessarily accompanies digester installation to maximize factory farm gas profit under the LCFS. And this example is not an outlier.

Other major factory farm expansions undertaken in tandem with LCFS credit generation plans include, but are not limited to:

- The Melo Dairy expansion and digester install, working with Maas Energy to inject into PG&E pipelines as renewable transportation fuel.[55]

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[47] CAL. ALTERNATIVE ENERGY AND ADVANCED TRANSPORTATION FINANCING AUTHORITY, REQUEST TO APPROVE PROJECT FOR SALES AND USE TAX EXEMPTION 3 (Mar. 16, 2021), https://www.treasurer.ca.gov/caeatfa/meeting/2021/20210316/staff/4.G.8.pdf.

[48] *Use Permit Application No. PLN2020-0081 - Ahlem Farms Jerseys*, CEQANET (received Dec. 10, 2020), https://ceqanet.opr.ca.gov/2020120171/2.

[49] COUNTY OF MERCED, NOTICE OF PREPARATION OF A DRAFT ENVIRONMENTAL IMPACT REPORT FOR THE VIERRA DAIRY EXPANSION PROJECT (Sept. 2021), https://web2.co.merced.ca.us/pdfs/env_docs/eir/CUP20-009/NOP_IS_2021-09-28_CUP20-009_VierraDairy.pdf.

[50] SJVAPCD, NOTICE OF FINAL ACTION – AUTHORITY TO CONSTRUCT (May 6, 2020), http://www.valleyair.org/notices/Docs/2020/05-14-20_(N-1182555)/Packet.pdf.

[51] SJVAPCD, NOTICE OF FINAL ACTION FOR ISSUANCE OF AUTHORITY TO CONSTRUCT PERMITS (Sept. 12, 2017), https://www.valleyair.org/notices/Docs/2017/09-12-17_(N-1150266)/Newspaper.pdf; *see also* Letter from Jeremy Ballard, Stanislaus County, to Aemetis, Inc. 255–56 (Mar. 25, 2020), https://www.stancounty.com/publicworks/pdf/projects/AemtisBiogasProject/20_10_27_Aemetis%20Biogas%20Pipeline%20ISMND.pdf (discussing digester buildouts at numerous expanding dairies, including Trinkler Dairy, Ahlem Farms Jerseys, K & R Blount Dairy, and S&S Dairy in the context of Aemetis' pipeline construction plans).

[52] *See* STANISLAUS COUNTY PLANNING COMMISSION, USE PERMIT APPLICATION FOR K&R BLOUNT DAIRY EXPANSION (July 16, 2015), https://www.stancounty.com/planning/agenda/2015/07-16-15/VIIA_SR_A_C.pdf (2015 application to allow expanded herd size); CENTRAL VALLEY REGIONAL WATER QUALITY CONTROL BOARD, INSPECTION REPORT, https://ciwqs.waterboards.ca.gov/ciwqs/readOnly/PublicAttachmentRetriever?parentID=33118239&attachmentID=2082677&attType=4 (2018 Inspection Report stating that "K & R Blount Dairy has applied for an expansion").

[53] *Notice of Determination Approving Antonio J Borha Holsteins Dairy Expansion*, CEQANET (Nov. 29, 2018), https://ceqanet.opr.ca.gov/2016121016/4; *see also* COUNTY OF MERCED, ENVIRONMENTAL IMPACT REPORT FOR THE AJ BORBA HOLSTEINS EXPANSION PROJECT (May 2018), https://www.co.merced.ca.us/AgendaCenter/ViewFile/Item/622?fileID=6095.

[54] *Draft EIR for Oliviera Dairy Expansion Project*, CEQANET (Apr. 9, 2019), https://ceqanet.opr.ca.gov/2018081058/2; http://www.valleyair.org/notIces/Docs/2020/06-18-20_(N-1183853)/Packet.pdf.

[55] COUNTY OF MERCED, CONTRACT BOARD AGENDA ITEM, https://web2.co.merced.ca.us/boardagenda/2021/20210713Board/271687/271692/271744/271832/ITEM%2032271832.pdf (providing Melo Dairy Biogas Expansion Project details); *see Press Releases, PG&E, PG&E Helps Advance Accessibility to Renewable Natural Gas Sources*

- The Vander Poel Dairy expansion alongside digester construction, which was subsequently part of Calgren's 2020 LCFS application, which CARB certified.[56]
- Smithfield Foods' massive factory farm expansion in Utah in partnership with Dominion Energy, which plans to use the factory farm gas generated by the new manure lagoons to generate LCFS credits.[57]
- Seven factory farms in Iowa seeking herd expansions along with digester buildouts, accompanied by a developer's intent to use the factory farm gas to generate LCFS credits from at least three factory farms.[58]

These concrete examples of LCFS-related factory farm expansions are only the tip of the iceberg. The manure "gold rush" to monetize factory farm methane pollution can only logically lead to more and more herd expansions and operational decisions that will maximize manure methane emissions, since any manure management decisions designed to proactively avoid methane generation from manure (such as solids separation or dry manure handling) would be held against an applicant when it comes time for CARB to certify a CI for a project. In fact, CARB could hardly have structured a program that would more effectively push these perverse incentives. CARB cannot be so naïve as to think that a program which fundamentally rewards applicants with windfall profits for producing as much manure as possible and managing it in intentionally unsustainable ways has no effect on how factory farms operate, evolve, and impact the environment and local communities.

The factory farm and natural gas industry have identified the LCFS "gold rush" as the new frontier for mega-factory farm development and financial success, with many industry actors and investors recognizing that manure gas has become nearly as valuable, if not more valuable, than milk produced at large dairies. As a manager for one of the largest mega-dairies in the United States said: "The most valuable product we have [at Threemile Canyon dairy in

*for California Customers*, PG&E (Jan. 13, 2022), https://www.pge.com/en_US/about-pge/media-newsroom/news-details.page?pageID=db8b414e-5ced-45a3-a31a-5c20203e71f3&ts=1642264019336 (stating that factory farm gas from this cluster of dairies "will make Merced a leading producer of renewable transportation fuels").

[56] SJVAPCD, NOTICE OF FINAL ACTION – AUTHORITY TO CONSTRUCT (May 22, 2019), http://valleyair.org/notices/Docs/2019/05-22-19_(S-1182819)/notice.pdf; CALEPA & CAL. AIR RES. BD., LCFS TIER 2 PATHWAY APP. B0098 (certified June 30, 2020), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0098_cover.pdf.

[57] Sarah Golden, *The Secret to the Happy Relationship Between Smithfield Foods and Dominion Energy*, GREENBIZ (Feb. 14, 2020), https://www.greenbiz.com/article/secret-happy-relationship-between-smithfield-foods-and-dominion-energy; *see* Lisa Held, *Are Biogas Subsidies Benefiting the Largest Industrial Animal Farms?*, CIVIL EATS (Sept. 20, 2021), https://civileats.com/2021/09/20/are-biogas-subsidies-benefiting-the-largest-industrial-animal-farms/ (discussing Smithfield's massive expansion of hog factory farming in Utah as "part of the company's Align Renewable Natural Gas initiative, created in conjunction with Dominion Energy").

[58] Erin Jordan, *Nine Iowa Dairies Get Digester Permits Since New Law, Seven Plan Expansion*, THE GAZETTE (Dec. 3, 2021), https://www.thegazette.com/agriculture/nine-iowa-dairies-get-digester-permits-since-new-law-seven-plan-expansion/; Kailey Foster, *A Few Hundred Thousand Gallons of Manure Spill at IA Fuel Plant*, KOEL (Feb. 14, 2022), https://koel.com/manure-fuel-spill/ (noting that the digester was intended by Gevo to provide "fuel to power cars in California"); *BP Acquires RNG Project from Gevo*, MANURE MANAGER (Aug. 11, 2021), https://www.manuremanager.com/bp-acquires-rng-project-from-gevo/ (noting the intent to generate LCFS credits); SEC Form 10-Q, https://www.sec.gov/Archives/edgar/data/1392380/000143774921012120/gevo20210331_10q.htm (Gevo disclosure stating that it will source factory farm gas from three dairies and sell into the California market).

Oregon] is natural gas."[59] CARB certified Threemile Canyon's LCFS pathway in 2020.[60]

Recent industry and media statements making a similar point include, but are not limited to:

- "We used to joke about how funny it would be if we could make more money off the poop than the milk," [California mega-dairy Bar 20's] Sheheady said. "And now we're essentially here."[61]
- "If profits are $2 to $3 per hundredweight, they could likely exceed the profit from milk. At that point, milk has become the by-product of manure production."[62]
- "Cow manure is now worth more than milk at some California dairy farms."[63]
- The LCFS "gold rush" is "attracting companies from Amazon to Chevron."[64]
- A principal at a global agribusiness consulting firm noting that cow manure may be worth more than milk in the future—"[s]o, there is a gold rush to install this kind of technology on large-scale dairy farms" in order to profit off the LCFS.[65]

Many other media and industry sources have likewise identified the "gold rush" to monetize intentionally created factory farm methane emissions under the LCFS.[66]

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[59] Tracy Loew, *Manure Is Big Business at Oregon's Largest Dairy with Conversion to Natural Gas*, STATESMAN JOURNAL (Apr. 1, 2019), https://www.statesmanjournal.com/story/tech/science/environment/2019/03/31/oregon-threemile-canyon-farms-dairy-natural-gas-manure/3247197002/.

[60] CALEPA & CAL. AIR RES. BD., LCFS TIER 2 PATHWAY APP. B0072 (certified Sep. 30, 2020), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0072_summary.pdf.

[61] Kaya Laterman, *This California Dairy Farm's Secret Ingredient for Clean Electricity: Cow Poop*, DAILY BEAST (Jan. 22, 2022), https://www.thedailybeast.com/california-dairy-farm-has-microgrid-powered-by-clean-electricity-made-from-methane-from-cow-poop?via=newsletter.

[62] Michael McCully, *Energy Revenue Could Be a Game Changer for Dairy Farms*, HOARD'S DAIRYMAN (Sept. 23, 2021), https://hoards.com/article-30925-energy-revenue-could-be-a-game-changer-for-dairy-farms.html.

[63] *Manure Becomes More Valuable Than Milk at California Dairies*, SBJ (Oct. 20, 2021), https://sbj.net/stories/manure-becomes-more-valuable-than-milk-at-california-dairies,76541#:~:text=Cow%20manure%20is%20now%20worth,can%20exceed%20that%20of%20milk.

[64] Phred Dvorak, *California's Green-Energy Subsidies Spur a Gold Rush in Cow Manure*, WALL STREET J. (Feb. 19, 2022), https://www.wsj.com/articles/californias-green-energy-subsidies-spur-a-gold-rush-in-cow-manure-11645279200.

[65] Emma Hopkins-Obrien, *Dairy Industry Leads the Way for Innovation*, FARMER'S EXCHANGE (Dec. 17, 2021), http://www.farmers-exchange.net/detailPage.aspx?articleID=21153.

[66] *See, e.g.*, Janet Wilson & Joshua Yeager, *Is Manure the Future of Fuel? California Say Yes, but Environmentalists Say It Stinks*, USA TODAY (Mar. 3, 2022), https://www.usatoday.com/story/money/2022/03/03/california-manure-biogas-clean-energy-future-chevron-environmentalists-object/9341873002/?gnt-cfr=1; Marie J. French & Ry Rivard, *Cow Poop and Landfill Gas Shipped to California*, POLITICO (Feb. 14, 2022), https://www.politico.com/newsletters/weekly-new-york-new-jersey-energy/2022/02/14/cow-poop-and-landfill-gas-shipped-to-california-00008502; *California's Dairy Goldrush*, BLUESOURCE (July 20, 2021), https://www.bluesource.com/blog/californias-dairy-goldrush/; Chuck Abbott, *The New California Gold Rush Into Anaerobic Digesters*, SUCCESSFUL FARMING (Feb. 4, 2022), https://www.agriculture.com/news/business/the-new-california-gold-rush-into-anaerobic-digesters; Rachel Cohen, *Why There's a "Gold Rush" to Build Dairy Digesters in Idaho*, BOISE STATE PUB. RADIO (Feb. 11, 2022), https://www.boisestatepublicradio.org/news/2022-02-11/why-theres-a-gold-rush-to-build-dairy-digesters-in-idaho; Frank Jossi, *California Clean Fuel Standard Sparks Renewable Gas Boom in Midwest*, ENERGY NEWS NETWORK

These industry admissions and media coverage of the realities on the ground are not alone; recent economic research indicates that CARB's administration of the LCFS is distorting the dairy market and resulting in a windfall profit for the biggest polluters. A growing number of researchers and agricultural economists are raising alarms about the LCFS's treatment of factory farm gas.

For example, Aaron Smith at the University of California, Davis, found a large gap between the windfall profit received by a factory farm under the LCFS versus the support needed to run and maintain a digester.[67] In other words, the LCFS is rewarding factory farm and factory farm gas developers far beyond what a rational policy would sanction to simply incentivize methane capture. Hence, the "gold rush" will affect how factory farm operators make operational decisions so that they maximize profit. As Mr. Smith concluded, "[the] fact [that manure gas is so overvalued] should make us pause. The large subsidy is de[s]igned to prevent methane emissions that would have happened otherwise. But, what if the farmer adds cows *because of* the subsidy? Then we are no longer paying to reduce emissions."

Additionally, the Union of Concerned Scientists ("UCS") recently worked with researchers at Cal Poly Humboldt to assess LCFS treatment of factory farm gas and reached alarming conclusions.[68] Their analysis similarly found windfall profits that are likely distorting the dairy market. UCS's comments to CARB, noted above, open with their concern that the LCFS is "likely . . . contributing to industry consolidation and putting dairies that use other manure methane strategies at a competitive disadvantage."[69] UCS also warned that "the largest polluter is the one receiving a large subsidy."[70]

Thus, data from the field, anecdotal evidence from industry, statements by key industry players in the media, and academic research all point in the same direction: the LCFS causes perverse incentives that undermine supposed GHG reductions and exacerbate environmental injustice. CARB did not substantively respond to Petitioners' arguments that CARB's treatment of factory farm gas under the LCFS is unlawful for numerous reasons, including due to the expansion and other perverse incentive problems explained above. This additional evidence of the factory farm gas effect underscores the arbitrary and capricious Response.

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(May 13, 2021), https://energynews.us/2021/05/13/california-clean-fuel-standard-sparks-renewable-gas-boom-in-midwest/; Andrew R. Skwor & Patrick Wood, *American Dairy at the Carbon Markets – Agriculture's Latest Gold Rush, Part 1*, MSA (Dec. 13, 2021), https://www.msa-ps.com/american-dairy-at-the-carbon-market-agricultures-latest-gold-rush-part-i/; Maxson Irsik, *California Has Carbon Credit Opportunities for Out-of-State Dairies*, HIGH PLAINS JOURNAL (Jan. 20, 2021), https://www.hpj.com/opinion/california-has-carbon-credit-opportunities-for-out-of-state-dairies/article_efd6ebaa-56b9-11eb-a648-c387e359b04e.html; Leah Douglas & Nichola Groom, *Biden Spending Bill Ignites Debate over Dairy Methane Pollution*, REUTERS (Jan. 11, 2022), https://www.reuters.com/markets/commodities/biden-spending-bill-ignites-debate-over-dairy-methane-pollution-2022-01-11/.

[67] Aaron Smith, *What's Worth More: A Cow's Milk or Its Poop?*, AARON SMITH (Feb. 3, 2021), https://asmith.ucdavis.edu/news/cow-power-rising.

[68] *See supra* note 42 and associated text.

[69] *See* Jeremy Martin, *supra* note 42, at 1.

[70] *Id.* at 2.

### b. The LCFS causes factory farm herds to consolidate geographically.

Environmental and public health impacts from factory farms do not merely depend on the total aggregate number of dairy cows in California. More relevant factors include where and how those dairies operate. For purposes of explanation, if California's total population of dairy cows is 1.5 million, it matters immensely if 95% of those cows are housed in confinement facilities with liquified manure lagoons in the San Joaquin Valley as opposed to less intensive pasture-based operations. The LCFS has the effect of driving ever greater concentration in the geographic distribution of dairy cows, which negates the argument that small reductions in the overall, statewide dairy cow population somehow makes environmental justice impacts from expanded local herds impossible.

CARB cannot dodge the reality that cluster projects and centralized biogas upgrading and pipeline infrastructure further consolidates the dairy industry in favor of the largest factory farms expanding in close proximity to this infrastructure so that operators can maximize LCFS credits as an immensely profitable source of revenue. As California Bioenergy, one of the leading factory farm gas developers in California, candidly stated to CARB in response to an opposition comment filed by certain Petitioners, "the consolidation of herds to facilities with digesters should be encouraged[.]"[71] It leaves no room for ambiguity when a leading factory farm gas developer has embraced consolidation, and the clear economic signals to market participants like California Bioenergy originate from the LCFS.

Therefore, localized concentration and localized expansions are the relevant metric to assess the environmental justice impacts of CARB's unlawful administration of the LCFS, not the aggregate statewide dairy herd. In fact, without evidence to the contrary, Petitioners believe that any marginal reduction in overall numbers are most likely attributable, at least in part, to the loss of small, more sustainable dairy operations (which are generally unable to benefit from the LCFS) in the face of ever more advantaged mega-dairies now rewarded with an additional and sizeable source of revenue.

## 3. CARB does not dispute and has arbitrarily and capriciously failed to consider the issue of whether the LCFS may allow non-additional reductions from factory farm gas.

CARB should grant the Petition because the LCFS does not comply with AB 32's mandate that market-based mechanisms ensure the additionality of reductions. The Response failed to consider or otherwise respond to the Petition and the significant number of credits generated by factory farm gas projects that would have otherwise occurred notwithstanding the LCFS. These credits therefore lack validity as market-based compliance instruments, and CARB should not grant further pathway applications that lack additionality. CARB may neither simply ignore this lack of additionality and address it after the Scoping Plan, nor may CARB rely on its misplaced interpretation of section 39730.7(e) of the Health & Safety Code and continue

[71] California Bioenergy, Response to Leadership Counsel for Justice and Accountability, Public Justice, and the Animal Legal Defense Fund (Sept. 29, 2021), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0185_response2.pdf.

authorizing non-additional pathway certifications. The Legislature has established important limits on CARB's authority to implement market-based mechanisms to protect communities and ensure that any voluntary reductions within pollution trading schemes like the LCFS represent real-world emissions reductions. CARB has no authority to override this direction and no authority to ignore the issue while continuing to grant pathway certifications.

As the Petition explains,[72] AB 32 requires that any credits issued for emission reductions under market-based programs must be in addition to (1) "any [GHG] emission reduction otherwise required by law or regulation" and (2) "any other [GHG] emission reduction that otherwise would occur."[73] The LCFS unquestionably meets the definition of a market-based compliance mechanism.[74] The LCFS limits carbon intensity, requires any fuel producer to meet a compliance obligation, and any producer that does not meet the obligation—a deficit holder—must purchase credits to comply with the LCFS.[75] And CARB maintains the LCFS credit bank, acting as a market maker between the purchasers and sellers of LCFS credits.[76]

CARB itself described the LCFS as a market-based mechanism when promulgating amendments to the LCFS:

> The LCFS is a market-based approach designed to reduce the carbon intensity of transportation fuels by 10 percent by 2020, from a 2010 baseline. It is important to note that the Cap-and-Trade Program and the LCFS program have complementary, but not identical programmatic goals: Cap-and-Trade is designed to reduce greenhouse gasses from multiple sources by setting a firm limit on GHGs; the LCFS is designed to reduce the carbon intensity of transportation fuels. As a market-based, fuel-neutral program, the LCFS provides regulated parties with flexibility to achieve the most cost-effective approach for reducing transportation fuels' carbon intensity. . . .
>
> CARB staff disagrees that the LCFS is fundamentally a command-and-control system. The LCFS is a fuel-neutral, market-based program that does not give preference to specific transportation fuels and instead bases compliance on a system of credits and

[72] Petition, *supra* note 1, at 18–24.
[73] § 38562(d)(2).
[74] "Market-based compliance mechanism means either of the following: (1) A system of market-based declining annual aggregate emissions limitations for sources or categories of sources that emit greenhouse gases; and (2) Greenhouse gas emissions exchanges, banking, credits, and other transactions, governed by rules and protocols established by the state board, that result in the same greenhouse gas emission reduction, over the same time period, as direct compliance with a greenhouse gas emission limit or emission reduction measure adopted by the state board pursuant to this division." Health & Safety Code § 38606(k); *see Rocky Mountain Farmers Union v. Corey*, 730 F.3d 1070, 1106 (9th Cir. 2013) (noting the LCFS is a market-based program).
[75] *See, e.g.*, CAL. AIR RES. BD., LCFS BASICS (2019), https://ww2.arb.ca.gov/sites/default/files/2020-09/basics-notes.pdf (last visited March 21, 2022).
[76] *See LCFS Reporting Tool and Credit Bank & Transfer System (LRT-CBTS)*, CAL. AIR RES. BD., https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/lcfs-registration-and-reporting (last visited March 25, 2022).

> deficits based on each fuel's carbon intensity. Carbon intensity (CI) is a measure of the GHG emissions associated with the various production, distribution, and consumption steps in the "life cycle" of a transportation fuel. It is difficult to respond with depth to this assertion because the commenter provides no specifics to support the claim that the LCFS is not market-based. Notably, the commenter does not describe what components of the program could be considered command-and-control.[77]

Additionally, CARB's descriptions of the LCFS program closely parallel the statute's definition of "market-based compliance mechanism." The definition states in relevant part that a market-based compliance mechanism is: "A system of market-based declining annual aggregate emissions limitations for sources or categories of sources that emit greenhouse gases."[78] CARB explains that the LCFS has a "market for credit transactions," where "entities with credits to sell can opt to pledge credits into the market and entities needing credits must purchase their pro-rata share of these pledged credits."[79] CARB explains that credits are generated relative "to a declining CI benchmark for each year."[80] The LCFS exhibits many if not most of the features of a market-based compliance mechanism, including a Cap-and-Trade allowance-like system with yearly declinations,[81] transaction rules,[82] recordkeeping and auditing requirements,[83] an account system to manage credit transfers—the LCFS Reporting Tool and Credit Bank & Transfer System (LRT-CBTS)[84]—and a portal that applicants must use to demonstrate compliance,[85] among others. In addition to CARB's interpretation, designation, and treatment of the program as a market-based mechanism and the overall structure of the regulation evincing the same, the

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[77] CAL. AIR RES. BD., FINAL STATEMENT OF REASONS FOR RULEMAKING, INCLUDING SUMMARY OF COMMENTS AND AGENCY RESPONSE 679–81 (2015), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2015/lcfs2015/fsorlcfs.pdf; *see also* CAL. AIR RES. BD., RESPONSES TO COMMENTS ON THE DRAFT ENVIRONMENTAL ANALYSIS FOR THE AMENDMENTS TO THE LOW CARBON FUEL STANDARD AND ALTERNATIVE DIESEL FUEL REGULATIONS B4-42 (2018), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2018/lcfs18/rtcea.pdf (CARB responding, "Because the LCFS is a market-based mechanism…"); CAL. AIR RES. BD., STAFF DISCUSSION PAPER: RENEWABLE NATURAL GAS FROM DAIRY AND LIVESTOCK MANURE 6 (April 13, 2017), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/lcfs_meetings/041717discussionpaper_livestock.pdf (in which CARB staff note in 2017 discussion paper that additionality requirements for the LCFS *are* intended to be identical to those of the compliance offset protocol, "ensure any crediting is for GHG reductions resulting from actions not required by law or beyond business as usual").

[78] CAL. HEALTH & SAFETY CODE § 38505(k). Note that this is one of two definitions provided.

[79] LCFS Basics, *supra* note 75.

[80] *Low Carbon Fuel Standard: About*, CAL. AIR RES. BD., https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/about (last visited Mar. 25, 2022).

[81] *See* CAL. CODE REGS. TIT. 17 §§ 95482–95486.

[82] *See* CAL. CODE REGS. TIT. 17 § 95491.

[83] *See* CAL. CODE REGS. TIT. 17 § 95491.1.

[84] CAL. CODE REGS. TIT. 17 § 95483.2(b). ("The LRT-CBTS is designed to support fuel transaction reporting, compliance demonstration, credit generation, banking, and transfers.").

[85] *See* CAL. AIR RES. BOARD, LOW CARBON FUEL STANDARD – ANNUAL REPORTING AND VERIFICATION USER GUIDE 3-4 (Aug. 9, 2021), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/guidance/Reporting_and_Verification_User_Guide.pdf.

designation of California's LCFS as a market-based mechanism is ubiquitous in academic and technical literature.[86]

CARB incorporated only one of the additionality prongs into the LCFS, which requires that any credits issued for emission reductions must be "additional to any legal requirement for the capture and destruction of biomethane that are nonadditional emission reductions."[87] And CARB specifically declined to incorporate the additionality requirements contained in the Livestock Protocol to the LCFS.[88] In addition to this flaw in the LCFS itself, CARB's implementation of the LCFS ignores additionality requirements altogether.

CARB presently implements two programs which render a significant number of California-based factory farm gas projects non-additional. First, CARB relies on reductions from the Dairy Digester Research & Development Program (DDRDP) as credit towards the state-wide obligation to reduce methane from manure management as required by SB 1383, codified at Health & Safety Code § 39730.7(b)(1). CARB attributes 1.9 MMTCO2e of methane reductions to 123 dairy digester projects funded by the DDRDP.[89] CARB also identifies future reductions needed to meet the 2030 target, and assumes at least 210 digester projects are needed, in combination with AMMP projects, to achieve 4.4 MMTCO2e of needed methane reductions.[90] Because CARB claims reductions from the same projects as creditable towards the SB 1383 mandate, it may not at the same time authorize those same reductions as additional in the LCFS. As discussed in the Petition, both the California Department of Food & Agriculture and CARB report to the Legislature that appropriated public funds in the DDRDP are responsible for the full reductions by that program.

The same double-counting problem also occurs because of the Aliso Canyon Mitigation Agreement. The Mitigation Agreement legally requires Southern California Gas Company (SoCalGas) to achieve methane reductions from factory farm dairies in California.[91] The parties intended the agreement to mitigate the harms from the most damaging man-made GHG leak in United States history—SoCalGas' ruptured well that released at least 109,000 metric tons of

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[86] *See, e.g.*, CENTER FOR CLIMATE AND ENERGY SOLUTIONS, POLICY CONSIDERATIONS FOR EMERGING CARBON PROGRAMS 2 (June 2016), https://www.c2es.org/wp-content/uploads/2016/06/emerging-carbon-programs.pdf (describing Low Carbon Fuel Standards as an example of a market-based policy option, specifically of a baseline-and-credit program); *Regional Activities*, NATIONAL LOW CARBON FUEL STANDARD PROJECT, https://nationallcfsproject.ucdavis.edu/regional-activities/ (stating California's "LCFS is a market-based mechanism") (last visited Mar. 25, 2022).

[87] *See* Cal. Code Regs. Tit. 17, § 95488.9(f)(1)(B) ("A fuel pathway that utilizes biomethane from dairy cattle or swine manure digestion may be certified with a CI that reflects the reduction of GHG emissions achieved by the voluntary capture of methane, provided that . . . the baseline quantity of avoided methane reflected in the CI calculation is additional to any legal requirement for the capture and destruction of biomethane.").

[88] Low Carbon Fuel Standard, Frequently Asked Questions, *supra* note 37, at 5 ("***Additionality requirements*** that are referenced in the Livestock Protocol . . . ***are not required under LCFS***." (emphasis added)).

[89] CAL. AIR RES. BD., ANALYSIS OF PROGRESS TOWARD ACHIEVING THE 2030 DAIRY AND LIVESTOCK SECTOR METHANE EMISSIONS TARGET (DRAFT) 10, Table 1, (June 2021), https://ww2.arb.ca.gov/sites/default/files/2022-03/draft-2030-dairy-livestock-sb1383-analysis.pdf.

[90] *Id*.

[91] *People v. Southern California Gas Company*, Case Nos. BC602973 & BC628120, Appendix A to Consent Decree, Mitigation Agreement, https://www.arb.ca.gov/html/aliso-canyon/aliso-canyon-mitigation-agreement.pdf?_ga=2.146452402.708596706.1633463951-1172357510.1559256345.

methane before it was sealed.[92] SoCalGas funds the construction of digesters and receives "mitigation credits" for the associated emissions reductions. The conditions of the agreement legally require changes intended to reduce emissions and yet at least eight facilities that have generated mitigation credits relied on by SoCalGas have also been part of pathways certified by CARB. California Bioenergy sought and received LCFS credits for the S&S, Moonlight, Hamstra, Trilogy, Maple, T&W, BV Dairy, and Western Sky dairies.[93]

In total, CARB has certified LCFS credits for *at least* six pathways with nonadditional emission reductions. Four of these pathways include projects that had received DDRDP funds and from which CARB claims credit towards the SB 1383 reduction requirement, and two additional pathways were for projects that had received both DDRDP funds *and* delivered reductions as part of the Aliso Canyon Mitigation Agreement, meaning that the same emission reductions have been claimed by three separate programs: the LCFS, the SB 1383 and DDRDP reductions, and by SoCalGas to comply with the Mitigation Agreement.[94] This absurd result means that deficit generators are purchasing illusory credits that do not represent actual emissions reductions and California communities bear the burden of that increased pollution.[95]

### 4. Factory farm gas causes adverse and disparate environmental impacts.

#### a) Factory farm gas production exacerbates water pollution.

As discussed in the Petition, dairies throughout the Central Valley actively pollute drinking water with nitrate at levels that exceed drinking water standards, exposing nearby households and communities to unsafe drinking water that can cause Blue Baby Syndrome and that has been linked to cancer.[96] Petitioners cited to several sources demonstrating that nitrate pollution is caused in significant part by dairies, and that pollution is widespread and increasing.

One report in particular bears additional emphasis as CARB considers this Petition for Reconsideration. The Central Valley Summary Representative Monitoring Report[97] was prepared by and for the Central Valley Dairy Representative Monitoring Program, a non-profit

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[92] CAL. AIR RES. BD., RESPONSES TO FREQUENTLY ASKED QUESTIONS: ALISO CANYON LITIGATION MITIGATION SETTLEMENT, https://ww3.arb.ca.gov/html/aliso-canyon/aliso-canyon-faqs.pdf?_ga=2.67705041.1139070712.1533833674-1489205872.1532954259.

[93] *See* CALEPA & CAL. AIR RES. BD., LCFS TIER 2 PATHWAY APP. B0185 (certified Sep. 30, 2021), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0185_cover.pdf; CALEPA & CAL. AIR RES. BD., LCFS TIER 2 PATHWAY APP. B0198 (certified Sep. 30, 2021), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0198_cover.pdf.

[94] *See* CALEPA & CAL. AIR RES. BD., LCFS TIER 2 PATHWAY APPS. B0019 (DDRDP); B0104 (DDRDP); B0106 (DDRDP); B0172 (DDRDP); B0185 (DDRDP and Alison Canyon settlement); B0198 (DDRDP and Aliso Canyon settlement). Note that many pathways, including these, are tied to multiple large factory farm gas operations. In this case, though there were only two pathways that received funds from DDRDP and the Aliso Canyon settlement, there were eight factory farm gas operations.

[95] *See* Petition, *supra* note 1, at 11; 20–23; 37 (explaining details).

[96] *Id.* at 29–30.

[97] CENTRAL VALLEY DAIRY REPRESENTATIVE MONITORING PROGRAM, SUMMARY REPRESENTATIVE MONITORING REPORT (REVISED*) (Apr. 19, 2019), https://www.waterboards.ca.gov/centralvalley/water_issues/confined_animal_facilities/groundwater_monitoring/srmr_20190419.pdf.

association of dairy owners and operators, in response to direction from the Central Valley Regional Water Quality Control Board.[98] It thus contains the conclusions of representatives of the dairy industry itself, and presents years of monitoring data from forty-two Central Valley dairies chosen to be representative of the industry in the region.

As an industry report, its findings regarding widespread and continuing nitrate pollution should be afforded substantial weight. Some of the key conclusions from the report include:

- "CVDRMP's data set documents that elevated nitrate-N (i.e., as nitrogen) concentrations were present beneath ***all monitored dairies***."[99]
- "… mean groundwater nitrate-N concentration beneath dairies overlaying shallow groundwater (<55 feet deep) was 48 mg/L (median=35 mg/L) and 38 mg/L in deeper groundwater (median=35 mg/L). The mean groundwater nitrate-N concentration in areas of permeable soils was 59 mg/L (median=46 mg/L) and 29 mg/L (median=21 mg/L) in areas of clay-rich soils."[100]
- "…approximately 94 percent of nitrogen loading on dairies (that is, the portion of nitrogen that enters the soil and is not recovered by plants) occurs on cropland."[101]
- There is evidence of a "substantial amount of 'unaccounted-for' manure nitrogen" on many dairies, indicating that dairy reporting regarding field applications has been inaccurate and applied nitrogen has been underreported.[102]
- Dairies have an "excess supply of nitrogen" in the form of manure than can be safely applied to cropland without causing or contributing to nitrate pollution.[103]
- "To date, implementation of the Dairy Order does not appear to have resulted in a trend to lower nitrate-N concentrations across the industry."[104]

To summarize these findings, the dairy industry representatives have acknowledged in a thorough report required by the Regional Water Board that all representative dairies are actively polluting groundwater with nitrate, that the problem is caused by excess supply (i.e., too much manure to be safely applied to the dairies' cropland currently used for manure disposal), and that the Dairy Order has not resulted in a trend to lower nitrate concentrations to date.

Nitrate pollution caused by Central Valley dairies is a vast problem impacting most (if not all) dairy operations in the region. The problem is only exacerbated when a dairy increases its herd size, thus increasing its "excess supply" of manure. This is true even if the increased herd size on a particular dairy is accompanied by the reduction in herd size in the region overall. Nitrate pollution in groundwater is a hyper-local issue, primarily impacting nearby households and communities that rely on downgradient groundwater for drinking, cooking, and other

[98] *Id.* at a.
[99] *Id.* at 6 (internal citation omitted) (emphasis added).
[100] *Id.*
[101] *Id.* at 10.
[102] *Id.*
[103] *Id.*
[104] *Id.* at 6–7.

domestic purposes. CARB cannot ignore these impacts as it adopts and implements policies that incentivize additional manure production at individual dairies participating in the LCFS.

**b) Factory farm gas production exacerbates water consumption.**

Dairies have already dealt serious damage to California's water resources, and perversely incentivizing their expansion and consolidation in the most parched region of the state exacerbates the effects of the ongoing historic megadrought.[105] These industrial facilities consume "a massive amount of water" for various operational purposes, such as flushing manure, watering animals, and irrigating the crops upon which they rely for manure and digestate management.[106] In addition, dairies rely upon water-intensive crops to feed dairy cows. Those crops consume more than ten million acre-feet of water—or twenty percent of all water used in California—each year.[107] Overall, animal agriculture is responsible for forty-seven percent of California's total water footprint.[108]

To feed their extreme water consumption, dairies seek sites above major aquifers and treat groundwater as a "free good" after they pump it from the ground.[109] The San Joaquin Valley, where many mega dairies and methane digesters are operating, is ground zero for critical groundwater overdraft and water scarcity.[110] Thousands of private and community water wells, upon which many Californians rely for drinking water, have already run dry.[111] Further industry consolidation and expansion from the manure "gold rush" would further tap scarce groundwater resources in order to produce methane-based fuels when operators could instead avoid water intensive liquefied manure management.

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[105] A. Park Williams et al., *Rapid intensification of the emerging southwestern North American megadrought in 2020-2021*, 12 NATURE CLIMATE CHANGE 232 (Mar. 2022); A. Park Williams et al., *Large contribution from anthropogenic warming to an emerging North American megadrought*, 368 SCIENCE 314 (Apr. 17, 2020).

[106] *See, e.g.*, WILLIAM J. WEIDA, CONCENTRATED ANIMAL FEEDING OPERATIONS AND THE ECONOMICS OF EFFICIENCY 22 (Mar. 19, 2000), https://www.sraproject.org/wp-content/uploads/2017/10/cafosandtheeconomicsofefficiency.pdf.

[107] Justin Fox, *Why California Needs Thirsty Alfalfa*, BLOOMBERG (May 26, 2015), https://www.bloomberg.com/opinion/articles/2015-05-26/why-they-grow-thirsty-alfalfa-in-parched-california; *see generally* James McWilliams, *Meat Makes the Planet Thirsty*, N.Y. TIMES (Mar. 7, 2014), https://www.nytimes.com/2014/03/08/opinion/meat-makes-the-planet-thirsty.html ("Grown on over a million acres in California, alfalfa sucks up more water than any other crop in the state. And it has one primary destination: cattle.").

[108] JULIAN FULTON ET AL., CALIFORNIA'S WATER FOOTPRINT 3 (Dec. 2012), PACIFIC INST., https://pacinst.org/wpcontent/uploads/2013/02/ca_ftprint_full_report3.pdf.

[109] Weida, *supra* note 106, at 22.

[110] *Critically Overdrafted Basins*, CAL. DEP'T OF WATER RES., https://water.ca.gov/programs/groundwater-management/bulletin-118/critically-overdrafted-basins (last visited Mar. 22, 2022) (showing most groundwater basins and subbasins in the San Joaquin Valley are critically overdrafted); *see* ELLEN HANAK ET AL., WATER AND THE FUTURE OF THE SAN JOAQUIN VALLEY (2019), PUB. POL. INST. OF CAL., https://www.researchgate.net/publication/331476376_Water_and_the_Future_of_the_San_Joaquin_Valley.

[111] *Groundwater Management and Drought: An Interview with the San Joaquin Valley Partnership*, CAL. DEP'T OF WATER RES., (Mar. 8, 2022), https://water.ca.gov/News/Blog/2022/March-22/Groundwater-Management-and-Drought-An-Interview-with-the-San-Joaquin-Valley-Partnership (noting that groundwater overdraft is causing domestic well owners to "lose access to their primary source of drinking water," leaving them unable to "afford or obtain services due to drilling backlogs or financial challenges" and forcing them to seek out and rely on emergency sources of drinking water); *see* Jelena Jezdimirovic et al., *Will Groundwater Sustainability Plans End the Problem of Dry Drinking Water Wells?*, PUB. POL'Y INST. OF CALIFORNIA (May 14, 2020), https://www.ppic.org/blog/will-groundwater-sustainability-plans-end-the-problem-of-dry-drinking-water-wells/.

Moreover, factory farm gas production relies upon methane digesters, which require "abundant water resources, with a proportion equal to 1:1 of the amount of water and manure to be loaded into the digester,"[112] to pump and dilute manure.[113] In arid climates it may be necessary to pump groundwater for this purpose.[114]

### c) Factory farm gas interferes with efforts to attain air quality standards and inflicts disparate impacts on the basis of race and income.

Fuels derived from factory farm gas have a significant negative impact on air quality in the San Joaquin Valley, which result in a racially disparate impact in violation of Government Code § 11135 and Title VI of the Civil Rights Act. Moreover, AB 32 requires that CARB must ensure its policies do not to "interfere with, efforts to achieve and maintain federal and state ambient air quality standards and to reduce toxic air contaminant emissions."[115] CARB must also ensure that "activities undertaken to comply with the regulations do not disproportionately impact low-income communities."[116] The LCFS and pathways certified by CARB inflict racially and economically disparate impacts and interfere with efforts to achieve and maintain federal ambient air quality standards in two significant ways. First, anaerobic digesters increase ammonia emissions, which in turn reacts with oxides of nitrogen (NOx) to form ammonium nitrate, which significantly contributes to fine particulate matter (PM2.5) pollution. Second, digester engines powering turbines to generate electric vehicle fuel pathways emit significant and unabated additional NOx, PM2.5, and volatile organic compound (VOC) emissions in the air basin. Combined, both effects exacerbate the PM2.5 pollution crisis in the San Joaquin Valley.

The U.S. Environmental Protection Agency's EJSCREEN mapping tool[117] produced the two maps below which show the racially disparate impact visually with the stark contrast between the Valley and the rest of California.

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[112] Tatiana Nevzorova & Vladimir Kutcherov, *Barriers to the wider implementation of biogas as a source of energy: A state-of-the-art review*, 26 ENERGY STRATEGY REVIEWS 7 (Oct. 14, 2019), https://www.sciencedirect.com/science/article/pii/S2211467X19301075#bib113.

[113] ENVTL. PROTECTION AGENCY, AGSTAR, PROJECT DEVELOPMENT HANDBOOK: A HANDBOOK FOR DEVELOPING ANAEROBIC DIGESTION/BIOGAS SYSTEMS ON FARMS IN THE UNITED STATES 9-5, https://www.epa.gov/sites/default/files/2014-12/documents/agstar-handbook.pdf (3rd Ed.).

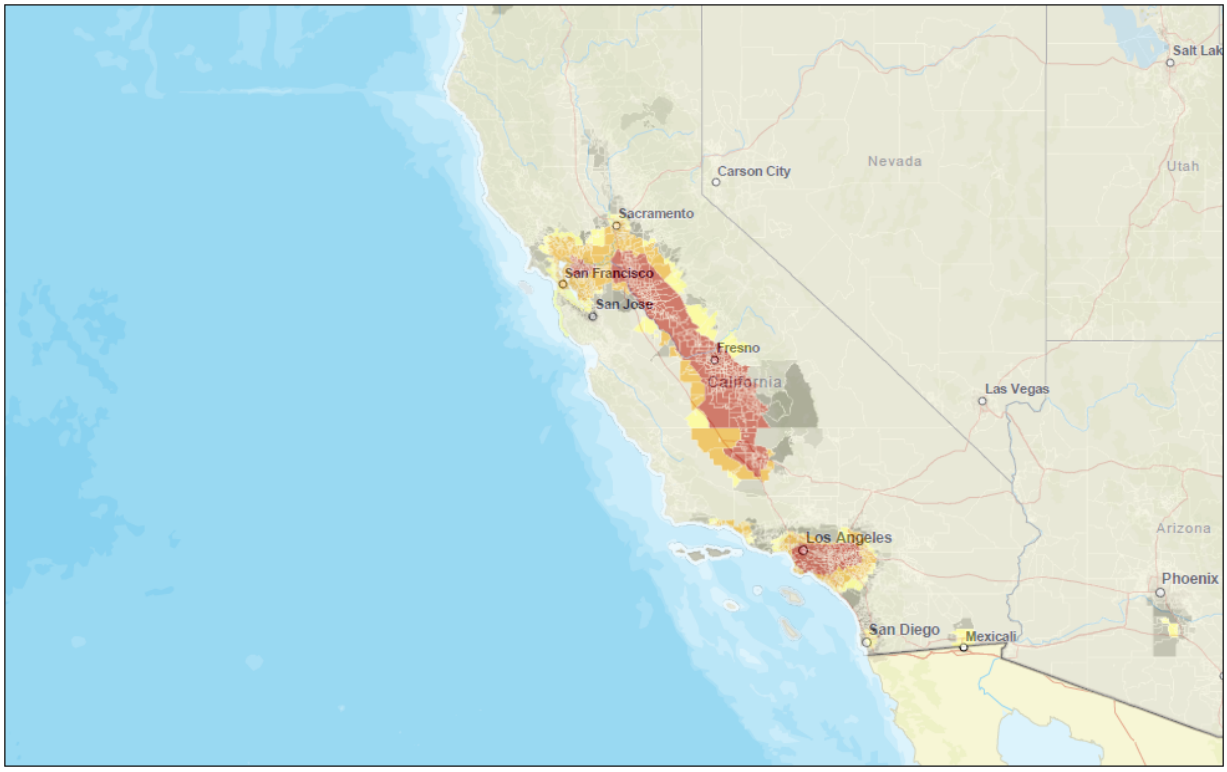
[114] *Id*.

[115] § 38562(b)(4).

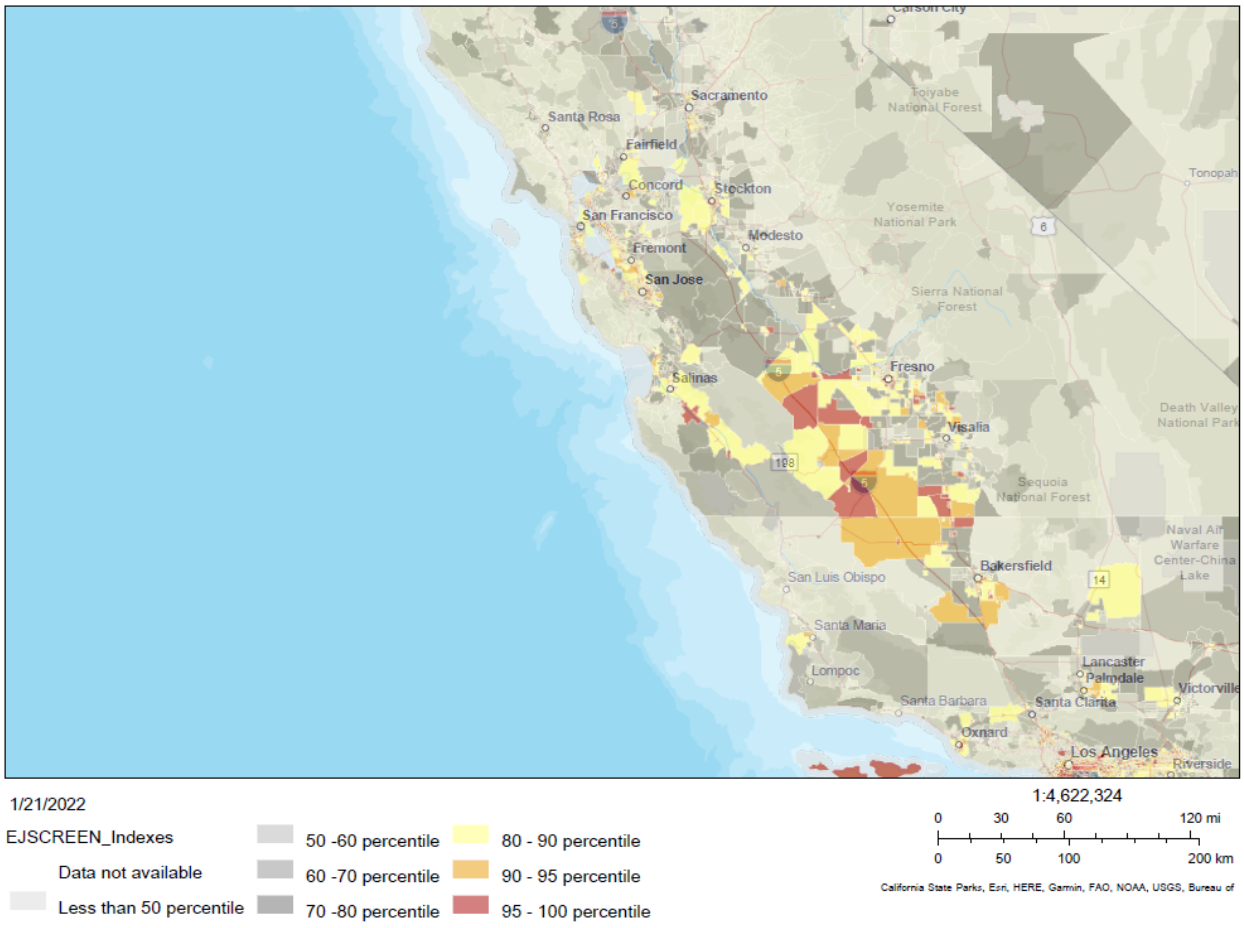
[116] § 38562(b)(2).

[117] *See EJSCREEN: Environmental Justice Screening and Mapping Tool*, ENVTL. PROTECTION AGENCY, https://www.epa.gov/ejscreen (last visited Mar. 25, 2022).

## PM2.5 Levels in the Ambient Air



People of Color Populations




Recent scientific research literature favorably cited by EPA finds that "emission sources that disproportionately expose [people of color] are pervasive throughout society."[118] Tessum notes that disparities *nationally* are most related to PM2.5 from transportation fuels. The San Joaquin Valley, however, presents a unique rural racial demographic with much higher populations of people of color compared to the rest of rural and urban California, and higher PM2.5 exposure since the Valley has the worst long term PM2.5 concentrations and hence the highest design values with respect to the 2012 annual PM2.5 national ambient air quality standard. Ammonia reacts with nitric oxide in the atmosphere to form ammonium nitrate, which comprises 38 percent of the PM2.5 mass on an annual average basis in Bakersfield, and 61

[118] Attach. 8, Christopher W. Tessum, et al., *PM2.5 polluters disproportionately and systemically affect people of color in the United States*, 27 SCI. ADVANCES (Apr. 28, 2021), https://www.science.org/doi/epdf/10.1126/sciadv.abf4491; Attach. 9, *Study Finds Exposure to Air Pollution Higher for People of Color Regardless of Region or Income*, ENVTL. PROTECTION AGENCY (Sept. 20, 2021), https://www.epa.gov/sciencematters/study-finds-exposure-air-pollution-higher-people-color-regardless-region-or-income#:~:text=In%20the%20United%20States%2C%20people,%2C%20Climate%2C%20and%20Energy%20Solutions.

percent on high PM2.5 days.[119]

The "disadvantaged communities" of California, as defined pursuant to California Senate Bill 535, are concentrated in the San Joaquin Valley.[120] Seven of the eight counties in the Valley (all except San Joaquin County) report mean income well below the 120% limit that defines low-income.[121] Every county in the San Joaquin Valley has lower household and per capita incomes, and higher poverty rates than California as a whole.[122] While median household income in California in 2019 was $75,235, countywide household median incomes for San Joaquin Valley counties ranged from $49,687 to $64,432. The highest producing dairy counties in the state and in the San Joaquin Valley, Merced and Tulare, show median household incomes at $53,672 and $49.687—both at 71 percent or below statewide median income.[123]

[119] SJVAPCD, 2018 PLAN FOR THE 1997, 2006, AND 2012 PM2.5 STANDARDS 3-2 to 3-3 (Nov. 15 2018), https://www.valleyair.org/pmplans/documents/2018/pm-plan-adopted/2018-Plan-for-the-1997-2006-and-2012-PM2.5-Standards.pdf.

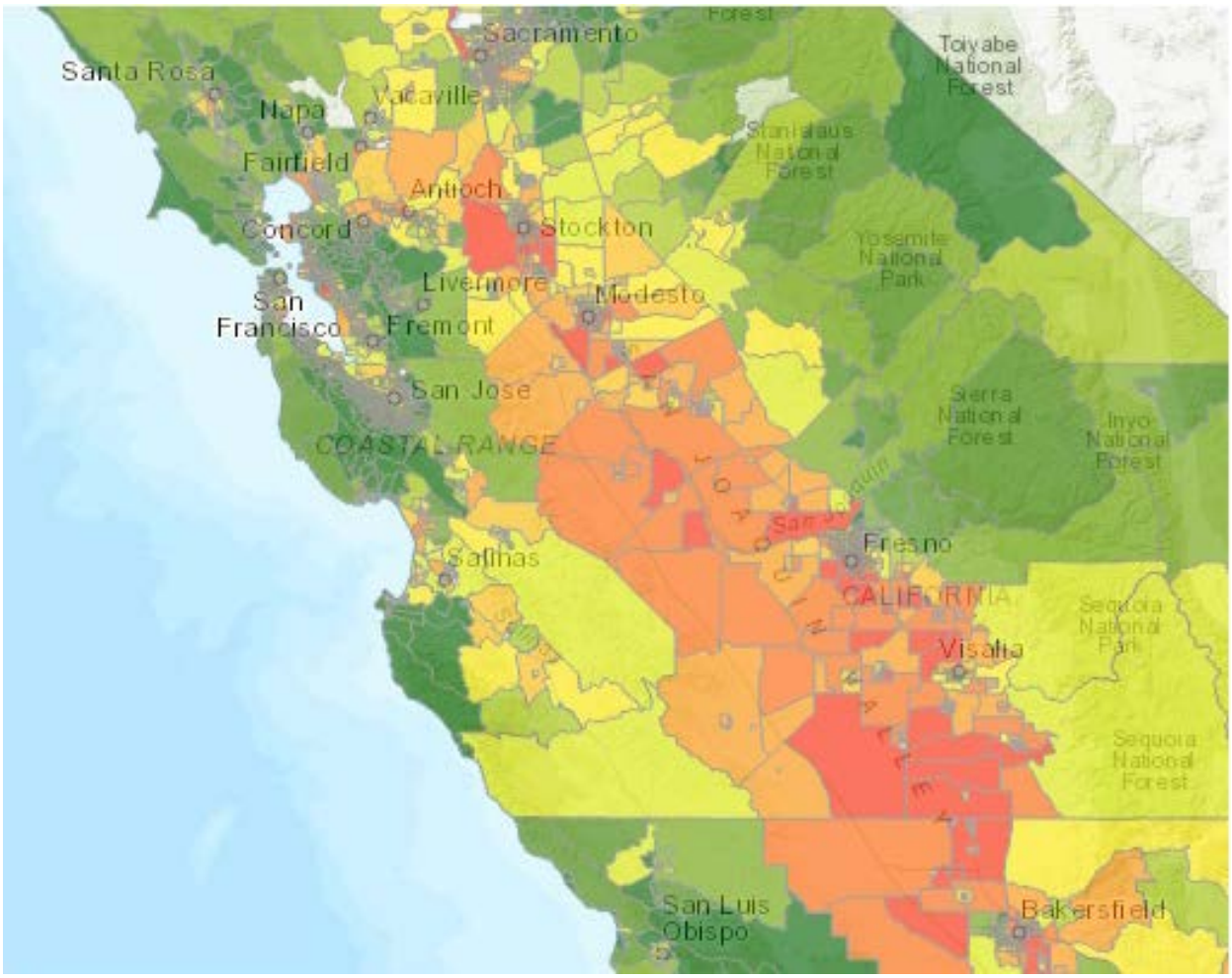
[120] CALEPA, DESIGNATION OF DISADVANTAGED COMMUNITIES PURSUANT TO SENATE BILL 535 (DE LEÓN) 1-32 (Apr. 2017), https://calepa.ca.gov/wp-content/uploads/sites/6/2017/04/SB-535-Designation-Final.pdf. All eight counties of the San Joaquin Valley exhibit the highest scores indicating the greatest pollution burden relative to the rest of California. *See Maps & Data*, CAL. OFFICE OF ENV'T HEALTH HAZARD ASSESSMENT, https://oehha.ca.gov/calenviroscreen/maps-data (last visited Mar. 25, 2022) (flagging areas of California that exhibit high to low pollution burden scores); *see also infra* page 27, San Joaquin Valley CalEviroScreen 4.0 map.

[121] Section 39711 of the Health and Safety Code sets the ceiling for low-income communities at 120% of the area median income. Additionally, Section 39711 designates communities with disproportionate environmental impacts and concentrations of low income, high unemployment, low educational attainment, and other burdensome socioeconomic factors as disadvantaged communities. Attach. 10, *Income Limits*, U.S. DEP'T OF HOUSING AND URBAN DEV., https://www.huduser.gov/portal/datasets/il.html#2020_data (last updated Apr. 1, 2020) (choose 30% Income Limit for ALL Areas (Excel)); Attach. 11, *FY 2020 State Income Limits* (2020), U.S. DEP'T OF HOUSING AND URBAN DEV., https://www.huduser.gov/portal/datasets/il/il20/State-Incomelimits-Report-FY20r.pdf.

[122] Attach. 12, *Quick Facts*, U.S. CENSUS, https://www.census.gov/quickfacts/fact/table/POP645219 (last visited Mar. 25, 2022).

[123] Poverty rates in every single county in the San Joaquin Valley also exceed poverty rates in California, with Merced and Tulare facing 17 and 18.9 percent poverty rates, respectively (as compared to 11.8 percent at the statewide level). *Id.*

**San Joaquin Valley, CalEnviroScreen 4.0**




San Joaquin Valley residents are disproportionately Latino as compared to California as a whole. All eight San Joaquin Valley Counties have higher Latino populations than the state, with populations ranging from 42 percent to 65.6 percent, as compared to the state population with 39.4 percent of residents classified as Latino. At least seven of eight San Joaquin Valley counties have a lower proportion of white residents as compared to the state as a whole.[124] Merced and Tulare counties have white, non-Latino populations of 26.5 and 27.7 percent, and Latino populations of 65.6 and 61 percent, respectively.[125] Like Merced and Tulare, Kern County also demonstrates much higher Latino populations than the rest of the state, with a Latino population of 54.6 percent.

[124] According to recent census data, 36.5 percent of the state population is classified as white, non-Latino, while 7 of the 8 counties in the San Joaquin Valley have white, non-Latino populations that range from only 26.5 to 33.2 percent. *Id.*
[125] *Id.* at 114.

### i. Factory farm gas increases ammonia emissions.

Industrial dairies in the San Joaquin Valley are the largest source of ammonia.[126] Factory farm gas production adds even more ammonia to the air basin: one study documents that ammonia emissions from digestate increased 81% relative to raw manure.[127] Anaerobic digestion causes this increase in ammonia emissions, "due to an increased concentration of ammoniacal nitrogen."[128] Ammonia reacts with oxides of nitrogen to form ammonium nitrate, the most significant component of the San Joaquin Valley's PM2.5 pollution problem.[129]

CARB has analyzed the impact of ammonia emissions on ambient PM2.5 as part of the recent 2018 PM2.5 Plan for the Valley. CARB found that ammonia contributed 5.2 $\mu g/m^3$ to the ambient air and found that a 30 percent and 70 percent reduction in ammonia would result in a range of ambient reductions in PM2.5 from 0.08 to 2.3 $\mu g/m^3$.[130] For context, the 2012 annual PM2.5 standard is 12 $\mu g/m^3$.[131] The overall contribution of ammonia from current dairy activities would only increase as more anaerobic digesters cause an increase in ammoniacal nitrogen in the digestate and thus increase ammonia emitted into the air basin. This air pollution impact interferes with efforts to attain the PM2.5 24-hour and annual standards and causes a disparate impact on the basis of race and income. CARB cannot ignore this reality and must grant the Petition.

### ii. Factory farm gas electricity pathways increase ozone and PM2.5 precursors.

The Petition identifies the on-site combustion of factory farm gas using internal combustion engines to power turbines for electricity generation at dairy operations as a significant air quality impact in the San Joaquin Valley Air Basin.[132] This form of factory farm gas fuel pathway to generate LCFS credits produces negative CI fuel pathways designated for electric vehicles. For example, CARB certified a pathway for such fuel generated at the Hilarides Dairy for a -758.46 CI in B016301[133] and at the Bidart-Old River Dairy for a -558.62 CI in B005901.[134] To date, Petitioners have identified eight certified pathways generating electric vehicle fuel in factory farm gas-powered engines, all located in the San Joaquin Valley, and an

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[126] SJVAPCD, 2018 PLAN FOR THE 1997, 2006, AND 2012 PM2.5 STANDARDS, APPENDIX B AND APPENDIX G, *available at* http://valleyair.org/pmplans/documents/2018/pm-plan-adopted/B.pdf *and* http://valleyair.org/pmplans/documents/2018/pm-plan-adopted/G.pdf.
[127] *See* Holly, et al., *supra* note 41.
[128] *Id.*
[129] SJVAPCD, 2018 PLAN FOR THE 1997, 2006, AND 2012 PM2.5 STANDARDS, APPENDIX B AND APPENDIX G, *available at* http://valleyair.org/pmplans/documents/2018/pm-plan-adopted/B.pdf *and* http://valleyair.org/pmplans/documents/2018/pm-plan-adopted/G.pdf.
[130] SJVAPCD, 2018 PM2.5 PLAN, APPENDIX G, 3 and tables 2 through 7 (Oct. 2018), https://www.valleyair.org/pmplans/documents/2018/pm-plan-adopted/G.pdf.
[131] *See* 78 Fed. Reg. 3086 (Jan. 15, 2013).
[132] Petition, *supra* note 1, at 30.
[133] CALEPA & CAL. AIR RES. BD., LCFS TIER 2 PATHWAY APP. B016301 (certified June 21, 2021), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0163_cover.pdf.
[134] CALEPA & CAL. AIR RES. BD., LCFS TIER 2 PATHWAY APP. B005901 (re-certified Mar. 25, 2021), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0059_cover.pdf.

additional number of similar facilities out of state.[135] Petitioners have further identified an additional three pending pathway certification applications, including one for the Lakeview Dairy.[136]

These fuel pathways represent a pollution-intensive form of fuel and one that rewards the developer with an extremely low CI value, creating an incentive to further develop this form of fuel pathway and thus even more air pollution in the Valley. To illustrate, the Lakeview Dairy Biogas project in Kern County uses two internal combustion engines to produce over 1,000 kW of electricity on-site and has applied for a fuel with a -382.98 CI value.[137] And this project, as permitted by the Air District with required pollution control technology, still emits 4.58 tons/year of NOx, 1.98 tons/year of PM2.5, and 3.18 tons/year of VOC after the imposition of Best Available Control Technology as required by the State Implementation Plan.[138] Compared to a natural gas combined cycle plant in Avenal also permitted by the Air District, the Lakeview digester project produces much higher levels of NOx, sulfur oxides (SOx), and VOC emissions per unit of electricity generated.[139] However, unlike the natural gas plant, Lakeview Dairy Biogas is not required to purchase emission reduction credits for the air pollution emitted.[140] This facility *increases* air pollution in the San Joaquin Valley.

With eight certified pathways and at least three more pending, CARB will soon be allowing the functional equivalent of the Avenal Power Center operating at about 50 percent capacity and without having offset that pollution with emission reduction credits. Another dozen electric fuel pathways powered by factory farm gas-fueled engines at Valley dairies would emit the same amount of NOx pollution as Avenal at full capacity, but only generate 4.4 percent of the electricity.[141] A similar pattern results from the emissions of VOCs.[142] This absurdity is compounded by Air District offset thresholds such that the digester engines do not buy emissions offsets and thus add more air pollution to the air basin, while in theory the Avenal Power Center would have had to purchase offsets from other sources to achieve a no net increase. This occurs in one of the most polluted air basins in the United States and classified as nonattainment for several fine particulate matter National Ambient Air Quality Standards.[143] CARB has effectively allowed the LCFS to add more air pollution to the San Joaquin Valley, call it "renewable" fuel

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[135] *See* CALEPA & CAL. AIR RES. BD., LCFS TIER 2 PATHWAY APPS. B001901, B003701, B008901, B005901, B016601, B003801, B002401, and B016301.
[136] *See* CALEPA & CAL. AIR RES. BD., LCFS TIER 2 PATHWAY APPS. B0104, B0105, and B0106.
[137] SJVAPCD, NOTICE OF PRELIMINARY DECISION – AUTHORITY TO CONSTRUCT (Mar. 22, 2016), http://www.valleyair.org/notiCes/Docs/2016/03-22-16_(S-1143770)/S-1143770.pdf; CALEPA & CAL. AIR RES. BD., LCFS TIER 2 PATHWAY APP. B0104 (certified TBD), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0104_summary.pdf.
[138] SJVAPCD, *supra* note 137, at 14.
[139] Attach. 13, Digester v. Avenal Comparison; Attach. 14, SJVAPCD, NOTICE OF FINAL DETERMINATION OF COMPLIANCE, AVENAL POWER CENTER, 3, 27 (Dec. 17, 2010). Producing 1.059 megawatts and emitting 4.58 tons/year of NOx, the Lakeview turbine generates 0.17 percent of the electricity while the engines powering the turbine emit 4.6 percent of the NOx pollution.
[140] Attach. 15, SJVAPCD, NOTICE OF PRELIMINARY DECISION – AUTHORITY TO CONSTRUCT 14 (Mar. 22, 2016).
[141] Digester v. Avenal Comparison, *supra* note 139. This assumes that Lakeview represents the average emissions from these factory farm gas operations.
[142] *Id*.
[143] 80 Fed. Reg. 18,528 (April 7, 2015); 81 Fed. Reg. 84,481 (November 23, 2016); 80 Fed. Reg. 2,206, 2,217 (January 15, 2015).

for electric vehicles, and then allows credits from that fuel to be sold to fossil fuel deficit holders who then may increase the pollution from their fuels sold in California. By allowing polluting factory farm gas to generate credits for "renewable" electric vehicle fuel, despite the harmful health impacts associated with emissions from the use of factory farm gas to generate that electricity, CARB ignores its statutory obligation not to "interfere with, efforts to achieve and maintain federal and state ambient air quality standards and to reduce toxic air contaminant emissions."[144] CARB must also grant the Petition and ensure the LCFS-related air pollution does not inflict a disparate impact on the basis of race, and must ensure that the LCFS complies with AB 32, Government Code § 11135, and Title VI of the Civil Rights Act.

**d. Factory farm gas fuels consume significant energy inputs to produce which render factory farm gas much more pollution intensive than previously disclosed.**

As noted above, Petitioners have submitted comments on dozens of pathway certifications and consistently have objected to the heavy redaction of information as proprietary and confidential business information. Until recently, Petitioners have not seen some of the fuel inputs for factory farm gas development as a result of this heavy-handed redaction. But recently, fuel pathway applications from Wisconsin-based factory farm gas operators shed much-needed transparency on the energy-intensive generation of factory farm gas. CARB should grant the Petition and, because such information was unavailable at the time of the Petition, also consider and disclose net energy consumption when calculating the CI values for factory farm-gas derived fuels.

First, the significance of the redactions to date have rendered meaningful public review of fuel consumption and energy inputs impossible. Below is an example of an application from a Sacramento-area factory farm gas project which claimed one of the largest negative CIs.[145]

[144] § 38562(b).

[145] SMUD, NEW HOPE DAIRY DIGESTER GREET LCFS PATHWAY TO PRODUCE ELECTRICITY TO CHARGE ELECTRIC VEHICLES IN SMUD REGION & CALIFORNIA (Dec. 4, 2020), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0166_1_report.pdf.

Sacramento 1500 Cow dairy 06/03/2021

**4. Life Cycle Results for Carbon Intensity**

The calculated Carbon Intensity for New Hope dairy digester system to charge electric vehicles = **-750.81 $gCO_{2e}$/MJ**, see table below.

[redacted]

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Still other pathway applications fully redact all input data and only disclose the final CI. This CI calculation from the Western Sky Dairy in Kern County illustrates this degree of redaction.[146]

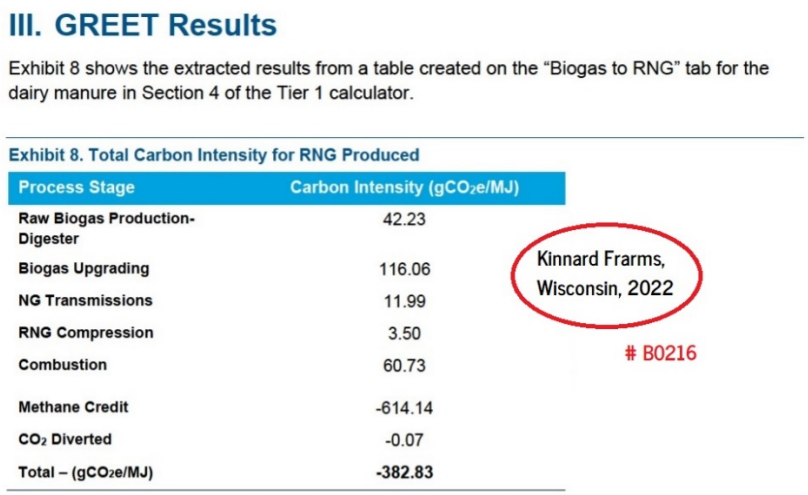
**Exhibit 25. Total Carbon Intensity for Dairy Manure Pathway-Western Sky Biogas LLC**

| Process Stage | Carbon Intensity ($gCO_2e$/MJ Biogas) |
|---|---|
| Diesel Consumption | [redacted] |
| Electricity Consumption | [redacted] |
| Loss/Fugitives | [redacted] |
| Biomethane Transmission | [redacted] |
| Compression of CNG | [redacted] |
| Tailpipe Emissions | [redacted] |
| Methane Avoided | [redacted] |
| $CO_2$ Diverted | [redacted] |
| Final CNG CI ($gCO_2e$/MJ) | -385.40 |

09/30/2021 Kern County, CA

[146] CALIFORNIA BIOENERGY, LIFE-CYCLE ASSESSMENT OF DAIRY MANURE BIOGAS TO CNG (Sep. 30, 2021), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0198_report.pdf. Also noteworthy is the fact that Western Sky Dairy is one of the eight dairies generating reductions credited towards the DDRDP, the Aliso Canyon Mitigation Agreement, and the LCFS.

On February 25, 2022, CARB posed a Tier 2 pathway application for factory farm gas CNG fuel for pipeline injection at Kinnard Farms in Wisconsin.[147]



## III. GREET Results

Exhibit 8 shows the extracted results from a table created on the "Biogas to RNG" tab for the dairy manure in Section 4 of the Tier 1 calculator.

**Exhibit 8. Total Carbon Intensity for RNG Produced**

| Process Stage | Carbon Intensity ($gCO_2e/MJ$) |
|---|---|
| Raw Biogas Production-Digester | 42.23 |
| Biogas Upgrading | 116.06 |
| NG Transmissions | 11.99 |
| RNG Compression | 3.50 |
| Combustion | 60.73 |
| Methane Credit | -614.14 |
| $CO_2$ Diverted | -0.07 |
| Total – ($gCO_2e/MJ$) | **-382.83** |

Kinnard Frarms, Wisconsin, 2022

# B0216

These data show that for Kinnard Farms, the CI of the fuels to produce the factory farm gas have a total CI of 173.70. The actual fuels used to produce the gas are redacted. But if we assume conservatively that these fuels (likely a combination of electricity, diesel, and natural gas) have an average CI themselves of 100 then we can approximate the energy consumed to produce the factory farm gas. The estimate in this case is that 1.7370 MJ of energy has been consumed to produce 1.0 MJ of the final factory farm gas product.

There are two disturbing conclusions from this analysis. One, the energy to produce the factory farm gas is greater than the energy in the final product which demonstrates the entire process to be inherently unsustainable in terms of this energy balance. The EROI (Energy Return on Investment) for this situation is approximately 0.58. An EROI less than 1.0 is not sustainable in any other area of energy production. The second issue here is the fact that these energy inputs (to the extent they are not based on electricity from solar, wind or water) all produce pollution from combustion and most of that pollution is localized. Until some of these numbers were given to the public in recent applications, there was no way of knowing the extent of pollution and energy consumed in the operation of these digesters and the subsequent cleaning, upgrading, compressing and transport of the resulting fuel.

### B. SB 1383 mandates neither the inclusion nor the overvaluation of factory farm gas in the LCFS.

CARB should grant the Petition because the Response erroneously interprets SB 1383 as a mandate to include factory farm gas in the LCFS such that the Executive Officer could not grant the relief sought in the Petition. Nor does SB 1383 mandate CARB include inflated LCFS credits from grossly negative CI values or include illusory credits from non-additional reductions

[147] DTE ENERGY TRADING, KEWUANEE RNG PRODUCTION PATHWAY (Oct. 21, 2021) https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0216_lca.pdf.

from other programs. The Executive Officer's categorical rejection of the Petition applies the law as if the Legislature bound CARB's authority and denied the agency any choice other than including factory farm gas in the LCFS. Specifically, the Executive Officer interprets Health & Safety Code § 39730.7(e) as a binding legislative command that "directs CARB to 'ensure' LCFS crediting of methane reductions" and that CARB must comply with this "statutory direction" to authorize LCFS credits for factory farm gas.[148]

Neither section 39730.7(e) nor its legislative history direct CARB to include factory farm gas in the LCFS. Instead, the statutory provision seeks to respond to an entirely different legislative concern with respect to the validity of credits generated given CARB's authority elsewhere in SB 1383 to adopt regulations that mandate methane reductions from manure management.

> No later than January 1, 2018, the state board shall provide guidance on credits generated pursuant to the Low-Carbon Fuel Standard regulations (Subarticle 7 (commencing with Section 95480) of Title 17 of the California Code of Regulations) and the market-based compliance mechanism developed pursuant to Part 5 (commencing with Section 38570) of Division 25.5 from the methane reduction protocols described in the strategy and *shall ensure that projects developed before the implementation of regulations adopted pursuant to subdivision (b) receive credit for at least 10 years.* Projects shall be eligible for an extension of credits after the first 10 years to the extent allowed by regulations adopted pursuant to the California Global Warming Solutions Act of 2006 (Division 25.5 (commencing with Section 38500)).[149]

This provision to ensure credit for projects makes sense when read in the context of the overall statutory scheme. In another provision of SB 1383, the Legislature directed CARB to adopt mandatory methane reductions from manure management and gave CARB discretion on when CARB could implement such regulations, but not earlier than January 1, 2024.[150] And since SB 1383 responded to the unabated methane emitted by manure management with this regulatory mandate, section 38562(d)(2) of the Health & Safety Code would render such reductions non-additional upon the adoption of such regulations. And thus, the narrowly drawn grandfathering language in section 39730.7(e) the Legislature adopted does not concern the eligibility to sells credits in the LCFS as a matter of right, but rather the additionality of any valid credits generated prior to the regulations.

The Legislature thus did not direct CARB to include factory farm gas in the LCFS as the Executive Officer interprets in SB 1383. And the legislative history supports the plain meaning of the statutory language. The dairy amendments to SB 1383 occurred within the final 24 hours of the legislative session, and the Senate floor analysis documents the purpose of section 39730.7(e) as a grandfathering mechanism. Moreover, none of the committee reports indicate

[148] Response, *see supra* note 9, at 3, 5.
[149] § 39730.7(e) (emphasis added).
[150] Health & Safety Code § 39730.7(b)(1), (b)(4).

any legislative intent to require that CARB include factory farm gas in the LCFS.[151] As a result, the Response denying the relief sought by the Petition is contrary to law and otherwise arbitrary and capricious, and the Board should grant the Petition.

### C. San Joaquin Valley communities cannot wait until 2023 or later for CARB to address the issues raised in the Petition, which disproportionately harm them.

The Response states that it would be premature to amend the LCFS at this time because the Scoping Plan is scheduled to be updated by the end of 2022.[152] This is akin to stating that it would be premature to shut off a firehose spraying gasoline on a house fire because the proper report has not yet been filed. CARB's administration of the LCFS as to factory farm gas is fueling the expansion and consolidation of an industry that is sickening and *killing* San Joaquin Valley residents. This is an emergency, and CARB must respond accordingly.

The Petition and this Petition for Reconsideration highlight the ways in which the dairy industry is already harming San Joaquin Valley residents, who CalEnviroScreen designates as a "sensitive population."[153] First and foremost, dairy air pollution is killing San Joaquin Valley residents. As the Petition notes, CARB admits that PM2.5 exposure *alone* "is responsible for about 1,200 cases of premature death in the Valley each year."[154] And dairy air pollution is also sickening these residents, who experience higher rates of asthma, low birth weight, and cardiovascular disease compared to state incidence rates.[155] Sometimes the air is so dangerous to breathe that local authorities recommend schools hold recess indoors, depriving children of access to outdoor recreation.[156] As described above, factory farm expansion and consolidation in

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[151] Senate Rules Committee, Senate Floor Analysis, SB 1383 (August 31, 2016) at 4, https://leginfo.legislature.ca.gov/faces/billAnalysisClient.xhtml?bill_id=201520160SB1383#; *see also* Assembly Committee on Natural Resources, Senate Third Reading Analysis, SB 1383 (August 31, 2016), https://leginfo.legislature.ca.gov/faces/billAnalysisClient.xhtml?bill_id=201520160SB1383#; Senate Committee on Environmental Quality, SB 1383 (August 31, 2016), https://leginfo.legislature.ca.gov/faces/billAnalysisClient.xhtml?bill_id=201520160SB1383#; Assembly Committee on Natural Resources, SB 1383 (August 30, 2016), https://leginfo.legislature.ca.gov/faces/billAnalysisClient.xhtml?bill_id=201520160SB1383#.

[152] Response, *supra* note 9, at 4.

[153] Petition, *supra* note 1, at 10; *see supra* section III.A.3.c.

[154] Petition, *supra* note 1, at 10; (quoting *Clean-air plan for San Joaquin Valley first to meet all federal standards for fine particle pollution*, CAL. AIR RES. BD. (Jan. 24, 2019), https://ww2.arb.ca.gov/news/clean-air-plan-san-joaquin-valley-first-meet-all-federal-standards-fine-particle-pollution).

[155] *Id.* (citing *Indicators Overview*, CAL. OFFICE OF ENV'T HEALTH HAZARD ASSESSMENT, https://oehha.ca.gov/calenviroscreen/indicators#:~:text=Sensitive%20population%20indicators%20measure%20the,of%20their%20age%20or%20health (last visited Mar. 25, 2022); *see* AM. LUNG ASSN., STATE OF THE AIR 2021 23, https://www.lung.org/getmedia/17c6cb6c-8a38-42a7-a3b0-6744011da370/sota-2021.pdf; Ashley E. Larsen et al., *Agricultural pesticide use and adverse birth outcomes in the San Joaquin Valley of California*, 6 NATURE COMMC'N 1, 4–8 (2007); Amy M. Padula et al., *Traffic-Related Air Pollution and Risk of Preterm Birth in the San Joaquin Valley of California*, 24 ANN EPIDEMIOL 1, 6–9; *see also* Robbin Marks, Nat. Res. Def. Council, *Cesspools of Shame: How Factory Farm Lagoons and Sprayfields Threaten Environmental and Public Health* (2001), https://www.nrdc.org/sites/default/files/cesspools.pdf).

[156] *Id.* (citing Brendan Borrell, *California's Fertile Valley is Awash with Air Pollution*, MOTHER JONES (Dec. 10, 2018), https://www.motherjones.com/environment/2018/12/californias-fertile-valley-is-awash-in-air-pollution/; *see*

the San Joaquin Valley, which is occurring in response to the perverse incentives in the LCFS, makes local air quality *worse*, not better—especially for those who live near a dairy with a methane digester, and *particularly* for those who live near a dairy that produces and combusts the factory farm gas onsite.[157]

Second, dairy water pollution and consumption are sickening San Joaquin Valley residents. As noted above, domestic wells are already running dry in the San Joaquin Valley, and expansion and consolidation of dairies in this area is exacerbating the already severe water scarcity issues that residents face.[158] Moreover, as the Petition notes, what water resources remain in San Joaquin Valley communities are contaminated with nitrates, arsenic, and 1,2,3 TCP, among other things, and half of California's public water systems that serve unsafe drinking water are located in these communities.[159] Dairy nitrate loading has caused widespread nitrate pollution of drinking water sources, causing nitrate levels to exceed federal drinking water standards and exposing residents to severe illnesses such as Blue Baby Syndrome and cancer.[160] Nitrate levels exceed federal drinking water standards in 24 to 40% of domestic wells in San Joaquin Valley counties, compared to 10 to 15% of California's overall water supply.[161]

Accordingly, CARB is directly harming the residents of the San Joaquin Valley by administering the LCFS in such a way that makes air and other forms of pollution worse. This has a disparate impact on the basis of race and income, and CARB must immediately reform the LCFS to prevent these harms from continuing to intensify and compound.[162] CARB must act now and stop prioritizing industry interests in profit over the needs of residents of the San Joaquin Valley.

## IV. CARB SHOULD SUSPEND PATHWAY CERTIFICATIONS PENDING A RULEMAKING.

CARB has the authority to pause pathway certifications pending a rulemaking to address the substantial issues raised in the Petition, including but not limited to over-valued credits and non-additional credits that are undermining the market and leading to racially disparate impacts in California. CARB has this authority for three primary reasons. First, CARB has no duty to process and approve pathway certifications by a date certain. Second, CARB's interpretation of its "well to wheel" system boundary for biomethane from dairy and swine manure is a matter of agency interpretation and neither codified in the LCFS regulations nor the governing statutory scheme. Third, and most importantly, CARB has an affirmative duty to ensure its programs and

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*also Policies and Procedures for Poor Outdoor Air Quality Days*, SJVAPCD, http://www.valleyair.org/programs/ActiveIndoorRecess/intro.htm (last visited Mar. 25, 2022).

[157] *See supra* sections III.A.2; III.A.3.

[158] *See supra* section III.A.3.b.

[159] *See* Petition, *supra* note 1, at 9 (citing Del Real, J.A., *They Grow the Nation's Food, but They Can't Drink the Water*, N.Y. TIMES (May 21, 2019), https://www.nytimes.com/2019/05/21/us/california-central-valley-tainted-water.html).

[160] *See supra* section III.A.3.a; Petition, *supra* note 1, at 29–30.

[161] *See* Petition, *supra* note 1, at 9 (citing Eli Moore, et al., *The Human Costs of Nitrate-contaminated Drinking Water in the San Joaquin Valley*, PAC. INST., 11 (2011), https://pacinst.org/publication/human-costs-of-nitrate-contaminated-drinking-water-in-the-san-joaquin- valley/).

[162] *See* Petition, *supra* note 1, at 8–9 (noting that San Joaquin Valley residents are disproportionately low-income and Latino/a/e as compared to California as a whole); *supra* section III.A.3; *infra* section IV.C.

policies comply with both AB 32 and civil rights laws, including Government Code § 11135 and Title VI of the Civil Rights Act of 1964, 42 U.S.C. § 2000d. Thus, CARB may not simply defer consideration of the Petition until some discretionary future date while allowing further deterioration of the LCFS market and racial discrimination.

### A. The LCFS regulations governing the pathway certification process impose no duty on CARB to approve Tier 1 or Tier 2 applications on a specific timeline and give CARB authority to modify its implementation of factory farm gas credit certification.

The regulations for processing LCFS credit applications provide CARB authority to decide when and whether to grant applications and include the authority to modify or delete *any* determination related to factory farm gas credit generation. This authority has two aspects. First, the Executive Officer has discretion to pause application processes for Tier 1 and Tier 2 pathway certifications according to its LCFS regulations codified at 17 Cal. Code of Regs. §§ 95488.6 and 95488.7. Neither provision compels the Executive Officer to certify an application by any date. Neither provision establishes timetables for the Executive Officer's review and processing of applications, including the Executive Officer's assessment and determination of whether a Tier 2 applicant's response to public comments is "adequate."[163] The provisions give the Executive Officer authority to request additional information and give the Executive Officer the discretion to certify or reject a pathway application.[164] The Executive Officer also has no obligation to even consider Provisional pathway applications (*i.e.,* facilities without the requisite 24 months of operational data to support the application).[165]

Second, the Executive Officer has authority to modify or delete any determination related to the generation of credits from factory farm gas. Section 95488.9 governs the special circumstances for fuel pathway applications, including the carbon intensity of factory farm gas. "[A] fuel pathway that utilizes biomethane from dairy cattle or swine manure digestion *may* be certified with a CI that reflects the reduction of greenhouse gas emissions" provided that the captured methane "otherwise would have been vented to the atmosphere" and the avoided methane "is additional to any legal requirement."[166]

This authority to certify LCFS credits for factory farm gas has an important parallel provision which authorizes the Executive Officer to modify or delete any determination made pursuant to this section. Section 95495 provides extremely broad authority to the Executive Officer to "modify or delete a Certified CI." The regulation defines "Certified CI" to mean "*any* determination relating to carbon intensity made pursuant to sections 95488 through 95488.10."[167] Furthermore, the section authorizes modification or deletion of a Certified CI

[163] 17 Cal. Code of Regs. § 95488.7(d)(5)(B).
[164] 17 Cal. Code of Regs. §§ 95488.6(b), 95488.7(d).
[165] 17 Cal. Code of Regs. § 95488.9(c) ("Executive Officer *may* consider Provisional pathway applications" (emphasis added)). CARB has approved at least one provisional application since the factory farm gas petition was filed on October 27, 2021.
[166] 17 Cal. Code of Regs. § 95488.9(f)(1), (f)(1)(A), (f)(1)(B) (emphasis added).
[167] 17 Cal. Code of Regs. § 95495(a) (emphasis added).

when "[a]ny of the information used to generate or support the Certified CI was incorrect[.]"[168] This broad modification and deletion provision thus allows the Executive Officer to correct its implementation of the provision authorizing factory farm gas credit generation, section 95488.9.

Taken together, the Executive Officer has ample authority to refrain from making the numerous determinations on pending or incoming Tier 1 and Tier 2 pathway certifications while it considers the issues raised by the Petitioners and several CARB members regarding factory farm gas in the LCFS.[169] The Executive Officer is not bound to act with haste on such applications. At the same time, the Executive Officer also has authority to modify or delete any determination relating to the carbon intensity of factory farm gas. The Executive Officer's assessment and approval of pathway applications require the agency to analyze the application in multiple ways to inform its judgement when making the decisions leading to certification or modification.

### B. CARB's well to wheels interpretation for biomethane from dairy and pig manure is a matter of agency interpretation and not codified.

The carbon intensity determinations that CARB has authority to modify or delete under 17 Cal. Code Regs. § 95495 are the product of its own interpretation of the "well-to-wheels" life cycle analysis for factory farm gas. The LCFS requires a full "well-to-wheels" life cycle analysis to account for all emissions associated with a given fuel.[170] That carbon intensity is based on CARB's narrow interpretation of the life cycle of biomethane fuels from dairy and pig manure that exclude emissions upstream and downstream of the liquefied manure lagoon. For a Tier 1 application, the applicant uses the "Simplified Calculator" to input various parameters to determine the carbon intensity.[171] Such well-to-wheels accounting requires Tier 2 pathways to include "a description of all fuel production feedstocks used, including all pre-processing to which feedstocks are subject."[172] Likewise, applicants must provide:

> a detailed description of the calculation of the pathway CI. This description must provide clear, detailed, and quantitative information on process inputs and outputs, energy consumption, greenhouse gas emissions generation, and the final pathway carbon intensity, as calculated using CA-GREET3.0. Important intermediate values in each of the primary life cycle stages shall be shown. *Those stages include but are not limited to feedstock production and transport*; fuel

[168] 17 Cal. Code of Regs. § 95495(b)(1)(A).
[169] *See January 27, 2022, Board Meeting Agenda*, CAL. AIR RES. BD., Agenda Item 4 (Board member discussion begins at 3:29), https://cal-span.org/unipage/?site=cal-span&owner=CARB&date=2022-01-27.
[170] 17 Cal. Code of Regs. § 95481(a)(66).
[171] *See* 17 Cal. Code of Regs. §§ 95488.6(a)(1); Tier 1 Simplified CI Calculator for Biomethane from Anaerobic Digestion of Dairy and Swine Manure, https://www.arb.ca.gov/fuels/lcfs/ca-greet/tier1-dsm-calculator-corrected.xlsm?_ga=2.79602192.588832615.1643761833-1197463774.1634834889; Tier 1 Simplified CI Calculator Instruction Manual Biomethane from Anaerobic Digestion of Dairy and Swine Manure, https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/ca-greet/tier1-dsm-im.pdf?_ga=2.87401756.588832615.1643761833-1197463774.1634834889.
[172] 17 Cal. Code of Regs. § 95488.7(a)(2)(A)(2).

> production, fuel transport, and dispensing; co-product production, transport and use; waste generation, treatment and disposal; and fuel use in a vehicle.[173]

Nothing in AB 32 or the LCFS regulations compel the narrow well-to-wheels system boundary applied to factory farm gas projects. CARB appears to ground its interpretation on the system boundary described in the cap and trade Compliance Offset Protocol Livestock Projects, which represents an uncodified agency interpretation and not compelled by the Legislature.[174]

### C. CARB has a duty to ensure its policies and programs comply with AB 32 and civil rights laws.

Setting aside the fact that CARB has the authority to pause Tier 1 and Tier 2 pathway certifications and modify or delete the Certified CI (which includes any determination with respect to factory farm gas fuels), CARB has the *affirmative duty* to ensure that its policies and programs comply with AB 32 and civil rights laws. This affirmative duty compels CARB to pause factory farm gas pathway certifications while it considers amendments to the LCFS to address the significant issues raised in the petition because to do otherwise risks continued violation of California and federal law.

First, AB 32 directs CARB to ensure that the LCFS represents the maximum cost-effective, technologically feasible reductions and does not disproportionately impact low-income communities.[175] AB 32 also directs CARB to ensure that LCFS credits are additional.[176] These provisions do not allow CARB to continue implementing the LCFS without regard to the substantial issues raised by the petition that indicate CARB's widespread certification of over-valued and illusory, non-additional credits is distorting and undermining the LCFS program. Second, California law prohibits CARB from adopting and implementing the LCFS in a manner that subjects people to discrimination. Government Code § 11135 states:

> No person in the State of California shall, on the basis of sex, race, color, religion, ancestry, national origin, ethnic group identification, age, mental disability, physical disability, medical condition, genetic information, marital status, or sexual orientation, be unlawfully denied full and equal access to the benefits of, or be

[173] 17 Cal. Code of Regs. § 95488.7(a)(2)(B) (emphasis added).
[174] *See* Livestock Protocol, *supra* note 36, section 1.1(b) and Table 4.1, Description of all GHG Sources, GHG Sinks, and GHG Reservoirs; *see also* CAL. AIR RES. BD., RESPONSE TO ANIMAL DEFENSE LEGAL FUND COMMENT, https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/new_temp_carb_response.pdf (CARB arguing that "Emissions from existing CAFO operations are accounted for, but do not include emissions associated with enteric methane and animal feed use because these emissions should more appropriately be allocated to and associated with the preexisting underlying, non-fuel product stream, and are thus excluded from the system boundary in the Board approved Tier 1 Calculator."). Table 4.1 of the Compliance Offset Protocol Livestock Projects also shows that nitrous oxide from digestate composting and storage is specifically excluded in downstream emissions. This particular downstream exclusion has a significant impact on the CI determination. A 2017 study which CARB does not dispute found that composting of digested manure solids released such significant nitrous oxide emissions relative to undigested manure solids that the climate benefits of the captured methane from the digestion process *were cancelled out*. *See* Holly et al., *supra* note 41, at 410, 414, 418.
[175] Health & Safety Code §§ 38560.5(c), 38562(a) & (b)(2).
[176] § 38562(d)(2).

> unlawfully subjected to discrimination under, any program or activity that is conducted, operated, or administered by the state or by any state agency, is funded directly by the state, or receives any financial assistance from the state.

CARB has a similar duty under federal law because it receives federal financial assistance. Section 601 of the Civil Rights Act provides that no person shall, "on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity" covered by Title VI.[177] Not only does CARB have authority to stop granting pathway certifications for over-valued and non-additional credits, correct its interpretation underlying the certified CI determinations, and critically reassess the environmental justice implications of incentivizing factory farm pollution—CARB has *the obligation* to do so to prevent discrimination.

## V. CONCLUSION

For the foregoing reasons, CARB should reconsider and grant the Petition. In addition, CARB must grant the requested interim relief by suspending certification of pathways for factory farm gas pending rulemaking to address the serious deficiencies in the LCFS. To do otherwise would undermine the goals and purpose of AB 32, devastate our land, air, water, and climate, allow oil companies to pollute more with inflated and illusory credits, and exacerbate disparate impacts in San Joaquin Valley communities already harmed by air and water pollution.

Respectfully submitted March 25, 2022,

Phoebe Seaton
Michael Claiborne
Jamie Katz
Leadership Counsel for
Justice & Accountability

Brent Newell
Law Offices of Brent J. Newell

Tom Frantz
Association of Irritated Residents

Tarah Heinzen
Tyler Lobdell
Food & Water Watch

Cristina Stella
Christine Ball-Blakely
Animal Legal Defense Fund

[177] 42 U.S.C. § 2000d.

*Attach. 1*

**BEFORE THE CALIFORNIA AIR RESOURCES BOARD**

# PETITION FOR RULEMAKING TO EXCLUDE ALL FUELS DERIVED FROM BIOMETHANE FROM DAIRY AND SWINE MANURE FROM THE LOW CARBON FUEL STANDARD PROGRAM

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## PETITION FOR RULEMAKING

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# I. INTRODUCTION

The California Air Resources Board (CARB) allows inflated and non-additional credits derived from factory farm gas[1] to undermine the integrity of the Low Carbon Fuel Standard (LCFS) pollution trading scheme and exacerbate discriminatory environmental and public health harms in the San Joaquin Valley. The LCFS increases harmful pollution to air, water, and land in rural low-income and Latina/o/e communities; inflates factory farm gas reductions by excluding upstream and downstream emissions; allows non-additional reductions from other factory farm gas incentive programs to generate credits; fails to achieve reductions from transportation fuels when these inflated and non-additional factory farm credits justify excessive fossil fuel emissions; and perversely incentivizes increased greenhouse gas emissions and pollution from dairy and pig factory farms.

To remedy these deficiencies, the Association of Irritated Residents (AIR), Leadership Counsel for Justice & Accountability, Food & Water Watch, and Animal Legal Defense Fund petition the CARB for rulemaking to amend the LCFS to exclude all fuels derived from factory farm gas. In the alternative, CARB must reform the LCFS program to account for the full life cycle of factory farm gas emissions – including all upstream and downstream emissions from activities and inputs at dairy and pig facilities – and exclude non-additional emissions reductions that occur as a result of other factory farm gas incentives, including the Dairy Digester Research Development Program. CARB must also take steps to ensure that its policies and practices do not impose discriminatory harms on low-income and Latina/o/e communities in the San Joaquin Valley.

In 2006, the California Legislature determined that climate change posed "a serious threat to the economic well-being, public health, natural resources, and the environment of California."[2] To address these threats, CARB designed a range of programs that would monitor, regulate, and ultimately reduce greenhouse gas emissions, including the LCFS.[3] But as written and as implemented, the LCFS pathways for factory farm gas do not effectively reduce greenhouse gas emissions, violating CARB's obligation to achieve the maximum cost-effective and technologically feasible emissions reductions.

The LCFS intentionally promotes factory farm gas, a fusion of Big Ag and Big Oil & Gas, two of the industries most responsible for the climate crisis and whose entire business model relies on extraction and exploitation. Big Ag brought us polluted wells, foul air, antibiotic-resistant pathogens, methane-spewing manure lagoons, and workplace conditions that caused rampant outbreaks of COVID-19. Big Ag has driven family farmers off their farms, stripped wealth from our communities, and gutted our rural main streets. Big Oil & Gas brought us countless oil spills, tanker wrecks, pipeline explosions, and climate damage. There is no reason to entrust our future to the very industries responsible for the harms the LCFS seeks to address.

[1] Factory farm gas refers to the fuel the LCFS designates "biomethane from the anaerobic digestion of dairy and swine manure."
[2] CAL. HEALTH & SAFETY CODE § 38501.
[3] CAL. HEALTH & SAFETY CODE § 38510.

The results of CARB's embrace of these false solutions to the benefit of Big Ag and Big Oil & Gas are clear: due to the LCFS's deficient accounting of the emissions from factory farm gas, the program encourages increased production of the liquified manure necessary to generate factory farm gas, resulting in *more* intentionally created methane from new and expanding dairy and pig facilities. By propping up factory farm gas, the LCFS provides a new way for big corporations to get rich off a problem they created. In CARB's accounting of the carbon intensity of factory farm gas, the LCFS fails to include the full quantity of associated upstream and downstream greenhouse gas emissions, leading to an exaggerated negative carbon intensity value and a corresponding inflation of LCFS credit prices for factory farm gas. The resulting inflated credits do not encourage emissions reductions, instead, they reward factory farms for the production of toxic manure as though it were a cash crop. This "hot air" in the credit market, along with the award of credits for reductions from other incentive programs that would have occurred anyway, undermines the LCFS framework by allowing transportation fuel producers to emit more climate pollution based on illusory reductions.

No amount of corporate public relations spin, greenwashing, or deficient carbon intensity calculations can hide the fact that factory farm gas is created from massive harm. By incentivizing increased manure production and liquification, the LCFS program also fails to maximize additional environmental benefits in violation of the *Global Warming Solutions Act of 2006* (AB 32), and even increases the well-documented environmental and public health harms caused by pig and dairy factory farms. These facilities release enormous quantities of solid, liquid, and gaseous waste. In addition to greenhouse gas emissions, the waste from both pigs and dairy cows releases various co-pollutants including ammonia, hydrogen sulfide, volatile organic compounds (VOCs), and severe odor. The factory farm system relies on disposing the manure nitrogen on crops, which also leads to both nitrous oxide emissions and nitrate contamination of groundwater. Experience tells us that racism, exploitation, and extraction are embedded in the factory farm system – we know these harms are disproportionately imposed on Black, Indigenous, People of Color, and low-income communities around the country. In California, these harms discriminatorily impact low-income and Latina/o/e communities in the San Joaquin Valley in violation of state and federal law.[4]

CARB has an affirmative duty under Government Code section 11135 (CA 11135) and Title VI of the Civil Rights Act of 1964, 42 U.S.C. § 2000d, to ensure that its policies and practices do not have a discriminatory impact on the basis of race.[5] CARB has an affirmative duty under AB 32 to ensure that "activities undertaken to comply with the regulations do not disproportionately impact low-income communities" and to design regulations in a manner that is equitable.[6] Finally, Government Code section 12955 (CA 12955) prohibits any practice or program that has a discriminatory effect on members of protected classes with respect to housing opportunities, including with respect to the use and enjoyment of dwellings.[7] Furthermore, the

[4] Addressing discriminatory impacts resulting from the LCFS's inclusion of factory farm gas in other parts of the country where dairy and pig factory farms are concentrated is beyond the scope of this petition. However, CARB should also evaluate these potential impacts, given that the program includes applicants from around the country. CAL. AIR RES. BD., *LCFS Pathways Requiring Public Comments*, https://ww2.arb.ca.gov/resources/documents/lcfs-pathways-requiring-public-comments#t2.

[5] CAL. GOV'T CODE § 11135; 42 U.S.C. § 2000d.

[6] CAL. HEALTH & SAFETY CODE § 38562(b).

[7] CAL. GOV'T CODE § 12955.8; CAL. CODE REGS. TIT. 2 § 12161.

accountability our democracy depends on the public knowing the truth: who is benefiting, where the money is coming from, who is defining the problem, who is being impacted, and how they are harmed by the LCFS. By failing to even conduct a transparent disparity analysis of this highly-technical program, CARB impedes the public's ability to fairly evaluate CARB's choice to prop up Big Ag and Big Oil & Gas.

A people's government – our government – protects and serves the people's interests. It invests in food and climate solutions that create a healthy future for our children and grandchildren. It invests in good jobs that strengthen our rural communities. But CARB has created and implemented a pollution trading scheme that benefits polluters rather than uses the power granted by the people of California to prevent harms. On top of decades of discriminatory impacts in the San Joaquin Valley, California is facing the dire impacts of the climate crisis. We cannot afford a scheme that serves corporate interests over the people's needs.

To remedy these harms and to bring the LCFS regulation into compliance with state and federal law, the petitioners request that CARB amend section 95488.9 of the LCFS to exclude any "fuel pathway that utilizes biomethane from dairy and swine manure digestion."[8] In the alternative, petitioners request that CARB amend the LCFS regulation to (a) ensure that the life cycle analysis for biomethane from dairy and swine manure is expanded to include a full accounting of life cycle emissions; (b) amend section 95488.9 to ensure additionality of reductions; (c) properly classify methane from swine and dairy factory farms as intentionally occurring; (d) ensure compliance with state and federal civil rights law, including but not limited to conducting disparity analyses of LCFS pathways and credit trading; and (e) ensure the LCFS provides environmental benefits and does not degrade water quality and interfere with efforts to improve air quality in the San Joaquin Valley.

## II. BACKGROUND

### A. THE LCFS PROGRAM

AB 32 set a statewide target to reduce California's greenhouse gas emissions to 1990 levels by 2020.[9] In 2007, Governor Arnold Schwarzenegger issued Executive Order S-01-07, which directed CARB to adopt the LCFS pollution trading scheme to diversify California's transportation fuels and curb dependence on petroleum.[10] The California Office of Administrative Law approved the LCFS regulation in 2010 and the regulation has since undergone four rounds of amendments.[11]

According to CARB, "[T]he LCFS is designed to encourage the use of cleaner low-carbon transportation fuels in California, encourage the production of those fuels, and therefore, reduce

[8] CAL. CODE REGS. TIT. 17 § 95488.9.
[9] CAL. HEALTH & SAFETY CODE § 38550.
[10] CAL. EXEC. DEP'T, Exec. Order No. S-01-07, (Jan. 22, 2007), *available at* https://www.library.ca.gov/Content/pdf/GovernmentPublications/executive-order-proclamation/5107-5108.pdf; *see also generally,* CAL. HEALTH & SAFETY CODE § 38560.5 (requiring CARB to establish GHG reduction measures).
[11] CAL. CODE REGS. TIT. 17 § 95480 et seq.

greenhouse gas emissions and decrease petroleum dependence in the transportation sector."[12] The LCFS, like similar pollution trading schemes, constructs a market where credits and deficits that represent emissions in relation to a declining baseline can be traded. These tradeable LCFS credits provide a new revenue stream for producers of fuels that have been deemed low-carbon intensity with the goal of incentivizing increased production and displacing the use of more greenhouse gas-intensive fuels. The LCFS requires entities that produce conventional transportation fuels to report the carbon intensity of these fuels, while certain alternative fuel producers may opt into the program and demonstrate their fuel's carbon intensity in their application.[13]

Every year, CARB sets progressively lower benchmarks for the carbon intensity of fuels.[14] Transportation fuels with carbon intensity values above the annual benchmark generate deficits, and transportation fuels with carbon intensity values below the benchmark generate credits (see Figure 1, Appendix C).[15] While obligated parties are required to either meet the benchmark or purchase credits to offset the extra emissions associated with their fuel, voluntary parties that produce alternative, low-CI fuels are incentivized to participate because fuels with carbon intensities below the benchmark generate revenue through the sale of LCFS credits.[16]

The LCFS regulation defines "carbon intensity" as "the quantity of life cycle greenhouse gas emissions, per unit of fuel energy, expressed in grams of carbon dioxide equivalent per megajoule ($gCO_2e/MJ$)."[17] The emissions included in each fuel's carbon intensity calculation are usually bounded by "fuel pathways," defined as "the collective set of processes, operations, parameters, conditions, locations, and technologies throughout all stages that CARB considers appropriate to account for in the system boundary of a complete well-to-wheel analysis of [a given] fuel's life cycle greenhouse gas emissions."[18] Accurate and thorough life cycle analyses for each fuel and the accurate accounting of the baseline against which each fuel's carbon intensity is compared are independent and necessary preconditions for the program to identify which fuels to encourage to decrease net greenhouse gas emissions.

The LCFS classifies fuel pathways into three groups: Lookup Table, Tier 1, and Tier 2 pathways.[19] Regulated parties can register their fuels using the standard pathways in the Lookup

[12] *Low Carbon Fuel Standard: About,* CAL. AIR RES. BD., https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/about (last visited Oct. 12, 2021).
[13] CAL. CODE REGS. TIT. 17 §§ 95483-95483.1.
[14] CAL. CODE REGS. TIT. 17 § 95484.
[15] *Id.*
[16] CARB accounts for credits and implements credit transfers with the LCFS Reporting Tool and Credit Bank & Transfer System. CAL. AIR RES. BD., *LCFS Registration and Reporting*, https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/lcfs-registration-and-reporting (last visited Oct. 12, 2021).
[17] CAL. CODE REGS. TIT. 17 § 95481(a)(26). "Life Cycle Greenhouse Gas Emissions," in turn, is defined as "the aggregate quantity of greenhouse gas emissions (including direct emissions and significant indirect emissions, such as significant emissions from land use changes) as determined by the Executive Officer, related to the full fuel life cycle, including all stages of fuel and feedstock production and distribution, from feedstock generation or extraction through the distribution and delivery and use of the finished fuel to the ultimate consumer, where the mass values for all greenhouse gases are adjusted to account for their relative global warming potential. CAL. CODE REGS. TIT. 17 § 95481(a)(88).
[18] CAL. CODE REGS. TIT. 17 § 95481(a)(66).
[19] CAL. CODE REGS. TIT. 17 § 95488.1(a).

Table if the fuel produced "closely corresponds" to a Lookup Table pathway.[20] Tier 1 and Tier 2 pathways are open to voluntary applicants, including those seeking credit for factory farm gas. Tier 1 is for "the most common low carbon fuels" and uses a Simplified CI calculator, where Tier 2 is for "innovative, next generation fuel pathways," and uses the full CA-GREET3.0 model.[21] Tier 1 includes fuels like ethanol and biomethane anaerobic digesters of dairy and swine manure, among others.[22] Tier 2 includes fuels from sources not in Tier 1 as well as pathways included in Tier 1 that use "innovative production methods."[23] The majority of factory farm gas producers apply for Tier 2 pathways rather than the Tier 1 pathway.

Ten years after enacting AB 32, the California Legislature set a new target for greenhouse gas emissions in Senate Bill 32 (SB 32) – 40 percent below 1990 levels.[24] The Legislature stipulated, however, that SB 32 would only be operative if it also enacted Assembly Bill 197 (AB 197), which amended AB 32 in several ways.[25] AB 197 added Section 38562.5, which required that regulations promulgated to achieve emissions reductions beyond the statewide greenhouse gas limit, including the LCFS, consider the social costs of greenhouse gases, prioritize direct emissions reductions, and incorporate the requirements of Section 38562(b).[26] These requirements include crucial mandates to design the regulations in a manner that is equitable; ensure that activities taken to comply with the regulations "do not disproportionately impact low-income communities" and "do not interfere with, efforts to achieve and maintain federal and state ambient air quality standards and to reduce toxic air contaminant emissions;" and consider the overall societal benefits, including reductions in other air pollutants and other benefits to the environment.[27]

### B. THE SAN JOAQUIN VALLEY

California's San Joaquin Valley, as discussed in this petition, refers to eight counties that compose the valley floor from San Joaquin County in the north, to Kern County in the south. While disadvantaged communities within the region confront air pollution, toxic emissions, and unsafe drinking water at rates and degrees disproportionate to other communities in the state, the San Joaquin Valley is also home to resilient, diverse communities and networks that have worked together over decades to promote robust mutual aid networks, expand civic engagement, and lead

[20] CAL. CODE REGS. TIT. 17 § 95488.5(a)(1)-(6) ("Closely corresponds" means that the applicant's fuel pathway and a pathway on the Lookup Table are consistent in feedstock, production technology, the region in which the feedstock and fuel is produced, transport distance (if applicable), types and amount of thermal and electrical energy used in feedstock and finished fuel production, and that the CI of the entity's product is lower than or equal to the CI of the pathway in the lookup table.)

[21] CAL. AIR RES. BD., LCFS Guidance 19-01, Book and Claim Accounting for Low-CI Electricity 2, *available at* https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/guidance/lcfsguidance_19-01.pdf. While Tier 1 applicants provide a "discrete set of inputs" based on the specifics of their operations to be used by one of the pre-existing Tier 1 Simplified CI Calculators, Tier 2 applicants must conduct and submit a full life cycle analysis using the CA-GREET3.0 model for their own customized pathway. CAL. CODE REGS. TIT. 17 § 95488.3.

[22] CAL. CODE REGS. TIT. 17 § 95488.1(c).

[23] CAL. CODE REGS. TIT. 17 § 95488.1(d).

[24] CAL. HEALTH & SAFETY CODE § 38566.

[25] SB 32, 2016 CAL. LEGIS. SERV. CH. 249.

[26] AB 197, 2016 CAL. LEGIS. SERV. CH. 250.

[27] CAL. HEALTH & SAFETY CODE §§ 38562(2), (4), (6).

efforts from the household to the community level to model climate resilience and environmental stewardship.

The region is known for and, to a great extent, characterized by industrial agricultural operations, including large confined animal feeding operations. Decades of similar investment, land use, and economic development strategies have failed and continue to fail to prioritize the economic well-being and health of San Joaquin Valley residents, leading to severe income inequality, poverty, and environmental degradation despite the inherent assets of the region.

The "disadvantaged communities" of California, as defined pursuant to Senate Bill 535, are concentrated in the San Joaquin Valley.[28] Seven of the eight counties in the Valley (all except San Joaquin County) report mean income well below the 120% limit that defines low-income.[29] Every county in the San Joaquin Valley has lower household and per capita incomes, and higher poverty rates than California as a whole.[30] While median household income in California in 2019 was $75,235, countywide household median incomes for San Joaquin Valley Counties ranged from $49,687 to $64,432. The highest producing dairy counties in the state and in the San Joaquin Valley, Merced and Tulare, show median household incomes at $53,672 and $49.687 – both at 71 percent or below statewide median income.[31] Notably, nine of ten of the most recent applications for consideration for Low Carbon Fuel Standard Tier 2 Pathways from California factory farm gas were in Tulare County and Kern County. Kern County, like Merced and Tulare, faces disproportionately high poverty rates at 19 percent. Even this data likely inflates reported income level, because it may exclude the San Joaquin Valley's thousands of undocumented residents and residents of the Valley's unincorporated communities.[32]

San Joaquin Valley residents are disproportionately Latina/o/e as compared to California as a whole. All eight San Joaquin Valley Counties have higher Latino populations than the state,[33] with populations ranging from 42 percent to 65.6 percent, as compared to the state population with

[28] CAL. ENV'T PROT. AGENCY, *Designation of Disadvantaged Communities Pursuant to Senate Bill 535 (De León)* 1-32 (Apr. 2017), https://calepa.ca.gov/wp-content/uploads/sites/6/2017/04/SB-535-Designation-Final.pdf.
[29] Section 39711 of the Health and Safety Code sets the ceiling for low-income communities at 120% of the area median income. Additionally, Section 39711 designates communities with disproportionate environmental impacts and concentrations of low income, high unemployment, low educational attainment, and other burdensome socioeconomic factors as disadvantaged communities. All eight counties of the San Joaquin Valley fall within these categories. *See Maps & Data,* CAL. OFFICE OF ENV'T HEALTH HAZARD ASSESSMENT, https://oehha.ca.gov/calenviroscreen/maps-data (last visited Apr. 9, 2021) (flagging areas of California that exhibit high to low pollution burdening scores). *Income Limits*, U.S. DEP'T OF HOUSING AND URBAN DEV., https://www.huduser.gov/portal/datasets/il.html#2020_data (last updated Apr. 1, 2020) (choose 30% Income Limit for ALL Areas (Excel)); *FY 2020 State Income Limits* (2020), U.S. DEP'T OF HOUSING AND URBAN DEV., https://www.huduser.gov/portal/datasets/il/il20/State-Incomelimits-Report-FY20r.pdf.
[30] *Quick Facts*, U.S. CENSUS, https://www.census.gov/quickfacts/fact/table/POP645219 (last visited Oct. 12, 2021).
[31] Poverty rates in every single county in the San Joaquin Valley also exceed poverty rates in California, with Merced, Tulare facing 17 and 18.9 percent poverty rates (as compared to 11.8 percent at the statewide level). *Quick Facts*, U.S. CENSUS, https://www.census.gov/quickfacts/fact/table/POP645219 (last visited Oct. 12, 2021).
[32] 310,000 people live in low-income unincorporated communities in the San Joaquin Valley – "this is 70,000 more than what the Census Bureau included in its low-income Census Designated Places in the San Joaquin Valley." POLICYLINK, *California Unincorporated: Mapping Disadvantaged Communities in the San Joaquin Valley* 9 (2013), https://www.policylink.org/sites/default/files/CA%20UNINCORPORATED_FINAL.pdf.
[33] Latino is the term used by the U.S. Census.

39.4 percent of residents classified as Latino. At least seven of eight San Joaquin Valley communities have a lower proportion of white residents as compared to the state as a whole.[34] Merced and Tulare counties have white, non-Latino populations of 26.5 and 27.7 percent, and Latino populations of 65.6 and 61 percent, respectively.[35] Like Merced and Tulare, Kern County also demonstrates much higher Latino populations than the rest of the state, with a Latino population of 54.6 percent.

The disproportionately low-income and Latina/o/e residents of the San Joaquin Valley are exposed to the worst air quality in the state by most measures and lower income communities in the San Joaquin Valley are disproportionately subject to water contaminated with nitrates, arsenic, and 1,2,3 TCP, among others. The San Joaquin Valley is classified as an area that fails to meet several federal health-based standards for fine particulate matter ($PM_{2.5}$).[36] According to the American Lung Association, the San Joaquin Valley cities of Fresno-Madera-Hanford and Bakersfield are the second and third most polluted with respect to short-term exposure to $PM_{2.5}$.[37] The Valley cities of Bakersfield, Fresno-Madera-Hanford, and Visalia are the first, second, and third most polluted with respect to long-term exposure to $PM_{2.5}$.[38] The Valley also violates health-based standards for ozone.[39] Bakersfield, Visalia, and Fresno-Madera-Hanford are the second, third, and fourth most ozone-polluted cities in the in United States.[40] The San Joaquin Valley contains about half of California's 300 public water systems that currently serve unsafe drinking water.[41] Over the past three decades, nitrate levels in drinking water have exceeded the federal maximum contaminant level of 45 mg/L $NO_3$ (equivalent to 10 mg/L nitrate-N) in an estimated 24 to 40% of domestic wells in different counties in the San Joaquin Valley, compared to 10 to 15% of California's overall water supply.[42]

This pollution impacts the health and well-being of San Joaquin Valley residents.[43] Short-term exposure to $PM_{2.5}$ pollution causes premature death, decreased lung function, exacerbates respiratory disease such as asthma, and causes increased hospital admissions.[44] Long-term

[34] According to recent census data, 36.5 percent of the state population is classified as white, non-Latino, while 7 of the 8 counties in the San Joaquin Valley have white, non-Latino populations that range from only 26.5 to 33.2 percent. *Quick Facts*, U.S. CENSUS, https://www.census.gov/quickfacts/fact/table/POP645219 (last visited Oct. 12, 2021).
[35] *Quick Facts*, U.S. CENSUS, https://www.census.gov/quickfacts/fact/table/POP645219 (last visited Oct. 12, 2021).
[36] 80 FED. REG. 18,528 (April 7, 2015); 81 FED. REG. 2,993 (January 20, 2016); 80 FED. REG. 2,206, 2,217 (January 15, 2015).
[37] AM. LUNG ASSN., *State of the Air 2021* 37, *available at* https://www.lung.org/getmedia/17c6cb6c-8a38-42a7-a3b0-6744011da370/sota-2021.pdf.
38 *Id.* at 38.
[39] 75 FED. REG. 24409 (May 5, 2010); 77 FED. REG. 30088, 30092 (May 21, 2012).
[40] AM. LUNG ASSN., *supra* note 37 at 36.
[41] Del Real, J.A., *They Grow the Nation's Food, but They Can't Drink the Water*, N.Y. TIMES (May 21, 2019), https://www.nytimes.com/2019/05/21/us/california-central-valley-tainted-water.html.
[42] Eli Moore, et al., *The Human Costs of Nitrate-contaminated Drinking Water in the San Joaquin Valley*, PAC. INST., 11 (2011), https://pacinst.org/publication/human-costs-of-nitrate-contaminated-drinking-water-in-the-san-joaquin-valley/.
[43] The COVID-19 pandemic has made exposure to particulate matter even more dangerous, further highlighting the health risks associated with air pollution from factory farm dairies and factory farm gas. Xiao Wu et al., *Air pollution and COVID-19 mortality in the United States: Strengths and limitations of an ecological regression analysis*, 6 SCI. ADVANCES 1 at 1-2 (Nov. 4, 2020), https://advances.sciencemag.org/content/6/45/eabd4049.
[44] AM. LUNG ASSN., *supra* note 37 at 37-38.

exposure can cause asthma and decreased lung function in children, increased risk of death from cardiovascular disease, and increased risk of death from heart attacks.[45] Nitrates in drinking water can cause serious illness and death in infants ("blue baby syndrome") and are linked to pregnancy complications and birth defects, Sudden Infant Death Syndrome, and respiratory tract infections and a number of different cancers in adults and children.[46]

CARB has acknowledged that $PM_{2.5}$ exposure alone "is responsible for about 1,200 cases of premature death in the Valley each year."[47] San Joaquin Valley residents, who CalEnviroScreen designate a "sensitive population," experience higher rates of asthma, low birth weight, and cardiovascular disease compared to state incidence rates.[48] The California Institute for Rural Studies estimates that the costs of these air quality-related health harms total over $6 billion per year in the San Joaquin Valley.[49] This pollution also impacts residents' quality of life. For example, children in the San Joaquin Valley suffer from lack of access to outdoor recreation – on days with especially poor air quality, which occurred 40 days in Kern County in 2018, local authorities recommend that schools hold recess indoors.[50]

## III. CARB MUST EXCLUDE BIOMETHANE FROM DAIRY AND SWINE MANURE FROM THE LCFS OR IN THE ALTERNATIVE AMEND THE REGULATION TO ACCURATELY ACCOUNT FOR THE FULL CARBON INTENSITY OF THESE FUELS AND PROHIBIT CREDITS FROM NON-ADDITIONAL REDUCTIONS.

The LCFS violates sections 38560.5, 38562(b), 38562(d)(2), 38562.5 of the Health & Safety Code because it fails to achieve the maximum technologically feasible and cost-effective emissions reductions, fails to maximize additional environmental benefits, fails to ensure additionality of reductions, and exacerbates harms associated with industrial animal agriculture, including toxic air contaminants and dangerous water pollution. These failures prevent the state from maximizing greenhouse gas emissions reductions from transportation fuels and constitute a failure to use best scientific practices, as required by section 38562(e). Moreover, they harm San

[45] *Id*. at 38-39.
[46] WIS. DEP'T OF HEALTH SERV., *Infant Methemoglobinemia (Blue Baby Syndrome)*, https://www.dhs.wisconsin.gov/water/blue-baby-syndrome.htm (last updated Mar. 12, 2021).
[47] CAL. AIR RES. BD., *Clean-air plan for San Joaquin Valley first to meet all federal standards for fine particle pollution* (Jan. 24, 2019), https://ww2.arb.ca.gov/news/clean-air-plan-san-joaquin-valley-first-meet-all-federal-standards-fine-particle-pollution.
[48] *Indicators Overview*, CAL. OFFICE OF ENV'T HEALTH HAZARD ASSESSMENT, https://oehha.ca.gov/calenviroscreen/indicators#:~:text=Sensitive%20population%20indicators%20measure%20the,of%20their%20age%20or%20health (last visited Oct. 21, 2021); *see* AM. LUNG ASSN., *supra* note 37 at 23; Ashley E. Larsen et al., *Agricultural pesticide use and adverse birth outcomes in the San Joaquin Valley of California*, 6 NATURE COMMC'N 1, AT 4-8 (2007); Amy M. Padula et al., *Traffic-Related Air Pollution and Risk of Preterm Birth in the San Joaquin Valley of California*, 24(12) ANN EPIDEMIOL 1, 6-9; *see also* Robbin Marks, Nat. Res. Def. Council, *Cesspools of Shame: How Factory Farm Lagoons and Sprayfields Threaten Environmental and Public Health* (2001), https://www.nrdc.org/sites/default/files/cesspools.pdf.
[49] Lisa Kresge and Ron Strochlic, *Clearing the Air: Mitigating the Impact of Dairies on Fresno County's Air Quality and Public Health*, CAL. INST. FOR RURAL STUDIES 8, (Jul. 2007).
[50] Brendan Borrell, *California's Fertile Valley is Awash with Air Pollution*, MOTHERJONES (Dec. 10, 2018), https://www.motherjones.com/environment/2018/12/californias-fertile-valley-is-awash-in-air-pollution/. *See also Policies and Procedures for Poor Outdoor Air Quality Days*, SAN JOAQUIN VALLEY AIR POLLUTION CONTROL DIST., http://www.valleyair.org/programs/ActiveIndoorRecess/intro.htm (last visited Oct. 12, 2021).

Joaquin Valley communities with increased air and water pollution from factory farm dairies subsidized by the LCFS – harms the Legislature sought to address when it enacted AB 32 and AB 197.[51] For all of these reasons, CARB should amend the LCFS to exclude all fuels derived from biomethane from swine and dairy manure.[52] If CARB fails to do so, it must at a minimum amend the regulation to capture the full life cycle of associated greenhouse gas emissions in both the established Tier 1 pathway and the customized Tier 2 pathways and amend the regulation to ensure credited reductions are additional.[53]

### A. The fuel pathways for biomethane from dairy and swine manure fail to achieve the maximum technologically feasible and cost-effective emissions reductions.

AB 32 mandates that the early action measure regulations adopted by CARB "shall achieve the maximum technologically feasible and cost-effective reductions in greenhouse gas emissions from those sources or categories of sources, in furtherance of achieving the statewide greenhouse gas emissions limit."[54] CARB explicitly premised the adoption of the LCFS regulation on this mandate.[55] As written and in practice, however, the LCFS regulation does not incentivize, let alone achieve, the maximum emissions reductions in this sector due to the program's inflation of carbon intensity values for factory farm gas. These inflated credit values are the result of CARB's narrow interpretation of the life cycle emissions for factory farm gas. Moreover, CARB's failure to ensure that credited emissions reductions are additional to what otherwise would have occurred inject invalid credits into the overall market and allow fuel producers to emit more pollution.

By setting overly narrow system boundaries for the life cycle analysis of factory farm gas, the LCFS fails to account for emissions associated with a true "well-to-wheels" analysis, exaggerating the emissions reductions attributed to this fuel. AB 32 requires that market-based compliance mechanisms only credit "additional" emissions reductions, and thus exclude reductions already required by law or that otherwise would occur.[56] However, CARB has allowed the LCFS program to award credits generated from non-additional reductions at factory farms. Factory farm gas projects rely on multiple sources of revenue from grant programs, federal programs, and the Aliso Canyon settlement – all of this supplementary revenue renders reductions from factory farm gas projects either partially or fully non-additional, yet CARB has made no effort to prevent these non-additional credits from entering the market.

Because CARB has allowed grossly inflated carbon intensity scores to distort the market, and allowed non-additional reductions to generate credits, the LCFS perversely incentivizes bigger dairy and pig operations to generate more methane. As a result, credit revenue from dairy factory

[51] CAL. HEALTH & SAFETY CODE § 38501 (the Legislature named the "exacerbation of air quality problems, a reduction in the quality and supply of water to the state from the Sierra snowpack, a rise in sea levels resulting in the displacement of thousands of coastal businesses and residences, damage to marine ecosystems and the natural environment, and an increase in the incidences of infectious diseases, asthma, and other human health-related problems" as potential adverse impacts of climate change.)
[52] CAL. CODE REGS. TIT. 17 § 95488.3; CAL. CODE REGS. TIT. 17 § 95488.9(f)(1). *See* proposed amendments in Appendix A.
[53] *See* proposed amendments in Appendix B.
[54] CAL. HEALTH & SAFETY CODE § 38560.5.
[55] CAL. AIR RES. BD., RES. 19-27, (Nov. 21, 2019).
[56] CAL. HEALTH & SAFETY CODE § 38562(d)(2).

farm gas can be a more reliable income stream than milk revenue, propping up this high-emissions industry and further polluting nearby communities. Additionally, the financial windfall from these over-valued credits is traded to offset emissions from LCFS deficit holders. Together and separately, each of these violations undermines the LCFS program and constitutes a failure to achieve the maximum technologically feasible and cost-effective emissions reductions from transportation fuels in violation of AB 32.

### 1. The fuel pathways for biomethane from dairy and swine manure fail to incorporate life-cycle emissions, leading to inflated credits.

The LCFS over-values credits awarded to factory farm gas operations because the program omits significant emissions from the factory farm gas life cycle. Neither the established Tier 1 nor the customized Tier 2 pathways for biomethane from dairy and swine manure capture the greenhouse gas emissions associated with the full life cycle of factory farm gas. The pathways ignore both upstream and downstream emissions. In addition to setting overly narrow system boundaries, the factory farm gas life cycle analyses fail to properly account for the fact that the methane purportedly captured in the production of factory farm gas is intentionally created, resulting in an even more misleading accounting of associated climate harms. When the resulting inflated credits are traded, they allow LCFS deficit holders to achieve less than the required maximum technologically feasible and cost-effective reductions.

The LCFS requires a full "well-to-wheels" life cycle analysis to account for all emissions associated with a given fuel.[57] Such well-to-wheels accounting requires Tier 2 pathways to include "a description of all fuel production feedstocks used, including all pre-processing to which feedstocks are subject."[58] Likewise, applicants must provide:

> a detailed description of the calculation of the pathway CI. This description must provide clear, detailed, and quantitative information on process inputs and outputs, energy consumption, greenhouse gas emissions generation, and the final pathway carbon intensity, as calculated using CA-GREET3.0. Important intermediate values in each of the primary life cycle stages shall be shown. *Those stages include but are not limited to feedstock production and transport*; fuel production, fuel transport, and dispensing; co-product production, transport and use; waste generation, treatment and disposal; and fuel use in a vehicle.[59]

Feedstocks are the raw materials processed into fuel. The feedstock for factory farm gas is manure. Therefore, emissions from manure production and "pre-processing" must be included in the life cycle analysis for Tier 2 applicants. But the LCFS and CARB's implementation does not require their inclusion. For example, CalBioGas Kern Cluster's recent application begins the data-listing portion of its lifecycle analysis with the Dairy Livestock Input Data table.[60] This table does not provide an adequate analysis of the feedstock production energy input. In fact, this lifecycle

[57] CAL. CODE REGS. TIT. 17 § 95481(a)(66).
[58] CAL. CODE REGS. TIT. 17 § 95488.7(a)(2)(A)(2).
[59] CAL. CODE REGS. TIT. 17 § 95488.7(a)(2)(B) (emphasis added).
[60] CAL. AIR RES. BD., Low Carbon Fuel Standard Tier 2 Pathway Application B0198, *available at* https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0198_cover.pdf.

analysis contains no analysis pertaining to the emissions from the generation and processing of manure to produce the feedstock.

Accounting for the greenhouse gas emissions from the production and "pre-processing" of dairy or pig manure must include the inputs and infrastructure necessary to sustain a dairy cow or a pig: its food and water, the methane animals produce through enteric fermentation, the construction and maintenance of the lagoons required to hold manure, trucking livestock and other inputs, combustion of fuels at the dairy facility for electricity, and more. But the LCFS factory farm gas pathways only begin after the production of the manure itself, leaving out all upstream emissions generated formulating that manure.[61]

The regulation further enumerates that, "for fuels utilizing agricultural crops for feedstocks, the description [of feedstocks in the life cycle analysis report] shall include the agricultural practices used to produce those crops. This discussion shall cover energy and chemical use, typical crop yields, feedstock harvesting, transport modes and distances, storage, and pre-process (such as drying or oil extraction)."[62] In the Tier 2 pathways for ethanol production, this provision has been interpreted to include production and pre-processing of corn, the feedstock for ethanol. Similarly, the LCFS requires pathways that utilize organic material to "demonstrate that emissions are not significant beyond the system boundary of the fuel pathway," upon request.[63] Yet in the case of factory farm gas, none of the production and pre-processing of the feedstock is considered, making it an outlier in the LCFS program and out of compliance with section 95488.7.

The failure to include production and pre-processing of manure when calculating life cycle emissions is even more problematic because a common feed for dairy cows in California is distillers grains, a "co-product" of ethanol production. The designation of distillers grains as a "co-product" allows ethanol producers to split the emissions from corn production between the ethanol and distillers grains by weight, decreasing ethanol's carbon intensity in the LCFS analysis.[64] One ethanol industry blog noted that "the biggest factor for most of the low-CI scoring [ethanol] plants is the proportion of wet distillers grains sold locally."[65] Distillers grains are granted the "co-product" designation by virtue of the revenue they generate when sold as animal feed but because LCFS factory farm gas pathways do not account for production and pre-processing of manure, the emissions associated with distillers grains are never accounted for by the LCFS at all despite its

[61] CAL. AIR RES. BD., *Compliance Offset Protocol Livestock Projects* (Nov. 14, 2014), Table 4.1, Description of all GHG Sources, GHG Sinks, and GHG Reservoirs; *see also* CAL. AIR RES. BD., Response to Animal Defense Legal Fund Comment, https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/new_temp_carb_response.pdf (CARB arguing that "Emissions from existing CAFO operations are accounted for, but do not include emissions associated with enteric methane and animal feed use because these emissions should more appropriately be allocated to and associated with the preexisting underlying, non-fuel product stream, and are thus excluded from the system boundary in the Board approved Tier 1 Calculator.")

[62] CAL. CODE REGS. TIT. 17 § 95488.7(a)(2)(A)(2).

[63] CAL. CODE REGS. TIT. 17 § 95488.9(f)(2)(B).

[64] CAL. AIR RES. BD., *Tier 1 Simplified CI Calculator Instruction Manual: Starch and Fiber Ethano*l (Aug. 13, 2018), *available at* https://ww2.arb.ca.gov/resources/documents/lcfs-life-cycle-analysis-models-and-documentation.

[65] Susanne Retka Schill, *Meeting the California Low Carbon Challenge*, ETHANOL PROD. MAGAZINE (Feb. 8, 2016), http://ethanolproducer.com/articles/13000/meeting-the-california-low-carbon-challenge.

role in two transportation fuel life cycles.[66] Some ethanol plants also incorporate factory farm gas from dairies as a process fuel, further lowering the ethanol's carbon intensity.[67] These "negative" upstream emissions from factory farm gas and negative downstream emissions from the use of distillers grains as dairy feed both reduce the LCFS carbon intensity of ethanol, which would likely not receive credits otherwise.

While downstream emissions from distillers grains in ethanol production are accounted for by excluding them from that fuel's carbon intensity calculation, the by-product of dairy and swine factory farm gas, digestate – which would *increase* the carbon intensity of factory farm gas – remains largely unaccounted for, even though the LCFS requires all Tier 2 pathway application lifecycle analyses to include:

> a description of all co-products, byproducts, and waste products associated with production of the fuel. That description shall extend to all processing, such as drying of distiller's grains, applied to these materials after they leave the fuel production process, including processing that occurs after ownership of the materials passes to other parties.[68]

Demonstrably, any storage, land-application, or composting of digestate falls within the meaning of the term 'process,' but the LCFS does not require, and no factory farm gas lifecycle analyses include emissions from digestate.

The process of anaerobic digestion can result in "changes in the manure composition" that alter ammonia ($NH_3$) and nitrous oxide ($N_2O$) emissions, depending upon the management strategy used.[69] In the United States, liquid effluent from factory farm gas production is primarily applied to land as fertilizer and digestate solids are composted and then land applied or used for bedding on-farm (See Figure 4 in Appendix C).[70] Digestate land application and composting result in emissions of nitrous oxide, which has a global warming potential 265 to 298 times that of carbon dioxide.[71] A recent study found that digested solids that were composted released such significant

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[66] Somerville, Scott, Daniel A. Sumner, James Fadel, Ziyang Fu, Jarrett D. Hart, and Jennifer Heguy, *By-Product Use in California Dairy Feed Has Vital Sustainability Implications*, ARE UPDATE 24(2) (2020) 5, University of California Giannini Foundation of Agricultural Economics.

[67] For example, a Tier 2 ethanol pathway for a plant in Pixley, California uses biomethane from dairies as a process fuel to transform starch from corn into ethanol. *GFP Ethanol, LLC dba Calgren Renewable Fuels GREET Pathway for the Production of Ethanol from Corn and Fueled by NG and Biogas from Two Local Dairy Digesters* (Sept. 20, 2018), https://ww2.arb.ca.gov/sites/default/files/classic//fuels/lcfs/fuelpathways/comments/tier2/t2n-1279_report.pdf.

[68] CAL. CODE REGS. TIT. 17 § 95488.7(a)(2)(A)(8).

[69] Michael A. Holly et al., *Greenhouse gas and ammonia emissions from digested and separated dairy manure during storage and after land application Agriculture*, 239 ECOSYSTEMS AND ENV'T 410, 418 (Feb. 15, 2017), https://doi.org/10.1016/j.agee.2017.02.007.

[70] Ron Alexander, *Digestate Utilization in The U.S.*, 53 BIO CYCLE 56 (Jan. 2012), https://www.biocycle.net/digestate-utilization-in-the-u-s/. Mohanakrishnan Logan & Chettiyappan Visvanathan, *Management strategies for anaerobic digestate of organic fraction of municipal solid waste: Current status and future prospects*, 37 WASTE MGT. & RES. 27, 27 (Jan. 28, 2019), https://doi.org/10.1177/0734242X18816793.

[71] Holly, *supra* note 69 at 411. Alun Scott & Richard Blanchard, *The Role of Anaerobic Digestion in Reducing Dairy Farm Greenhouse Gas Emissions*, 13 SUSTAINABILITY 2 (Mar. 1, 2021) https://doi.org/10.3390/su13052612; *Understanding Global Warming Potentials*, ENV'T PROT. AGENCY, https://www.epa.gov/ghgemissions/understanding-global-warming-potentials (last visited Oct. 21, 2021).

nitrous oxide emissions relative to undigested manure solids that the climate benefits of the captured methane from the digestion process were cancelled out.[72] Additionally, many operators choose to store digestate in open-air lagoons. Open-air storage can release methane, potentially negating methane captured during digestion, as well as ammonia, which is harmful to nearby communities in the San Joaquin Valley and a $PM_{2.5}$ precursor.[73]

Despite the significant emissions associated with digestate and the high global warming potential of methane and nitrous oxide, the LCFS fails to fully account for this inevitable by-product of factory farm gas production. Digestate treatment and storage is within the Tier 1 system boundary for anaerobic digestion of dairy and swine manure (described as "effluent"), but the pathway does not contemplate emissions associated with effluent after storage.[74] In contrast to Tier 1, the Tier 2 system boundary in the CA GREET3.0 calculator includes emissions from "AD Residue Applied to Soil," in other words, digestate that is land applied.[75] In practice, however, digestate is not mentioned in several recent Tier 2 applications for cluster projects.[76] Further, in responding to a comment criticizing a project's lack of accounting for digestate emissions, the applicant responded in a letter to CARB that "land application of effluent is outside of the scope of the project."[77] These contradictory descriptions of the system boundary as related to digestate highlight an inconsistent approach to the quantification of emissions from digestate. Moreover, neither the pathways nor the project application materials seem to account for digestate uses other than land application. This excludes any emissions associated with the solids composting. By failing to account for downstream emissions associated with land application and the massive nitrous oxide emissions from solids composting, CARB's life cycle analysis omits significant greenhouse gas emissions from factory farm gas production and further inflates the factory farm gas credit value.

The factory farm gas life cycle analyses also fail to include downstream emissions associated with transport. The LCFS factory farm gas pathways mention, but do not require reporting of inputs to calculate emissions generated from the refining and transport of factory farm gas. For example, the Tier 1 Calculator for factory farm gas *can* quantify emissions leaked or

[72] Holly, *supra* note 69 at 414, 418.
[73] *See generally* Yun Li et al., *Manure digestate storage under different conditions: Chemical characteristics and contaminant residuals*, 639 SCI. OF THE TOTAL ENV'T 19 (Oct. 15, 2018), https://doi.org/10.1016/j.scitotenv.2018.05.128 (discussing the impacts of open storage).
[74] CAL. AIR RES. BD., Tier 1 Simplified CI Calculator Instruction Manual: Biomethane from Anaerobic Digestion of Dairy and Swine Manure (Aug. 13, 2018), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/ca-greet/tier1-dsm-im.pdf?_ga=2.63225775.1254208748.1633995805-239480191.1598055085.
[75] *LCFS Life Cycle Analysis Models and Documentation: California GREET3.0 Model,* CAL. AIR RES. BD., https://ww2.arb.ca.gov/resources/documents/lcfs-life-cycle-analysis-models-and-documentation (last visited July 29, 2021).
[76] *See* CAL. AIR RES. BD., *Fuel Pathway Table: Current Fuel Pathways*, *available at* https://ww2.arb.ca.gov/resources/documents/lcfs-pathway-certified-carbon-intensities (last visited Oct. 19, 2021).
[77] Letter from Michael D. Gallo, Gallo Cattle Company Regarding "Tier 2 Pathway Application: Application No. B0089" (June 26, 2020), on file with CAL. AIR RES. BD., https://ww2.arb.ca.gov/sites/default/files/classic//fuels/lcfs/fuelpathways/comments/tier2/b0089_response.pdf.

vented from the digester and associated pipeline infrastructure—but the applicant is not *required* to calculate it.[78]

In addition to the failure to account for various upstream and downstream emissions from factory farm gas production, the LCFS life cycle analyses do not address the fact that these emissions are associated with *intentionally created* methane. LCFS factory farm gas pathways are intended to credit "reduction[s] of greenhouse gas emissions achieved by the voluntary capture of methane" or "avoided methane emissions."[79] This structure is premised on the idea that the manure used to produce the gas is unavoidable waste, whose emissions would not otherwise be diverted. But the massive quantity of manure methane emissions that CARB seeks to mitigate is the result of the intentional liquification of the manure, one of multiple manure management methods. While necessary to produce factory farm gas, the production of vast quantities of liquified manure is by no means an inevitable result of dairy or pig farming.[80] Alternative manure management techniques are available. Techniques such as solid-liquid separation, scrape and vacuum collection of manure, composting, and pasture-based practices are all viable methods of manure management that would avoid the methane emissions caused by open-air lagoons of liquid manure. Preliminary findings from CARB's Dairy and Livestock Greenhouse Gas Emissions Working Group indicate that these methods of manure management may offer more cost-effective methane emissions reductions than anaerobic digestion and may deliver additional environmental and health benefits, such as reduced impact on water quality.[81] Avoiding manure generation and reducing the amount of manure that has to be managed is the best way to protect human and animal health, along with the environment (see Figure 3 in Appendix C on Waste Management Hierarchy).[82] But the LCFS program does the opposite of promoting dairy manure avoidance or even lower-emissions manure management practices. Instead, the LCFS program has created a new revenue stream for factory farms based on the manure itself – the source of the methane the program seeks to reduce – incentivizing the production and liquification of manure as though it were a cash crop.

Additionally, "even RNG from waste methane can have negative climate impacts relative to the most likely alternative of flaring, not venting, the methane."[83] Flaring, like other forms of combustion, converts methane to carbon dioxide, reducing the net emissions impact. Flaring is a ubiquitous, low cost means of reducing methane. Though flaring is not a sustainable means to

[78] CAL. AIR RES. BD., *Tier 1 Simplified CI Calculator Instruction Manual: Biomethane from Anaerobic Digestion of Dairy and Swine Manure* 1, 8–9, 13–14 (Aug. 13, 2018), https://ww2.arb.ca.gov/sites/default/files/classic//fuels/lcfs/ca-greet/tier1-dsm-im.pdf?_ga=2.153600376.1744114239.1608082460-1114251839.1598731081.

[79] CAL. CODE REGS. TIT. 17 § 95488.9(f).

[80] *Animal Agriculture in the U.S. – Trends in Production and Manure Management*, LIVESTOCK AND POULTRY ENV'T LEARNING CMTY. (Mar. 5, 2019), https://lpelc.org/animal-agriculture-in-the-u-s-trends-in-production-and-manure-management/.

[81] CAL. AIR RES. BD., *Findings and Recommendations: Subgroup 1: Fostering Markets for Non-digester Projects, Senate Bill 1383 Dairy and Livestock Working Group* 3 (Oct. 12, 2018), https://ww2.arb.ca.gov/sites/default/files/2020-11/dsg1_final_recommendations_11-26-18.pdf.

[82] A reduction of waste is the preferred management method in the Environmental Protection Agency's waste management hierarchy for decision-making. *Waste Management Hierarchy and Homeland Security Incidents,* ENV'T PROT. AGENCY, https://www.epa.gov/homeland-security-waste/waste-management-hierarchy-and-homeland-security-incidents (last visited Oct. 12, 2021).

[83] Emily Grubert, *At Scale, Renewable Natural Gas Systems Could be Climate Intensive: The Influence of Methane Feedstock and Leakage Rates*, 15 084041 ENV'T RES. LETTERS Aug. 2020, 2.

reduce emissions, it should be the baseline to which any emissions reductions associated with anaerobic digestion are compared.

Moreover, because factory farm gas can be sold as a fuel and used to generate significant supplemental revenue from LCFS credits, over time "it is not only possible but expected…to increase methane production beyond what would have happened anyway."[84] Any manure production that has been incentivized by LCFS credit revenue will also result in intentionally created methane, which according to one recent study, *is always GHG-positive*.[85]

Finally, the Agro-Ecological Zone Emissions Factor (AEZ-EF) used to measure emissions from land-use change by CA-GREET3.0, and therefore by Tier 2 applicants, fails to account for the full impacts from the industrial dairy and pig facilities producing factory farm gas.[86] CARB's Executive Officer may require fuel producers to include six specific "feedstock/finished biofuel combinations," in their calculations.[87] These feedstocks include corn, sugarcane, sorghum grain ethanol, soy, canola, and palm biomass-based diesel.[88] Apart from land-use change related to livestock grazing (which is rarely relevant to industrial livestock operations), the AEZ-EF model does not address the land-use change associated with industrial dairy farming which are required for the production of factory farm gas.[89]

The overly narrow life cycle analysis in the factory farm gas pathways not only undermines the program's capacity to incentivize reductions, but violates AB 32's mandate that "[T]he state board shall rely upon the best available economic and scientific information and its assessment of existing and projected technological capabilities when adopting the regulations required by this section."[90] Scientific literature provides a more complete account of greenhouse gases emitted during the life cycle of factory farm gas produced from dairy and pig facilities. These analyses incorporate emissions from feed production, enteric fermentation, farm management and operations, and the treatment, use, or disposal of digestate residues produced during anaerobic digestion in addition to manure management emissions.[91] Omitting these essential stages from the LCFS factory farm gas pathways neglects a significant portion of emissions involved in producing

[84] *Id.* at 5.
[85] *Id*. at 4.
[86] CAL. CODE REGS. TIT. 17 § 95488.3.
[87] CAL. CODE REGS. TIT. 17 § 95488.3(d).
[88] *Id*.
[89] Richard J. Pelvin et al., *Agro-ecological Zone Emission Factor (AEZ-F Model): A model of greenhouse gas emissions from land-use change for use with AEZ-based economic models* 3, 31 (Feb. 21, 2014), https://ww2.arb.ca.gov/sites/default/files/classic//fuels/lcfs/lcfs_meetings/aezef-report.pdf.
[90] CAL. HEALTH & SAFETY CODE § 38562 (e). In Resolution 19-27, CARB itself stated that the LCFS "was developed using the best available economic and scientific information and will achieve the maximum technologically feasible and cost-effective reductions in GHG emissions from transportation fuel used in California." CAL. AIR RES. BD., RES. 19-27, *supra* note 55.
[91] *See, e.g.,* E. M. Esteves et al., *Life cycle assessment of manure biogas production: A review,* 218 J. CLEAN PROD. 411–423 (2019), https://doi.org/10.1016/j.jclepro.2019.02.091; E. Cherubini et al., *Life cycle assessment of swine production in Brazil: a comparison of four manure management systems*, 87 J. CLEAN PROD. 68–77 (2015), https://doi.org/10.1016/j.jclepro.2014.10.035; V. Paolini et al., *Environmental impact of biogas: A short review of current knowledge*, 53, J. ENV'T SCI. HEALTH A 899–906 (2018), https://doi.org/10.1080/10934529.2018.1459076.

manure and, as a result, the pathway treats manure as if it is produced from thin air or as if lagoons of liquid manure occur naturally in the San Joaquin Valley. [92]

The LCFS regulation mandates a full accounting of the aggregate life cycle emissions from a given fuel. In CARB Resolution 19-27, the agency reiterated that the "[d]etermination of a fuel's energy demand and carbon intensity value is based on a "well-to-wheel" analysis, which includes production and processing, distribution, and vehicle operation.[93] And yet the factory farm gas pathways leave glaring gaps in the life cycle analysis beyond the narrow system boundaries. The premise that manure originates in manure lagoons ready for capture with no attendant emissions defies logic, yet CARB has embraced this to create an absurdly low carbon intensity value and inflated credit generating industry.

### 2. The fuel pathways for biomethane from dairy and swine manure fail to ensure that credited emissions reductions are additional to reductions that would have otherwise occurred.

The LCFS prohibits awarding credits for emissions reductions that are already required by law.[94] As a market-based compliance mechanism, however, the LCFS must also prohibit the award of credits for "any other greenhouse gas emission reduction that otherwise would occur."[95] While CARB promulgated the LCFS as an early action measure, CARB designed and implemented the LCFS as a market-based compliance mechanism. CARB itself described the LCFS as a market-based mechanism when promulgating amendments to the LCFS:

> The LCFS is a market-based approach designed to reduce the carbon intensity of transportation fuels by 10 percent by 2020, from a 2010 baseline. It is important to note that the Cap-and-Trade Program and the LCFS program have complementary, but not identical programmatic goals: Cap-and-Trade is designed to reduce greenhouse gasses from multiple sources by setting a firm limit on GHGs; the LCFS is designed to reduce the carbon intensity of transportation fuels. As a market-based, fuel-neutral program, the LCFS provides regulated parties with flexibility to achieve the most cost-effective approach for reducing transportation fuels' carbon intensity. . . .

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[92] A Naranjo et al., *Greenhouse Gas, Water, and Land Footprint Per Unit of Production of the California Dairy Industry Over 50 Years*, 103 J. DAIRY SCI. 3760–3773 (2020), https://www.journalofdairyscience.org/article/S0022-0302(20)30074-6/pdf; C. Alan Rotz et. al., *The Carbon Footprint of Dairy Production Systems Through Partial Life Cycle Assessment*, 93 J. DAIRY SCI. 1266–1282 (2010), https://doi.org/10.3168/jds.2009-2162; C. Alan Rotz, *Modeling Greenhouse Gas Emissions from Dairy Farms*, 101 J. DAIRY SCI. 6675–6690 (2018) https://www.sciencedirect.com/science/article/pii/S002203021731069X.

[93] CAL. AIR RES. BD., RES. 19-27, *supra* note 55; *see also* CAL. AIR RES. BD., *Appendix D: Draft Environmental Analysis* (Jan. 2, 2015), https://ww2.arb.ca.gov/sites/default/files/classic/regact/2015/lcfs2015/lcfs15appd.pdf.

[94] *See* CAL. CODE REGS. TIT. 17 § 95488.9(f)(1)(B) ("A fuel pathway that utilizes biomethane from dairy cattle or swine manure digestion may be certified with a CI that reflects the reduction of greenhouse gas emissions achieved by the voluntary capture of methane, provided that… the baseline quantity of avoided methane reflected in the CI calculation is additional to any legal requirement for the capture and destruction of biomethane.")

[95] CAL. HEALTH & SAFETY CODE § 38562(d)(2).

> ARB staff disagrees that the LCFS is fundamentally a command-and-control system. The LCFS is a fuel-neutral, market-based program that does not give preference to specific transportation fuels and instead bases compliance on a system of credits and deficits based on each fuel's carbon intensity. Carbon intensity (CI) is a measure of the GHG emissions associated with the various production, distribution, and consumption steps in the "life cycle" of a transportation fuel. It is difficult to respond with depth to this assertion because the commenter provides no specifics to support the claim that the LCFS is not market-based. Notably, the commenter does not describe what components of the program could be considered command-and-control.[96]

Additionally, CARB's descriptions of the LCFS program closely parallel the statute's definition of "market-based compliance mechanism." The defintion states in relevant part that a market-based compliance mechanism is: "A system of market-based declining annual aggregate emissions limitations for sources or categories of sources that emit greenhouse gases."[97] CARB explains that the LCFS has a "market for credit transactions," where "entities with credits to sell can opt to pledge credits into the market and entities needing credits must purchase their pro-rata share of these pledged credits."[98] CARB explains that credits are generated relative "to a declining CI benchmark for each year."[99] The LCFS exhibits many if not most of the features of a market-based compliance mechanism, including a Cap-and-Trade allowance-like system with yearly declinations,[100] transaction rules,[101] recordkeeping and auditing requirements,[102] an account system to manage credit transfers – the LCFS Reporting Tool and Credit Bank & Transfer System (LRT-CBTS),[103] and a portal that applicants must use to demonstrate compliance,[104] among others. In addition to CARB's interpretation, designation, and treatment of the program as a market-based

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[96] CAL. AIR RES. BD., *Final Statement of Reasons for Rulemaking, Including Summary of Comments and Agency Response* 679-681 (2015), *available at* https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2015/lcfs2015/fsorlcfs.pdf. *See also* CAL. AIR RES. BD., *Responses to Comments on the Draft Environmental Analysis for the Amendments to the Low Carbon Fuel Standard and Alternative Diesel Fuel Regulations* at B4-42 (2018), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2018/lcfs18/rtcea.pdf (CARB responding, "Because the LCFS is a market-based mechanism…"); CAL. AIR RES. BD., *Staff Discussion paper: Renewable Natural Gas from Dairy and Livestock Manure 6* (April 13, 2017), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/lcfs_meetings/041717discussionpaper_livestock.pdf (in which CARB staff note in 2017 discussion paper that additionality requirements for the LCFS *are* intended to be identical to those of the compliance offset protocol, "ensure any crediting is for GHG reductions resulting from actions not required by law or beyond business as usual").

[97] CAL. HEALTH & SAFETY CODE § 38505(k). Note that this is one of two definitions provided.

[98] CAL. AIR RES. BD., *LCFS Basics* (2019), *available at* https://ww2.arb.ca.gov/sites/default/files/2020-09/basics-notes.pdf (last visited Oct. 12, 2021).

[99] *Low Carbon Fuel Standard: About*, CAL. AIR RES. BD., https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/about (last visited Oct. 12, 2021).

[100] *See* CAL. CODE REGS. TIT. 17 §§ 95482 – 95486.

[101] *See* CAL. CODE REGS. TIT. 17 § 95491.

[102] *See* CAL. CODE REGS. TIT. 17 § 95491.1.

[103] CAL. CODE REGS. TIT. 17 § 95483.2(b). ("The LRT-CBTS is designed to support fuel transaction reporting, compliance demonstration, credit generation, banking, and transfers.").

[104] *See* CAL. AIR RES. BOARD, *Low Carbon Fuel Standard – Annual Reporting and Verification User Guide* 3-4 (Aug. 9, 2021), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/guidance/Reporting_and_Verification_User_Guide.pdf.

mechanism and the overall structure of the regulation evincing the same, the designation of California's LCFS as a market-based mechanism is ubiquitous in academic and technical literature.[105]

Because the LCFS is a market-based compliance mechanism, section 38562(d)(2) of the Health & Safety Code requires that CARB ensure greenhouse gas emissions reductions in the LCFS are "in addition to any greenhouse gas emission reduction otherwise required by law or regulation, and any other greenhouse gas emission reduction that otherwise would occur."[106] Additionality requirements are essential for market-based programs that operate with a declining emissions benchmark, like the LCFS. Because regulated parties are permitted to emit above the benchmark so long as they offset these emissions with the purchase of credits, the LCFS must ensure that credits reflect reductions that are additional to claim a net reduction. The additionality requirement enumerated in the LCFS currently is far too narrow. It requires only that reductions are "additional to any legal requirement for the capture and destruction of biomethane."[107] This weak language incorporates only one of the two prongs required by AB 32 and does not ensure that reductions are additional to those from other LCFS incentives. CARB should grant this petition and amend the LCFS to include the broader additionality requirement.

As implemented to date, the LCFS program allows generation, sale, and use of factory farm gas credits that are plainly not additional when the methane reductions attributed to these LCFS credits result from, and are attibuted to, other programs and revenue sources. The LCFS 1) allows the same emissions reductions to be counted and credited by multiple emission reductions programs; and 2) awards credits to facilities receiving public funding for anaerobic digesters and related infrastructure, even when that funding is contingent on the construction of this equipment.

Numerous state and federal funding opportunities, incentives, and other subsidies are available for anaerobic digestors at factory farms. The Aliso Canyon Mitigation Agreement that CARB negotiated with Southern California Gas Company (SoCalGas) legally requires SoCalGas to pay for methane reductions at factory farm dairies in California.[108] The parties intended the agreement to mitigate the harms from the most damaging man-made greenhouse gas leak in United States history – SoCalGas' ruptured well that released at least 109,000 metric tons of methane before it was sealed.[109] SoCalGas funds the construction of digesters, which are intended to mitigate the leaked methane, and receives "mitigation credits" for the associated emissions reductions. The conditions of the agreement legally require changes intended to reduce emissions

[105] *See, e.g.,* CENTER FOR CLIMATE AND ENERGY SOLUTIONS, *Policy Considerations for Emerging Carbon Programs* 2 (June 2016), https://www.c2es.org/wp-content/uploads/2016/06/emerging-carbon-programs.pdf (describing Low Carbon Fuel Standards as an example of a market-based policy option, specifically of a baseline-and-credit program); *Regional Activities*, NATIONAL LOW CARBON FUEL STANDARD PROJECT, https://nationallcfsproject.ucdavis.edu/regional-activities/ (stating California's "LCFS is a market-based mechanism") (last visited Oct. 12, 2021).
[106] CAL. HEALTH & SAFETY CODE § 38562(d)(2).
[107] CAL. CODE REGS. TIT. 17 § 95488.9(f)(1).
[108] *People v. Southern California Gas Company,* Case Nos. BC602973 & BC628120, Appendix A to Consent Decree, Mitigation Agreement, *available at* https://www.arb.ca.gov/html/aliso-canyon/aliso-canyon-mitigation-agreement.pdf?_ga=2.146452402.708596706.1633463951-1172357510.1559256345.
[109] CAL. AIR RES. BD., *Responses to Frequently Asked Questions: Aliso Canyon Litigation Mitigation Settlement*, https://ww3.arb.ca.gov/html/aliso-canyon/aliso-canyon-faqs.pdf?_ga=2.67705041.1139070712.1533833674-1489205872.1532954259.

and yet at least eight facilities that receive this funding have also applied for LCFS credits for biomethane production. California Bioenergy sought LCFS credits for the S&S, Moonlight, Hamstra, Trilogy, Maple, T&W, BV Dairy, and Western Sky dairies.[110] These eight dairies are among seventeen that participate in the Aliso Canyon Mitigation Agreement.[111] Under no circumstances should mitigation for the Aliso Canyon disaster simultaneously qualify for credits generated and used in the LCFS.

Furthermore, the Legislature has appropriated public funds from the Greenhouse Gas Reduction Fund (GGRF) for several years to secure climate benefits. The California DDRDP, funded through the GGRF, provides funding for factory farm gas infrastructure. The California Department of Food and Agriculture describes the DDRDP as "financial assistance for the installation of dairy digesters in California, which will result in reduced greenhouse gas emissions."[112] Since 2015, the DDRDP has funded 117 dairy projects through the DDRDP, for a total of $195,025,884, and for which the CDFA claims 21,023,793 MTCO2e of methane reductions.[113] CARB also claims these reductions in a report to the Legislature on the climate benefits from these grants.[114] At least eight of these dairy projects, and likely many more, have received DDRDP grants and sought LCFS credits. For instance, California Bioenergy sought LCFS credits for the S&S, Moonlight, Hamstra, Trilogy, Maple, T&W, BV Dairy, and Western Sky dairies, all of which received DDRDP grants.[115] Importantly, the DDRDP purports to limit how grant monies may be used, but it does not prohibit a project from generating LCFS credits.[116]

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[110] *See* CAL. AIR RES. BD., Low Carbon Fuel Standard Tier 2 Pathway Application B0185, *available at* https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0185_cover.pdf; CAL. AIR RES. BD., Low Carbon Fuel Standard Tier 2 Pathway Application B0198, *available at* https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0198_cover.pdf.

[111] CAL. AIR RES. BD., *Aliso Canyon Natural Gas Leak, List of dairies involved in the mitigation agreement*, https://www.arb.ca.gov/html/aliso-canyon/aliso-canyon-mitigation-project-dairy-sites.pdf?_ga=2.216890962.535652136.1632321175-1949797088.1632171356.

[112] *Dairy Digester Research & Development Program*, CAL. DEPT. OF FOOD & AG., https://www.cdfa.ca.gov/oefi/ddrdp/ (last visited Oct. 19, 2021).

[113] CAL. DEPT. OF FOOD & AG., *CDFA Dairy Digester Research and Development Program Flyer (Sept. 2021)*, *available at* https://www.cdfa.ca.gov/oefi/ddrdp/docs/DDRDP_flyer_2021.pdf. (A list of all project recipients can be found at CAL. DEPT. OF FOOD & AG., *Dairy Digester Research and Development Program Project-Level Data (Sept. 17, 2021),* https://www.cdfa.ca.gov/oefi/DDRDP/docs/DDRDP_Project_Level_Data.pdf.)

[114] CAL. CLIMATE INVESTMENTS, *2021 California Climate Investments Annual Report*, Table 2 (2021), *available at* http://ww2.arb.ca.gov/sites/default/files/cap-and-trade/auctionproceeds/2021_cci_annual_report.pdf.

[115] *See* CAL. AIR RES. BD., Low Carbon Fuel Standard Tier 2 Pathway Application B0185 *available at* https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0185_cover.pdf; CAL. AIR RES. BD., Low Carbon Fuel Standard Tier 2 Pathway Application B0198, *available at* https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0198_cover.pdf.

[116] *See 2020 DDRDP Request for Grant Applications,* CAL. DEPT. OF FOOD & AG., https://www.cdfa.ca.gov/oefi/DDRDP/docs/2020_DDRDP_RGA_Public_Comments.pdf (last visited Oct. 5, 2021) ("Once a project has been awarded funds, the project may not: • Change or alter their biogas end-use during the project term. • Change the herd size beyond the limits established by the existing dairy operation's permits during the project term. • Change ownership of the dairy and/or partnership entities… • Duplicate equipment or activities that will receive funding from the California Public Utilities Commission (CPUC) pilot project authorized by California Health and Safety Code Section 39730.7(d)(2) (e.g., interconnection costs). *Note: Biogas conditioning and clean-up costs are allowable under the DDRDP.* • Commercial dairy operations that have already accepted, or plan to accept a grant award by CDFA's Alternative Manure Management Program (AMMP).") (emphasis added). Note that by allowing DDRDP funds to cover upgrade costs and other costs that the CPUC incentives program cannot, the CDFA has ensured that factory farm gas projects can benefit from multiple funding sources.

Other public funds authorized by the Legislature subsidize factory farm gas projects seeking to interconnect with utility natural gas pipelines.[117] This additional source of funds quickly became oversubscribed, prompting the California Public Utilities Commission to double the size of the program, all paid for with proceeds from sales of Cap-and-Trade allowances.[118] The California Public Utilities Commission went a step further, proposing in 2017 that participants in the SB1383 dairy biomethane Pilot Program could avoid the costs associated with gas production equipment, specifically gathering lines and "treatment equipment."[119] In what would be a major break with California energy precedent, ratepayers got to foot the bill.[120]

Projects receiving public funds should not, under the principles of additionality, also generate LCFS credits that allow emissions elsewhere; in this situation public funds essentially allow a transportation fuel deficit holder to emit more greenhouse gases and allow the factory farm gas project to generate a financial windfall. Under no circumstances did the Legislature intend for this perverse result to occur.

This is not a hypothetical concern: CARB recently proposed approval of Tier 2 Pathway applications B0185 and B0198 for eight dairy digester projects that have received both Dairy

[117] *See* CAL. PUB. UTILITIES COMM'N, Decision Adopting the Standard Renewable Gas Interconnection and Operating Agreement, R.13-02-008 COM/CR6/jnf at 12 (Dec. 17, 2020), *available at* https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M356/K244/356244030.PDF ("D.15-06-029 created a $40 million monetary incentive program "to encourage potential biomethane producers to build and operate biomethane projects within California that interconnect with the utilities" in accordance with AB 1900 (Gatto, 2012). This monetary incentive program was subsequently codified by AB 2313 (Williams, 2016)…The $40 million approved by the CPUC for the monetary incentive program is currently fully subscribed and there is a wait list for an additional $38.5 million worth of project funding.").

[118] *See Id.* at 14 ("After weighing the benefit of increased biomethane capture and use against the modest reduction in the California Climate Credit necessary to fully fund all existing biomethane projects, including those on the waitlist, we find it appropriate to provide an additional $40 million in funding from Cap-and-Trade allowance proceeds for the monetary incentive program to fund the biomethane projects that are currently on the wait list, bringing total funding to $80 million.").

[119] Decision establishing the implementation and selection framework to implement the dairy biomethane pilots required by Senate Bill 1383 at 7-8 (Dec. 18, 2017), *available at* https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M201/K352/201352373.PDF (". . . [T]he biomethane producers should own and operate the digesters and the biogas collection lines and treatment equipment to remove hydrogen sulfide and water from the raw biogas. Although we do not allow utilities to own these facilities, the costs associated with the biogas collection lines and treatment equipment will be recovered from the transmission rates of utility ratepayers through a reimbursement to the dairy biomethane producer. Natural gas utilities will own and operate all facilities downstream of the biogas conditioning and upgrading facilities, including pipeline laterals from such facilities, to the point of receipt and any pipeline extensions.").

[120] *Id.* ("Historically the costs of gathering, gas conversion to pipeline quality specifications, transportation from a gas production site to a conversion facility, transportation from the conversion facility to the pipeline, and pipeline interconnection costs have been borne by California natural gas producers as part of the commodity cost of gas since the late 1980s, as 'gathering costs' that the CPUC has ruled should be assigned to gas producers . . . . For the purposes of the Dairy Pilots, and consistent with the language of SB 1383, we are allowing cost recovery of the biogas collection lines owned by dairy biomethane producers, and allowing utilities to own and operate pipelines that carry biomethane from biogas conditioning and upgrading facilities to existing utility transmission systems and the interconnection facilities, without changing the requirements of D.89-12-016 for non-renewable natural gas producers . . . .").

Digester Research Development Program (DDRDP) and Aliso Canyon settlement funds.[121] Both programs claim credit for the methane reductions associated with the digester projects. If the LCFS system grants credits for these same reductions and allows a deficit holder to use those credits to demonstrate compliance with the LCFS, the reductions will be without question not additional. This absurd result allows excessive emissions and CARB must grant this petition to ensure LCFS program integrity.[122]

A wide range of other state and federal financial assistance is available to factory farms to support the construction and implementation of factory farm gas systems. This public financing comes in the form of grants, "production incentive payments, low-interest financing, tax exemptions and incentives, and permitting assistance."[123] The California Energy Commission provides funding for factory farm gas development through its Natural Gas Research and Development program.[124] The program provides $100 million annually to various fuel transportation projects, including factory farm gas.[125] The Environmental Quality Incentives Program (EQIP) is a federal program that provides matching funds for agricultural operations to contract with Natural Resources Conservation Service to develop technology or infrastructure with environmental benefits, including the construction of anaerobic digestion infrastructure.[126] The Rural Energy for America Program also provides federal funds to develop factory farm gas systems. *See* 7 U.S.C. § 8107.

The LCFS is demonstrably and avowedly a market-based compliance mechanism and is thus properly subject to the requirements of section 38562(d)(2). As the forgoing demonstrates,

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[121] These dairy digester projects also may participate in the California Public Utilities Commission pilot projects, as California Bioenergy projects, which would confer additional public funds. *See* CAL. PUB. UTILITIES COMM'N, Press Release: CPUC, CARB, and Department of Food and Agriculture Select Dairy Biomethane Proejcts to Demonstrate Connection to Gas Pipelines (December 3, 2018), *available at* https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M246/K748/246748640.PDF.

[122] This has caused confusion in Tier 2 application comments. For example, in comments on several applications, the Chair of the Board for the Kings County Board of Supervisors commented to ask how these applicants could participate in the LCFS without double counting reductions, given that they also participated in bioMAT. CARB did not respond to the comments. *See* CAL. AIR RES. BD., Comment Log Display, Doug Verboon, Comment 61 for Public Comments for LCFS Pathway Applications (tier2lcfspathways-ws) - 2nd Workshop (Nov. 25, 2020), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0106_verboon_comments.pdf (commenting on Tier 2 Application B0106); CAL. AIR RES. BD., Comment Log Display, Doug Verboon, Comment 60 for Public Comments for LCFS Pathway Applications (tier2lcfspathways-ws) - 2nd Workshop (Nov. 25, 2020), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0105_verboon_comments.pdf (commenting on Tier 2 Application B0105); CAL. AIR RES. BD., Comment Log Display, Doug Verboon, Comment 59 for Public Comments for LCFS Pathway Applications (tier2lcfspathways-ws) - 2nd Workshop (Nov. 25, 2020), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b104_verboon_comments.pdf (commenting on Tier 2 Application B0104).

[123] CAL. DAIRY CAMPAIGN, *Economic Feasibility of Dairy Digester Clusters in California: A Case Study* 45, (June 2013) https://archive.epa.gov/region9/organics/web/pdf/cba-session2-econ-feas-dairy-digester-clusters.pdf.

[124] *Natural Gas Research and Development Program*, CAL. ENERGY. COMM'N., https://www.energy.ca.gov/sites/default/files/2019-05/naturalgas_faq.pdf (last visited Oct. 18, 2021).

[125] *Clean Transportation Program*, CAL. ENERGY. COMM'N., https://www.energy.ca.gov/programs-and-topics/programs/clean-transportation-program (last visited Oct. 18, 2021).

[126] Environmental Quality Incentives Program, NAT'L RES. CONS. SERVICE, https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/.

private and public funding either have been or could be used to reduce methane emissions from pig and dairy facilities.[127] The LCFS should not allow fuel producers to generate credits from such non-additional reductions that deficit holders then use to justify their excess emissions, undermining the integrity of the LCFS program.

### 3. CARB's crediting of non-additional reductions and the inflated credit value from CARB's failure to account for the full quantity of life-cycle emissions both incentivize increased manure generation and manure liquification and constitute a failure to achieve the maximum technologically feasible and cost-effective greenhouse gas emissions.

Including inflated credits and credits for non-additional reductions contravenes the fundamental purpose of the LCFS: to reduce greenhouse gas emissions associated with transportation fuels. Inflated credits and credits for non-additional reductions have the effect of increasing manure generation and liquification, and its associated greenhouse gas emissions. Additionally, by purchasing inflated credits, deficit generators can more easily meet their compliance obligations without reducing their emissions. As a result of these deficiencies, the LCFS fails to achieve the maximum technologically feasible and cost-effective emissions reductions.

The factory farm gas industry is currently made profitable by the LCFS and similar programs. In fact, "[w]ell over 50% of the revenue from most projects generating credits comes from the [LCFS and Federal RIN] credits."[128] A recent report by a private investment firm on the promising growth prospects for factory farm gas concluded that "operators are not in the business of producing RNG, they are in the business of monetizing RNG's environmental attributes through various federal and state programs."[129] This is by design: the goal of the LCFS factory farm gas pathways is to incentivize the development of factory farm gas as an alternative fuel. This goal assumes incentivizing development of factory farm gas will result in a net decrease in manure methane emissions. But this assumption – the result of the deficient life cycle analysis and inclusion of non-additional reductions – is mistaken.

Increased profitability and growth of the factory farm gas industry does not necessarily entail a reduction in manure methane emissions from participating factory farms. Due to the poor design of the LCFS pathways for factory farm gas, the program encourages not only capture of manure methane, as intended, but increased production of that methane. Revenue from LCFS credits is an increasingly enticing source of potential profit for many factory farms. In the case of

[127] For this reason, LCFS credits also should not be issued to facilities that already operate digesters to produce low-CI electricity but seek to convert to producing biomethane, as no truly additional emissions reductions occur upon switching fuel production pathways.

[128] Annie AcMoody & Paul Sousa, *Western United Dairies, Interest in California Dairy Manure Methane Digesters Follows the Money*, CoBANK, at 4, (Aug. 2020), https://www.cobank.com/documents/7714906/7715329/Interest-in-California-Dairy-Manure-Methane-Digesters-Follows-the-Money-Aug2020.pdf/be11d7d6-80df-7a7e-0cbd-9f4ebe730b25?t=1603745079998.

[129] STIFEL EQUITY RESEARCH, *Energy & Power – Biofuels: Renewable Natural Gas, A Game-Change in the Race for Net-Zero* (March 8, 2021), *available at* https://static1.squarespace.com/static/53a09c47e4b050b5ad5bf4f5/t/60ad5a8802a04b71ca252414/1621973643907/Stifel+RNG+Analysis.pdf.

industrial dairy operations, these inflated credits provide certainty for operators seeking to maintain or expand herd sizes by providing significant additional income to supplement volatile milk revenue.[130] In 2017, CARB itself "assume[d] that California's LCFS credits [would] contribute revenue of $865,000" (assuming $100 per metric ton of $CO_2$).[131] The average LCFS credit price has increased significantly since this estimate was made, with 2020 prices hovering around $200 per metric ton of $CO_2$ (see Figure 5 in Appendix C). As a result, LCFS credits can be a more reliable income stream than milk. The LCFS not only encourages the development of factory farm gas systems but entrenches the underlying factory farms and even incentives expansion of these operations – the very sources of manure methane the factory farm gas credits are intended to reduce.

LCFS credits derive their value from recipients' ability to sell these credits to LCFS participants that generate deficits. Deficit-generating facilities include producers of conventional, high carbon intensity fuels such as gasoline and diesel fuels. This means that the life cycle analysis deficiencies and granting of credits for non-additional reductions not only incentivize increased emissions from factory farms, but also function to allow emissions in other transportation fuel industries.

Additionally, because economies of scale for anaerobic digesters favor larger herd sizes, factory farm gas producers have an incentive to produce more liquid manure, by either increasing herd size or participating in a digester cluster. This is the case for factory farm gas from both cows and pigs. In California, where most digesters use manure from lagoons to produce gas for pipeline transport, the technology requires a minimum of 2,000 cows to be economically feasible.[132] Scale is central to making the technology investment profitable, and "each additional 1,000 cows reduce the cost per cow of digester projects by 15-20%."[133] EPA AgSTAR admits that most methane digesters "are not economically viable until greater than 10,000 hogs are incorporated."[134]

The programmatic distortions described in parts III(A)(1) and (2) will drive the expansion of factory farms to supply factory farm gas, intentionally creating greenhouse gas emissions and localized pollution. CARB should rescind the factory farm gas pathways and preclude factory farm

[130] The milk price that dairy farmers receive has fluctuated considerably over the past two decades while costs have remained relatively constant. In 2015 and 2016, dairies experienced negative average residuals (see Table 2 in Appendix C). In 2017, annual milk revenue from "a farm with 2,000 cows producing 230 hundredweight per cow per year (the average in the San Joaquin Valley)" totaled nearly $7.6 million based on the milk price of $16.50 per hundredweight. After factoring in 2017 cost estimates by the California Department of Food and Agriculture (CDFA), the "net revenue at the typical dairy in the southern San Joaquin Valley amounted to zero." *See* Justin Ellerby, CAL. CENTER FOR COOP. DEV., *Challenges and Opportunities for California's Dairy Economy* 5 (2010); William Matthews and Daniel Sumner, *Contributions of the California Dairy Industry to the California Economy in 2018*, UNIV. OF CAL. AGRIC. ISSUES CENTER 17-18 (2019), https://aic.ucdavis.edu/wp-content/uploads/2019/07/CMAB-Economic-Impact-Report_final.pdf; Hyunok Lee. & Daniel A. Sumner, *Dependence on policy revenue poses risks for investments in dairy digester,* 72 CAL. AG. 226-235, 231 (2018), https://doi.org/10.3733/ca.2018a0037.

[131] Hyunok Lee & Daniel A. Sumner, *supra* note 130 at 232.

[132] GLOBAL DATA POINT, *California Incentives Spur Dairy Manure Methane Digester Developments*, GALE: BUSINESS INSIGHTS (Doc. No. A631672444) (Aug. 6, 2020).

[133] *Id*.

[134] ENV'T PROT. AGENCY, *AgSTAR, Project Development Handbook: A Handbook for Developing Anaerobic Digestion/Biogas Systems on Farms in the United States* 7-2, n. 58, https://www.epa.gov/sites/default/files/2014-12/documents/agstar-handbook.pdf (3rd Ed.).

gas from the LCFS program. In the alternative, CARB must amend the regulation to ensure that the carbon intensity values account for the full life cycle of dairy and pig facility emissions, including production and pre-processing of manure feedstock and downstream emissions associated with digestate land application and composting, and prohibit credits from non-additional reductions.

### B. The fuel pathways for biomethane from dairy and swine manure fail to maximize additional environmental benefits and interfere with efforts to improve air quality.

The California Legislature directed CARB to design regulations in a manner that considers overall societal benefits, including other benefits to the environment and public health, and ensure that activities taken pursuant to the regulations do not interfere with the state's efforts to improve air quality.[135] The Legislature also declared, in enacting AB 32, that it intended that CARB design reduction measures in a manner that "maximizes additional environmental and economic cobenefits for California, and complements the state's efforts to improve air quality."[136] But so long as the LCFS program includes factory farm gas and incentivizes factory farm expansions and the resulting air pollution, it cannot maximize environmental benefits or improve air quality. Moreover, given these impacts, CARB has not adequately considered overall societal costs in the regulation's design.

Monetizing a waste stream, like manure, does not eliminate that waste. The material impacts of manure (and later digestate) remain, whether or not it generates revenue for confined animal feeding operations. Nearby communities must still contend with the harms from the production, transportation, storage, and processing of this waste. If anything, monetizing a waste stream like manure exacerbates these harms by disincentivizing waste reduction. Incentivizing larger herd sizes and the liquification of more manure exacerbates existing pollution to air, water, and land, and the associated public health harms from industrial dairy and pig facilities, in addition to increased greenhouse gas emissions.[137] Additionally, factory farm gas technology creates new and additional environmental and public health harms, including through the storage, composting, and land application of digestate.

The 3.9 million residents of the San Joaquin Valley face increased health risks from breathing polluted air.[138] Industrial dairy operations emit the ammonia that contributes to the some

[135] CAL. HEALTH & SAFETY CODE § 38562(b)(4) ("Ensure that activities undertaken pursuant to the regulations complement, and do not interfere with, efforts to achieve and maintain federal and state ambient air quality standards and to reduce toxic air contaminant emissions."); CAL. HEALTH & SAFETY CODE § 38562(b)*(*6) ("Consider overall societal benefits, including reductions in other air pollutants, diversification of energy sources, and other benefits to the economy, environment, and public health."). *See also* CAL. HEALTH & SAFETY CODE § 38562.5 (making section 38562(b) applicable to regulations adopted to achieve reductions beyond the statewide greenhouse gas emissions limit).

[136] CAL. HEALTH & SAFETY CODE § 38501.

[137] *EPA Activities for Cleaner Air - San Joaquin Valley,* U.S. ENV'T PROT. AGENCY, https://www.epa.gov/sanjoaquinvalley/epa-activities-cleaner-air (last updated Mar. 6, 2019).

[138] Rory Carroll, *Life in San Joaquin valley, the place with the worst air pollution in America*, THE GUARDIAN (May 13, 2016), https://www.theguardian.com/us-news/2016/may/13/california-san-joaquin-valley-porterville-pollution-poverty.

of the worst long-term and short-term $PM_{2.5}$ pollution in the United States, which causes health problems such as asthma and has been linked to premature death as described *supra* in part II.[139] Industrial dairies are also the largest source of volatile organic compounds (VOCs), which contribute to the Valley's ozone (smog) air pollution crisis.[140] The digestate from factory farm gas production can emit even more hazardous VOCs during storage. An analysis of digestate from pig manure identified nearly 50 VOCs, 22 of which are labeled hazardous by the EPA.[141] Of these 22 hazardous VOCs, "8 were identified to be or likely to be carcinogenic, and 14 were identified to be harmful to other human organs or systems."[142]

Biogenic and anthropogenic emissions of VOCs and nitrogen oxides (NOx) both form ground-level ozone, the concentration of which is "directly affected by temperature, solar radiation, wind speed and other meteorological factors."[143] VOCs from corn silage at dairies alone would be the largest source in the Valley, with such emissions forming more ozone than the VOCs emitted by passenger vehicles.[144] Breathing in ground-level ozone can trigger a variety of dangerous health problems like throat irritation, chest pain, and congestion. It can also lead to severe lung damage, making infants and the elderly more vulnerable to health effects.[145] Ozone causes respiratory inflammation, increased hospital admissions for respiratory illness, decreased lung function, enhanced respiratory symptoms for people with asthma, increased school absenteeism, and premature mortality.[146] Evidence indicates that "adverse public health effects occur following exposure to elevated levels of ozone, particularly in children and adults with lung disease."[147] The San Joaquin Valley is classified as an extreme ozone nonattainment area for the 1997 and 2008 8-hour ozone standards.[148]

Industrial dairies are also the largest source of ammonia.[149] Factory farm gas production adds even more ammonia to San Joaquin Valley air: ammonia emissions from digestate increased 81% relative to raw manure.[150] Anaerobic digestion causes this increase in ammonia emissions, "due to an increased concentration of ammoniacal nitrogen."[151] In addition to its unpleasant odor,

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[139] *Id*.
[140] *See* SAN JOAQUIN VALLEY AIR POLLUTION CONTROL DIST., *2016 Plan for the 2008 8-Hour Ozone Standard, Appendix B*, *available at* http://valleyair.org/Air_Quality_Plans/Ozone-Plan-2016/b.pdf.
[141] Yu Zhang et al., *Characterization of Volatile Organic Compound (VOC) Emissions from Swine Manure Biogas Digestate Storage*, 10 ATMOSPHERE 1, 7 (2019), https://doi.org/10.3390/atmos10070411.
[142] *Id.* at 8.
[143] 73 FED. REG. 16436, 16437 (March 27, 2008).
[144] *See* Cody J. Howard, et al., *Reactive Organic Gas Emissions from Livestock Feed Contribute Significantly to Ozone production in Central California*, 44 ENV'T SCI. TECHNOL. 7 2309–2314 (2010), https://pubs.acs.org/doi/abs/10.1021/es902864u.
[145] *Id*.
[146] 73 Fed. Reg. 16436, 16440 (March 27, 2008).
[147] 83 FED. REG. 61346, 61347 (November 29, 2018).
[148] 75 FED. REG. 24409 (May 5, 2010); 77 FED. REG. 30088, 30092 (May 21, 2012).
[149] SAN JOAQUIN VALLEY AIR CONTROL DIST., 2018 Plan for the 1997, 2006, and 2012 PM2.5 Standards, Appendix B and Appendix G, *available at* http://valleyair.org/pmplans/documents/2018/pm-plan-adopted/B.pdf and http://valleyair.org/pmplans/documents/2018/pm-plan-adopted/G.pdf.
150 *See* Holly, et al., *Greenhouse gas and ammonia emissions from digested and separated dairy manure during storage and after land disposal*, AG., ECOSYSTEMS AND ENV'T 239 (2017) 410–419, https://www.researchgate.net/publication/313731233_Greenhouse_gas_and_ammonia_emissions_from_digested_and_separated_dairy_manure_during_storage_and_after_land_application.
[151] *Id.*

which degrades quality of life for nearby residents, ammonia "is corrosive and can be a powerful irritant to skin, eyes, and digestive and respiratory tissues."[152] Ammonia also reacts with oxides of nitrogen to form ammonium nitrate, the most significant component of the San Joaquin Valley's $PM_{2.5}$ pollution problem.[153] Homes located within a quarter mile of a dairy confined animal feeding operation have experienced higher concentrations of both ammonia and particulate matter.[154] In addition to the harms of PM2.5 describes above, larger particles of dust pollution from factory farm dairies also carry harmful allergens and endotoxins to nearby homes.[155] Endotoxins are a "powerful inflammatory agent" that can interact with other components and lead to respiratory issues, and allergens can worsen asthma symptoms.[156] A study in rural Washington found that higher exposure to pollution from confined animal feeding operations was associated with degraded lung function in children with asthma living nearby.[157]

Depending on the physical characteristics (temperature, pH, total solid content) and the speed and frequency of the mixing process used to treat it, digestate from factory farm gas production can release dangerous concentrations of hydrogen sulfide.[158] High hydrogen sulfide emission levels are associated with a total solid content of seven percent, "which is the most appropriate for pumping and mixing of dairy manure."[159] Increasing the speed and frequency of mixing while in storage can also contribute to higher hydrogen sulfide emissions from digestate.[160] These emissions can have severe impacts on human health, particularly farm workers, and can even lead to death.[161] Furthermore, hydrogen sulfide may be detected on fields where manure is sprayed for fertilizer, and the gaseous substance can be dispersed by the wind.[162] Hydrogen sulfide gas is a respiratory tract irritant and in higher concentrations or with longer exposure, it can cause a pulmonary edema.[163] The acute symptoms of hydrogen sulfide exposure include nausea, headaches, delirium, disturbed equilibrium, tremors, convulsions, and skin and eye irritation.[164]

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[152] D'Ann L. Williams et al., *Airborne cow allergen, ammonia and particulate matter at homes vary with distance to industrial scale dairy operations: an exposure assessment*, 10 ENV'T HEALTH 1, 3 (2011), https://doi.org/10.1186/1476-069X-10-72.
[153] SAN JOAQUIN VALLEY AIR CONTROL DIST., *2018 Plan for the 1997, 2006, and 2012 PM2.5 Standards*, Appendix B and Appendix G, *available at* http://valleyair.org/pmplans/documents/2018/pm-plan-adopted/B.pdf and http://valleyair.org/pmplans/documents/2018/pm-plan-adopted/G.pdf.
[154] D'Ann Williams et al., *Cow allergen (Bos d2) and endotoxin concentrations are higher in the settled dust of homes proximate to industrial-scale dairy operations*, 26 J. EXPOSURE SCI. ENV'T EPIDEMIOLOGY 42, 46 (2016) https://doi.org/10.1038/jes.2014.57.
[155] *Id.*
[156] *Id.* at 42.
[157] Christine Loftus et al., *Estimated time-varying exposures to air emissions from animal feeding operations and childhood asthm*a, 223 INT. J. OF HYGIENE AND ENV'T HEALTH 192 (2020) https://doi.org/10.1016/j.ijheh.2019.09.003.
[158] Fetra J. Andriamanohiarisoamanana et al., *Effects of handling parameters on hydrogen sulfide emission from stored dairy manure*, 154 J. ENV'T MGMT. 110, 112-115 (2011), https://doi.org/10.1016/j.jenvman.2015.02.003.
[159] *Id.* at 115.
[160] *Id.* at 114.
[161] *Id.* at 110.
[162] *See* Agency for Toxic Substances and Disease Registry, Toxicological Profile for Hydrogen Sulfide and Carbonyl Sulfide, DEP'T OF HEALTH AND HUMAN SERVICES 27-138 (2016), https://www.atsdr.cdc.gov/toxprofiles/tp114.pdf; *See also* Amy Schultz et al., *Residential proximity to concentrated animal feeding operations and allergic and respiratory disease*, 130 ENV'T INT. 104911, 1 (2019), https://doi.org/10.1016/j.envint.2019.104911.
[163] *See* Agency for Toxic Substances and Disease Registry, *supra* note 162 at 27-138.
[164] *Id.*

Finally, inhalation of high concentrations or long-term exposure to hydrogen sulfide can result in extremely rapid unconsciousness and eventual death.[165]

Factory farm dairies also pollute the San Joaquin Valley's groundwater, primarily through the disposal of manure by land application on crops, which causes severe public health impacts to nearby communities. The Valley contains about half of California's 300 public water systems that currently serve unsafe drinking water.[166] This number does not include private wells and water systems serving fewer than 15 households. Unsafe water systems are concentrated in small towns and unincorporated communities.[167] Common pollutants in water from factory farm runoff include nitrogen, phosphorus, heavy metals, and pharmaceuticals.[168]

Nitrate contamination of water resources is one of the most widely documented environmental impacts in California's dairy-producing regions. Most nitrate contamination comes from chemical fertilizers and animal manure applied to fields.[169] Nitrogen application often far exceeds the crops' rate of nutrient intake and the soil's ability to absorb nutrients, which then leach into groundwater.[170] A study by University of California Davis found that 96% of nitrate pollution in the region comes from nitrogen applied to cropland, a third of which is in the form of animal manure.[171] The 2019 Central Valley Dairy Representative Monitoring Program reported that nitrate concentrations exceeded the maximum contaminant level in groundwater at all of the 42 dairy facilities.[172] The program identified the application of manure to crop fields as the main source of groundwater contamination, while finding other unaccounted nitrogen sources – too many cows – at the dairy facilities contributing to the excessive nitrate contamination.[173]

Between 1999 and 2008, seven out of eight counties in the San Joaquin Valley had above-average rates of Sudden Infant Death Syndrome which can be caused by nitrate contamination. 70% of San Joaquin Valley households believed their tap water to be unsafe when surveyed in 2011, and nitrate pollution still appears to be rising.[174] A 2016 study that mapped out the mass flows of nitrogen in the San Joaquin Valley, estimated that the health costs of total nitrate leaching to groundwater caused $500 million per year in health damages.[175] Application of biogas digestate, either as a liquid or composted solids,[176] will continue the trend in nitrate contamination in the San

[165] *Id.*
[166] J.A. Del Real, *They Grow the Nation's Food, but They Can't Drink the Water*, N.Y. TIMES (May 21, 2019), https://www.nytimes.com/2019/05/21/us/california-central-valley-tainted-water.html.
[167] *Id*.
[168] JoAnn Burkholder et al., *Impacts from Waste from Concentrated Animal Feeding Operations on Water Quality*, 115 ENV'T HEALTH PERSPECTIVES 308, 308 (2007), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1817674/.
[169] *The Sources and Solutions: Agriculture*, U.S. ENV'T PROT. AGENCY, https://www.epa.gov/nutrientpollution/sources-and-solutions-agriculture (last updated July 30, 2020).
[170] *Id.*
[171] Harter et al., *Addressing Nitrate in California's Drinking Water with a Focus on Tulare Lake Basin and Salinas Valley Groundwater*, CENTER FOR WATERSHED SCI., UNIV. CAL., DAVIS, 17 (2012).
[172] CENTRAL VALLEY DAIRY REP. MONITORING PROG., *Summary Representative Monitoring Report* at 8 (Revised 2020).
[173] *Id*.
[174] *Id*. at 28.
[175] Ariel I. Horowitz et al., *A multiple metrics approach to prioritizing strategies for measuring and managing reactive nitrogen in the San Joaquin Valley of California*, 11 ENV'T RES. LETTERS 1, 11 (2016).
[176] Roger Nkoa, *Agricultural benefits and environmental risks of soil fertilization with anaerobic digestates: A review*, 34 AGRON. SUSTAIN. DEV. 473, 473–492 (2014).

Joaquin Valley in particular, compounding the increase from the LCFS's subsidizing increased manure production.

In addition to the emissions from digestate storage and land application, certain Tier 2 anaerobic digester facilities generate additional air pollutants using factory farm gas to power internal combustion engines that generate electricity onsite.[177] According to a 2015 study commissioned by CARB, this form of electricity generation produces criteria air pollutants, like NOx and particulate matter.[178] Furthermore, the study found this technology would increase NOx emissions by 10 percent, exacerbating air quality in the Valley, in violation of CARB's duty to ensure that its programs do not interfere with efforts to reduce air pollution.[179] The San Joaquin Valley Unified Air Pollution Control District also documents criteria pollutant emissions from electricity generation from factory farm gas.

For example, the Lakeview Dairy Biogas project in Kern County uses two internal combustion engines to produce over 1,000 kW of electricity on-site.[180] And this project, as permitted by the Air District with required pollution control technology, still emits 4.58 tons/year of NOx, 1.98 tons/year of PM10, and 3.18 tons/year of VOC.[181] Compared to a natural gas combined cycle plant in Avenal permitted by the Air District, the Lakeview digester project produces much higher levels of NOx, SOx, and VOC emissions per unit of electricity generated.[182] However, unlike the natural gas plant, Lakeview Dairy Biogas is not required to purchase offset emission reduction credits for the toxic air pollution emitted.[183] This facility *increases* air pollution. But California Bioenergy also sought for LCFS credits under a Tier 2 pathway application for the Lakeview Dairy project.[184] By allowing polluting facilities like Lakeview Dairy to generate credits for "renewable" natural gas, despite the harmful health impacts associated with emissions from the use of factory farm gas to generate electricity, CARB ignores its statutory obligation not to "interfere with, efforts to achieve and maintain federal and state ambient air quality standards and to reduce toxic air contaminant emissions."[185]

Because the LCFS has resulted in and will continue to incentivize an increase in dangerous pollution to the air, water, and land of the San Joaquin Valley, it fails to comply with section

[177] Arnaud Marjollet, *District Notice of Preliminary Decision*, San Joaquin Valley: Air Pollution Control (Mar. 22, 2016), http://www.valleyair.org/notiCes/Docs/2016/03-22-16_(S-1143770)/S-1143770.pdf; *see also* CAL. AIR RES. BD., Staff Summary, Tier 2 Pathway Application B0104, Lakeview Dairy, https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0104_summary.pdf.
[178] Marc Carreras-Sospedra et al., *Assessment of the Emissions and Energy Impacts of Biomass and Biogas Use in California* at 9-10 (Feb. 2015), https://ww2.arb.ca.gov/sites/default/files/classic//research/apr/past/11-307.pdf.
[179] *Id*. at 4, 13.
[180] Arnaud Marjollet, *supra* note 177.
[181] *Id*. at 14.
[182] Brent Newell, *Comments filed to California Energy Commission*, 4 (July 11, 2017), *available at* https://efiling.energy.ca.gov/GetDocument.aspx?tn=220110&DocumentContentId=29811; Arnaud Marjollet, *supra* note 177 at 20.
[183] *Id*.
[184] CAL. AIR RES. BD., Staff Summary, Tier 2 Pathway Application B0104, Lakeview Dairy, https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0104_summary.pdf.
[185] CAL. HEALTH & SAFETY CODE § 38562 (b).

38562(b) (4) and (6) of the Health and Safety Code. Additionally, the LCFS program violates the Legislature's intent, expressed in section 38501(h) of the Health and Safety Code, to maximize additional environmental benefits. CARB should grant this petition and exclude factory farm gas from the program to address these violations.

## IV. CARB MUST EVALUATE AND AMEND THE LCFS TO REMEDY ITS DISPROPORTIONATE ADVERSE AND CUMULATIVE IMPACTS ON LOW-INCOME AND LATINA/O/E COMMUNITIES IN VIOLATION OF STATE AND FEDERAL LAW.

CA 11135 and Title VI of the Civil Rights Act impose an affirmative duty on CARB to ensure that its policies and practices do not have a discriminatory impact on the basis of race.[186] CA 12955 additionally prohibits any practice or program that has a discriminatory effect on members of protected classes with respect to housing opportunities, including with respect to the use and enjoyment of dwellings.[187] AB 32 requires CARB to ensure any activities undertaken in compliance with the statute do not disproportionately impact low-income populations, consider the social costs of greenhouse gas emissions, and design regulations in a manner that is equitable. CARB must assess and prevent the disparate impacts imposed by the LCFS to avoid further harm to communities and to comply with California and federal law.

### A. LCFS credits and the subsequent trading of those credits incentivize activities that result in public health and environmental harms in disproportionately low-income and Latina/o/e communities, particularly in the San Joaquin Valley.

The LCFS harms communities that are disproportionately Latina/o/e and low-income. These harms stem from (1) the generation of revenue for factory farms in proportion to the amount of manure they produce, (2) the encouragement of anaerobic digestion resulting in additional environmental harms related to digestate, and (3) allowing credits to offset emissions and toxic air pollutants elsewhere in California. Each of these harms impact disproportionately low-income and Black, Indigenous, or People of Color communities.

In California, the award of LCFS credits for factory farm gas and the harms these credits incentivize are concentrated in the San Joaquin Valley.[188] Part III(A)(3) shows how the LCFS has the effect of exacerbating existing adverse impacts from factory farms by incentivizing increased production and liquification of manure. Part III(B) describes the extensive environmental and public health harms associated with the increase in liquified manure, as well as the new harms

[186] CAL. GOV'T CODE § 11135; 42 U.S.C. § 2000d.
[187] CAL. GOV'T CODE § 12955.8; CAL. CODE REGS. TIT. 2 § 12161.
[188] The San Joaquin Valley hosts 89% of the state's dairy cow population, and all but one of its counties are ranked nationally for milk sales (See Table 3, Appendix C). CAL. DEP'T OF FOOD AND AGRIC., Small Dairy Climate Action Plan 1 (2018), https://www.cdfa.ca.gov/oefi/research/docs/CDFA_Summary_of_Final_Report.pdf; *See* Lori Pottinger, *California's Dairy Industry Faces Water Quality Challenges*, Public Institute of California (May 20, 2019), https://www.ppic.org/blog/californias-dairy-industry-faces-water-quality-challenges/ (all 117 DDRDP projects are in the Valley).

from digestate. Incentivizing expansion of factory farms may also negatively affect community and economic growth.[189] Part II shows that San Joaquin Valley communities impacted by these new and exacerbated harms are disproportionately Latina/o/e and disproportionately low-income. Part II also describes the preexisting cumulative harms impacting these communities: San Joaquin Valley residents experience "the worst" air pollution nationally, and high levels of drinking water and groundwater contamination, largely due to agricultural runoff.[190]

The LCFS's market-based structure shapes the distribution of adverse impacts imposed by its incentives. In addition to the harmful activities incentivized at credit-generating factory farm gas facilities, the LCFS facilitates harm by the deficit-generating facilities that purchase credits. In order to provide for the trading of credits and deficits, LCFS treats greenhouse gas emissions as fungible. This approach allows CARB to justify the greenhouse gas emissions from gasoline and diesel, for example, in excess of the program's benchmark when the producers of these fuels purchase the equivalent credits. This is viewed by CARB as a positive attribute of the LCFS program because it "lets the market decide" how to achieve the targeted emissions reductions. But treating emissions as fungible ignores the localized impacts of co-pollutants associated with the production, transport, and combustion of various transportation fuels. These harms do not disappear simply because a gasoline producer pays to justify its polluting practices. The sale of factory farm gas credits to LCFS deficit generators prolongs their ability to pollute, rather than make direct emissions reductions.

Given that LCFS deficit generators include producers of conventional fuels, such as gasoline, diesel, and compressed natural gas, there is good reason to believe that LCFS deficit generating industries may disproportionately harm low-income and Black, Indigenous, and People of Color – specifically Latina/o/e – communities. The vast majority of California oil and gas production is concentrated in the San Joaquin Valley and around Los Angeles.[191] California communities living in proximity to oil and gas extraction are known to be disproportionately low income and Latina/o/e.[192] In the San Joaquin Valley, the oil and gas industries are concentrated in Kern County, where residents are subject to the cumulative harms of petrochemical extraction in

[189] Research indicates that "concentration and industrialization of agricultural production removes more money from the community of which the farm is located than when smaller farms operate in the area." CHELSEA MACMULLAN, HUMANE SOC'Y OF THE U.S., DAIRY CAFOS IN CALIFORNIA'S SAN JOAQUIN VALLEY at 26 (2007), https://www.humanesociety.org/sites/default/files/archive/assets/pdfs/farm/macmullan_apa-2007_final.pdf. The ratio of payroll versus emissions produced by concentrated factory farm dairies ranks worse than the petroleum industry. *Id*. at 27. Additionally, factory farm dairy employees face greater health risks because of their proximity to air pollutants and bacteria. Working in the industry has been associated with respiratory diseases such as Chronic Bronchitis, Occupational Asthma, and Pharyngitis. *Id*. at 29. Lack of access to healthcare due to language barriers or undocumented status likely exacerbates these harms. *Id*.

[190] *See* Carroll, *supra* note 138; *see also* Burkholder, *supra* note 168 at 308.

[191] Judith Lewis Mernit, *The Oil Well Next Door: California's Silent Health Hazard*, YALE ENV'T 360 (March 31, 2021), https://e360.yale.edu/features/the-oil-well-next-door-californias-silent-health-hazard ("Kern County, as the southern end of the San Joaquin Valley, produces 70 percent of California' oil; the bulk of the rest comes out of Los Angeles.")

[192] *See, e.g.* Kyle Ferrar, *People and Production: Reducing Risk in California Extraction,* FRACTRACKER ALLIANCE, (Dec. 17, 2020), https://www.fractracker.org/2020/12/people-and-production/; John C. Fleming et al., *Disproportionate Impacts of Oil and Gas Extraction on Already "Disadvantaged" California Communities: How State Data Reveals Underlying Environmental Injustice*, https://www.essoar.org/doi/pdf/10.1002/essoar.10501675.1 (concluding that 77% of permits for oil and gas wells were issued in "communities with a higher-than-average percentage of residents living in poverty and/or communities with a majority non-white population").

addition to those of factory farm dairies. As noted in part II, Kern County has seen a recent increase in LCFS applications for factory farm gas pathways. Residents of Kern County already experience higher than average rates of Chronic Lower Respiratory Disease (CLRD), asthma, and respiratory system cancers.[193] The death rate from CLRD in Kern County from 2013 to 2016 was twelve times higher than the state's CLRD death rate during the same time period.[194] Exacerbation of CLRD cases is a primary reason for CLRD-related deaths.[195] In 2015 to 2016, 31.1% of children in Kern County had been diagnosed with asthma at some point in their life, compared to 15.2% of children statewide and 13.7% and 10.3% in Los Angeles County and Sacramento County, respectively.[196]

In addition to emissions from extraction and refining of these polluting fuels, LCFS credits can also be used to offset emissions from the combustion. The co-pollutants from these emissions likely impose disproportionate adverse impacts on low-income and Black, Indigenous, and People of Color communities in California. A 2014 analysis found that exposure to $PM_{2.5}$ from cars, trucks, and buses "is not equally distributed" across California.[197] More specifically, the analysis concluded that on average, "African American, Latino, and Asian Californians are exposed to more $PM_{2.5}$ pollution from cars, trucks, and buses than white Californians. These groups are exposed to $PM_{2.5}$ pollution 43, 39, and 21 percent higher, respectively, than white Californians."[198] Additionally, "[T]he lowest-income households in the state live where $PM_{2.5}$ pollution is 10 percent higher than the state average, while those with the highest incomes live where PM2.5 pollution is 13 percent below the state average."[199] Given that California's major diesel trucking corridors, Interstate 5 and State Highway 99, both run north-south directly through the San Joaquin Valley,[200] emissions from combustion of deficit-generating transportation fuels may well impose additional cumulative impacts on the same communities impacted by dairy factory farms as well as fossil fuel extraction and refining.

[193] Yongping Hao et al., *Ozone, Fine Particulate Matter, and Chronic Lower Respiratory Disease Mortality in the United States*, 192(3) AM. J. OF RESPIRATORY AND CRITICAL CARE MED. 337, 337–341, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4937454/.
[194] Nick Perez, *Despite decades of cleanup, respiratory disease deaths plague California county*, ENV'T HEALTH NEWS (Dec. 4, 2018) https://www.ehn.org/chronic-respiratory-disease-california-2621765230/pollution-persists.
[195] Elizabeth Oelsner et al., *Classifying Chronic Lower Respiratory Disease Events in Epidemiologic Cohort Studies*, 13 ANNALS OF THE AM. THORACIC SOC'Y 1057, 1057 (July 2016) https://doi.org/10.1513/AnnalsATS.201601-063OC.
[196] *Summary: Asthma*, KIDSDATA, https://www.kidsdata.org/topic/45/asthma/summary?gclid=Cj0KCQiAst2BBhDJARIsAGo2ldWxDuxZNs3gzxS4Qj3s048YVqkp4LWQ_nwYs7DSID4FDRTTdSsgq1waAgyxEALw_wcB (last visited Oct. 21, 2021).
[197] UNION OF CONCERNED SCI., *Inequitable Exposure to Air Pollution from Vehicles in California 1 (Feb. 2019)*, https://www.ucsusa.org/sites/default/files/attach/2019/02/cv-air-pollution-CA-web.pdf
[198] *Id.*
[199] *Id.* at 2.
[200] David Lighthall and John Capitman, *The Long Road to Clean Air in the San Joaquin Valley: Facing the Challenge of Public Engagement* 8 (Dec. 2007), CENTRAL VALLEY HEALTH POL'Y INST., https://chhs.fresnostate.edu/cvhpi/documents/cvhpi-air-quality-report07.pdf

### B. CARB must amend the LCFS regulation to come into compliance with CA 11135, CA 12955, and Title VI of the Civil Rights Act of 1964 and to prevent further discrimination.

CARB has an affirmative duty under CA 11135 to ensure that its policies and practices do not disproportionately impact residents on the basis of race, color, national origin, or ethnic group identification.[201] CA 11135's prohibition on discrimination applies to the LCFS because it meets the criteria of a program that is "conducted, operated, or administered" by CARB, a California state agency.[202] CA 12955 prohibits activities that limit housing opportunities for members of protected classes, including activities and programs that interfere with the use and enjoyment of one's dwelling or that results in the location of toxic, polluting, and/or hazardous land uses in a manner that adversely impacts the enjoyment of residence, land ownership, tenancy, or any other land use benefit related to residential use. The state is subject to the prohibitions included in the Fair Employment and Housing Act.[203] Title VI of the Civil Rights Act of 1964 and implementing regulations prohibit disparate impact discrimination on the basis of race by recipients of federal funds.[204] As a recipient of federal funding, CARB is subject to Title VI.[205]

As described above, the LCFS exacerbates harms in some San Joaquin Valley communities twice over: once when it incentives the expansion of factory farm dairies and anaerobic digestion, and again when the resulting credits are sold to justify the pollution from conventional transportation fuel production, distribution, and combustion. Some (and likely all) of these harms are imposed on communities that are disproportionately Latina/o/e. Additionally, the LCFS has the effect of defeating one of the objectives of AB 32 on a discriminatory basis: to maximize additional environmental benefits and complement efforts to reduce air pollution.

Not only are there "equally effective alternative practices" to achieve the goal of reducing transportation emissions, there are alternative practices that are demonstrably both more effective and less discriminatory.[206] Reducing net greenhouse gas emissions from transportation fuels is an important and legitimate goal. Sadly, the LCFS factory farm gas pathways fail to accomplish it. Therefore, California's greenhouse gas emissions targets provide no credible justification for the LCFS's discriminatory impacts. Moreover, there are other, less harmful agricultural practices that CARB could encourage to reduce net emissions. Rather than monetize the source of greenhouse gas emissions and related co-pollutants, CARB could encourage the direct reduction of emissions at their source by supporting practices such as solid-liquid separation, scrape and vacuum

[201] CAL. GOV'T CODE § 11135.
[202] *Id*.
[203] CA Legis. 352 (2021), CAL. LEGIS. SERV. CH. 352 (A.B. 948), amending CAL. GOVT CODE 12955; 2 CCR 12005(v); 2 CCR 12060.
[204] 42 U.S.C. §2000d; 40 C.F.R. §7.
[205] CARB has received funds EPA, including, for example, over $11.8 million in 2020 to administer the Diesel Emissions Reduction Act. Soledad Calvino, *U.S. EPA awards over $11.8 million for clean diesel projects in California*, U.S. ENV'T PROT. AGENCY (San Francisco), Aug. 30, 2020, News Release, https://www.epa.gov/newsreleases/us-epa- awards-over-118-million-clean-diesel-projects-california.
[206] *See, e.g., Elston v. Talladega Count.*, 997 F. 2d at 1413.

collection of manure, composting, and pasture-based practices. Similarly, there are less harmful policy tools that could be used to produce these reductions.[207]

CARB bears the duty to evaluate the potentially discriminatory impacts of its policies and practices and to prevent these harms in the first place, which it failed to do in the design of the LCFS regulation and fails to do on an ongoing basis. To bring the LCFS into compliance with its civil right obligations, CARB must cease and desist from operating the LCFS program in such a way that results in unlawful, discriminatory impacts as proscribed by CA Gov't Code Sections 11135 and 12955, et seq., and Title VI of the Civil Rights Act of 1964. To this end, CARB must a) conduct a disparity analysis to evaluate the program and b) amend the LCFS regulation to ensure that it does not continue to disproportionately harm low-income and Latina/o/e communities. A disparity analysis must include an evaluation of the distribution of impacts from incentives created by credit generation, direct emissions from deficit generators facilitated by the trading of LCFS credits, and the distribution of emissions from the combustion of these fuels.[208]

### C. CARB failed to design the LCFS regulation in a manner that is equitable and fails on an ongoing basis to consider the social costs of greenhouse gas emissions and ensure that the LCFS does not disproportionately impact low-income communities.

AB 32 mandated several safeguards to ensure equity and protect low-income communities in California from potential adverse impacts associated with the act's implementation. Section 38562(b)(2) of California Health and Safety Code requires that CARB design regulations "in a manner that is equitable" and "[ensure] that activities undertaken to comply with the regulations do not disproportionately impact low-income communities" to the extent feasible.[209] Section 38562(b)(2) also mandates that CARB "consider overall societal benefits, including reductions in other air pollutants, diversification of energy sources, and other benefits to the economy, environment, and public health."[210] Section 38562.5 further mandates that, "when adopting rules and regulations pursuant to this division to achieve emissions reductions beyond the state greenhouse gas emissions limit and to protect the state's most impacted and disadvantaged

[207] Environmental justice critiques of pollution trading schemes for their tendency to result in localized pollution that disproportionately impacts low-income and people of color communities are longstanding. *See, e.g., Environmental Justice Advocates Blast Emissions Trading Guide*, 10 INSIDE EPA'S CLEAN AIR REPORT 9, 6-7 (April 29, 1999), *available at* https://www.jstor.org/stable/48520963; Lily N. Chinn, *Can the Market Be Fair and Efficient? An Environmental Justice Critique of Emissions Trading*, 26 *Ecol. L. Quart.* 1 (1999), http://www.jstor.org/stable/24114004; Letter to the Biden-Harris Transition Team Re: EPA Administrator Appointment from Over 70 Environmental Justice Groups (December 2, 2020), *available at* https://1bps6437gg8c169i0y1drtgz-wpengine.netdna-ssl.com/wp-content/uploads/2020/12/2020-12-2-Nichols-letter.pdf.

[208] LCFS fuels originating from factory dairy farms include electricity, renewable natural gas, hydrogen, bio-compressed natural gas, bio-liquefied natural gas, and bio-liquefied-regasified-and recompressed (Bio-L-CNG). CAL. CODE REGS. TIT. 17, § 95481 (defining biogas, biomethane, and all LCFS fuels produced from biomethane).

[209] CAL. HEALTH & SAFETY CODE § 38562(b)(2). See also *Ass'n of Irritated Residents v. State Air Res. Bd.*, 206 Cal. App. 4th 1487, 1489 (2012).

[210] CAL. HEALTH & SAFETY CODE § 38562.

communities," the state board shall consider social costs.[211] CARB is currently out of compliance with each of these mandates and, accordingly, must cease and desist operation of the LCFS factory farm gas pathways unless and until it comes into compliance.

Section 38562(b)(2)'s charge to protect "low-income communities" includes "persons and families whose income does not exceed 120 percent of the area median income, adjusted for family size [...] in accordance with adjustment factors adopted and amended from time to time by the United States Department of Housing and Urban Development pursuant to Section 8 of the United States Housing Act of 1937."[212] Area median income covers "the median family income of a geographic area of the state."[213] The residents of the San Joaquin Valley are precisely the low-income communities Sections 38562 seek to protect. As demonstrated above, the LCFS factory farm gas pathways have a disproportionate adverse impact on the basis of race and income, demonstrating CARB's failure to have designed the regulations in a manner that is equitable.

Finally, 38562(b)(2) requires consideration of overall societal benefits. CARB must amend the LCFS regulation to account for this and remedy these violations to come into compliance with AB 32. In Section 38562.5 of California Health and Safety Code, social costs means "an estimate of the economic damages, including, but not limited to, changes in net agricultural productivity; impacts to public health; climate adaptation impacts, such as property damages from increased flood risk; and changes in energy system costs, per metric ton of greenhouse gas emission per year."[214] The greenhouse gas emissions and associated co-pollutants from the production of factory farm gas has significant socials costs to public health, as discussed extensively in parts III and IV(B). Amending the LCFS to account for a serious consideration of the social costs of the emissions associated with both factory farm gas and the conventional fuels that generate deficits would not only bring CARB into compliance with Section 38562.5, but it would assist CARB in understanding and evaluating the inequitable distribution of adverse impacts in a manner that supports civil rights compliance, a described above.

## V. CARB'S LACK OF TRANSPARENCY DENIES THE PUBLIC THE ABILITY TO REVIEW AND CHALLENGE EXISTING REGULATIONS, INCLUDING THE LCFS PATHWAYS FOR BIOMETHANE FROM DAIRY AND SWINE MANURE.

Meaningful public participation and advocacy regarding the impacts of the LCFS program have been hindered by CARB's lack of transparency. Locations of facilities purchasing the credits generated by factory farm dairies in the San Joaquin Valley are unknown to the public and attempts to obtain trading data through the California Public Records Act has produced only heavily redacted records. Without readily available trading data, it is difficult to determine potential disparate impacts caused by both the incentives produced by credit generation and the offsetting role of credit trading within the LCFS program. Community groups and advocates should not have

[211] CAL. HEALTH & SAFETY CODE § 38562.5. Note that the 2018 amendments made the LCFS generate reductions beyond the statewide limit.
[212] CAL. HEALTH & SAFETY CODE § 50093.
[213] *Id*.
[214] CAL. HEALTH & SAFETY CODE § 38506.

to seek out this information to conduct their own analyses of CARB's potentially discriminatory policies. CARB's control over the trading data places the agency in the best position to assess the disparate impact produced by the LCFS. Moreover, CARB has a clear, affirmative duty to comply with AB 32, CA 11135, and Title VI and prevent a disparate impact from its policies and practices.

## VI. CONCLUSION

Since the Legislature enacted AB 32 in 2006, both the predicted and actual climate change-related harms have become more dire.[215] The methane generated by factory farm dairies in California alone accounts for approximately 45 percent of the state's total methane emissions that contribute to these harms.[216] And the Intergovernmental Panel on Climate Change recently declared a climate code red when it called for strong, sustained, and rapid methane reductions to stabilize our climate.[217]

CARB must grant this petition and reform the LCFS. Rather than allow factory farm gas reductions to substitute for emissions increases from the transportation sector, CARB should amend the LCFS to exclude factory farm gas from this pollution trading scheme.[218] If CARB instead decides to continue allowing Big Oil & Gas to offset their transportation fuel emissions with factory farm gas, then CARB must (1) ensure that the LCFS does not inflict disparate impacts in violation of CA 11135, CA 12955, and Title VI of the Civil Rights Act; and (2) adopt all alternative LCFS amendments requested here to ensure LCFS integrity and protections for rural communities.

CARB must take this opportunity to reform a pollution trading scheme that has gone off the rails. The LCFS incentivizes more of that which it purports to control, allows inflated and illusory credits from factory farm gas to authorize more emissions from transportation fuel, refuses to acknowledge the truth that liquefied manure is intentionally created and not somehow naturally occurring awaiting only abatement, and authorizes non-additional credits generated at projects receiving massive incentives from public funds and the Aliso Canyon settlement agreement. This pollution trading scheme merely shifts emissions; it benefits Big Oil & Gas to allow more pollution from their transportation fuels. It benefits, entrenches, and expands the industrial dairy and pig industry with a revenue stream more valuable than milk. And it benefits the gas utilities that

[215] *See, e.g.*, Thomas Fuller and Christopher Flavelle, *A Climate Reckoning in Fire-Stricken California*, N.Y. TIMES (Sept. 10, 2020), https://www.nytimes.com/2020/09/10/us/climate-change-california-wildfires.html; Christopher Flavelle, *How California Became Ground Zero for Climate Disasters*, N.Y. TIMES (Sept. 20, 2020), https://www.nytimes.com/2020/09/20/climate/california-climate-change-fires.html; Nadja Popovich, *How Severe Is the Western Drought? See For Yourself.*, N.Y. TIMES (Sept. 20, 2020), https://www.nytimes.com/interactive/2021/06/11/climate/california-western-drought-map.html.

[216] CAL. AIR RES. BD., Short-Lived Climate Pollutant Reduction Strategy 56, Figure 4 (March 2017), https://ww2.arb.ca.gov/sites/default/files/2020-07/final_SLCP_strategy.pdf.

[217] IPCC, *Climate Change 2021: the Physical Science Basis, which represents the findings of Working Group I and its contribution to the Sixth Assessment Report*, *available at* https://www.ipcc.ch/report/ar6/wg1/.

[218] Petitioners do not suggest that methane from industrial dairy and pig facilities should be unabated. CARB has authority to adopt mandatory regulations to achieve up to a 40 percent reduction from manure methane emissions pursuant to Health & Safety Code § 39730.5.

desperately attempt to perpetuate the combustion of gas in the face of a future where electrified buildings and transportation are the only routes to achieve California's climate goals. San Joaquin Valley communities should not suffer the discriminatory effects of CARB's pollution trading scheme, and CARB should grant this petition and deliver environmental justice.

Respectfully Submitted this 27th of October, 2021,

Ruthie Lazenby
Vermont Law School
Environmental Justice Clinic

Brent Newell
Public Justice

Phoebe Seaton
Leadership Counsel for
Justice & Accountability

Tom Frantz
Association of Irritated Residents

Tarah Heinzen
Tyler Lobdell
Food & Water Watch

Cristina Stella
Christine Ball-Blakely
Animal Legal Defense Fund

# I. APPENDICES

## A. APPENDIX A: PROPOSED AMENDMENTS TO THE LCFS TO REMOVE ALL FUELS DERIVED FROM BIOMETHANE FROM DAIRY AND SWINE MANURE

§ 95488.3. Calculation of Fuel Pathway Carbon Intensities

(a) Calculating Carbon Intensities. Fuel pathway applicants and the Executive Officer will evaluate all pathways based on life cycle greenhouse gas emissions per unit of fuel energy, or carbon intensity, expressed in gCO2e/MJ. For this analysis, the fuel pathway applicant must use CA-GREET3.0 model (including the Simplified CI Calculators derived from that model) or another model determined by the Executive Officer to be equivalent or superior to CA-GREET3.0.

(b) CA-GREET3.0. The CA-GREET3.0 model (August 13, 2018) contains emission factors for calculating greenhouse gas emissions from site-specific inputs to fuel pathways and standard values for parts of the life cycle not included in applicant-specific data submission. The model is open source and publicly available at http://www.arb.ca.gov/fuels/lcfs/lcfs.htm and is incorporated herein by reference. CA-GREET3.0 includes contributions from the Oil Production Greenhouse Gas Estimator (OPGEE2.0) model (for emissions from crude extraction) and Global Trade Analysis Project (GTAP-BIO) together with the Agro-Ecological Zone Emissions Factor (AEZ-EF) model for land use change (LUC).

Tier 1 Simplified CI Calculators, which incorporate emission factors and life cycle inventory data from the CA-GREET3.0 model, are used to calculate carbon intensities for Tier 1 pathways. The eight Simplified CI Calculators listed below are publicly available at http://www.arb.ca.gov/fuels/lcfs/lcfs.htm and are incorporated herein by reference:

(1) Tier 1 Simplified CI Calculator for Starch and Fiber* Ethanol (August 13, 2018)

(2) Tier 1 Simplified CI Calculator for Sugarcane-derived Ethanol (August 13, 2018)

(3) Tier 1 Simplified CI Calculator for Biodiesel and Renewable Diesel (August 13, 2018)

(4) Tier 1 Simplified CI Calculator for LNG and L-CNG from North American Natural Gas (August 13, 2018)

(5) Tier 1 Simplified CI Calculator for Biomethane from North American Landfills (August 13, 2018)

(6) Tier 1 Simplified CI Calculator for Biomethane from Anaerobic Digestion of Wastewater Sludge (August 13, 2018)

~~(7) Tier 1 Simplified CI Calculator for Biomethane from Anaerobic Digestion of Organic Waste (August 13, 2018)~~

© OPGEE2.0. The OPGEE2.0 model is used to generate carbon intensities for crude oil used in the production of ultra-low sulfur diesel (ULSD) and California Reformulated Gasoline Blendstock for Oxygenate Blending (CARBOB).

(d) Accounting for Land Use Change. The Executive Officer calculates LUC effects for certain crop-based biofuels using the GTAP model (modified to include agricultural data and termed GTAP-BIO) and the AEZ-EF model. LUC values for six feedstock/finished biofuel combinations are provided in Table 6 below. The Executive Officer may use the same modeling framework to assess LUC values for other fuel or feedstock combinations, not currently found in Table 6, as part of processing a pathway application. Alternatively, the Executive Officer may require a fuel pathway applicant to use one of the values in Table 6, if the Executive Officer deems that value appropriate to use for a fuel or feedstock combination not currently listed in Table 6.

Table 6. Land Use Change Values for Use in CI Determination

| Biofuel | LUC (gCO<2>/MJ |
|---|---|
| Corn Ethanol | 19.8 |
| Sugarcane Ethanol | 11.8 |
| Soy Biomass-Based Diesel | 29.1 |
| Canola Biomass-Based Diesel | 14.5 |
| Grain Sorghum Ethanol | 19.4 |
| Palm Biomass-Based Diesel | 71.4 |

* Fiber in this case refers to corn and grain sorghum fiber exclusively.

§ 95488.9. Special Circumstances for Fuel Pathway Applications.

(f) Carbon Intensities that Reflect Avoided Methane Emissions from Dairy and Swine Manure or Organic Waste Diverted from Landfill Disposal.

(1) A fuel pathway that utilizes biomethane from dairy cattle or swine manure digestion ~~may~~ shall not be certified. ~~With a CI that reflects the reduction of greenhouse gas emissions achieved by the voluntary capture of methane, provided that:~~

~~(A) A biogas control system, or digester, is used to capture biomethane from manure management on **dairy** cattle and swine farms that would otherwise be vented to the atmosphere as a result of livestock operations from those farms.~~

~~(B) The baseline quantity of avoided methane reflected in the CI calculation is additional to any legal requirement for the capture and destruction of biomethane.~~

## B. APPENDIX B: PROPOSED AMENDMENTS TO REFORM THE LCFS PATHWAYS FOR BIOMETHANE FROM DAIRY AND SWINE MANURE

§ 95488.3. Calculation of Fuel Pathway Carbon Intensities

(a) Calculating Carbon Intensities. Fuel pathway applicants and the Executive Officer will evaluate all pathways based on life cycle greenhouse gas emissions per unit of fuel energy, or carbon intensity, expressed in gCO2e/MJ. For this analysis, the fuel pathway applicant must use CA-GREET3.0 model (including the Simplified CI Calculators derived from that model) or another model determined by the Executive Officer to be equivalent or superior to CA-GREET3.0.

(b) CA-GREET3.0. The CA-GREET3.0 model (August 13, 2018) contains emission factors for calculating greenhouse gas emissions from site-specific inputs to fuel pathways and standard values for parts of the life cycle not included in applicant-specific data submission. The model is open source and publicly available at http://www.arb.ca.gov/fuels/lcfs/lcfs.htm and is incorporated herein by reference. CA-GREET3.0 includes contributions from the Oil Production Greenhouse Gas Estimator (OPGEE2.0) model (for emissions from crude extraction) and Global Trade Analysis Project (GTAP-BIO) together with the Agro-Ecological Zone Emissions Factor (AEZ-EF) model for land use change (LUC).

Tier 1 Simplified CI Calculators, which incorporate emission factors and life cycle inventory data from the CA-GREET3.0 model, are used to calculate carbon intensities for Tier 1 pathways. The eight Simplified CI Calculators listed below are publicly available at http://www.arb.ca.gov/fuels/lcfs/lcfs.htm and are incorporated herein by reference:

(1) Tier 1 Simplified CI Calculator for Starch and Fiber* Ethanol (August 13, 2018)

(2) Tier 1 Simplified CI Calculator for Sugarcane-derived Ethanol (August 13, 2018)

(3) Tier 1 Simplified CI Calculator for Biodiesel and Renewable Diesel (August 13, 2018)

(4) Tier 1 Simplified CI Calculator for LNG and L-CNG from North American Natural Gas (August 13, 2018)

(5) Tier 1 Simplified CI Calculator for Biomethane from North American Landfills (August 13, 2018)

(6) Tier 1 Simplified CI Calculator for Biomethane from Anaerobic Digestion of Wastewater Sludge (August 13, 2018)

(7) Tier 1 Simplified CI Calculator for Biomethane from Anaerobic Digestion of Organic Waste (August 13, 2018)

(c) OPGEE2.0. The OPGEE2.0 model is used to generate carbon intensities for crude oil used in the production of ultra-low sulfur diesel (ULSD) and California Reformulated Gasoline Blendstock for Oxygenate Blending (CARBOB).

(d) Accounting for Land Use Change. The Executive Officer calculates LUC effects for certain crop-based biofuels using the GTAP model (modified to include agricultural data and termed GTAP-BIO) and the AEZ-EF model. LUC values for six feedstock/finished biofuel combinations are provided in Table 6 below. The Executive Officer may use the same modeling framework to assess LUC values for other fuel or feedstock combinations, not currently found in Table 6, as part of processing a pathway application. Alternatively, the Executive Officer may require a fuel pathway applicant to use one of the values in Table 6, if the Executive Officer deems that value appropriate to use for a fuel or feedstock combination not currently listed in Table 6.

Table 6. Land Use Change Values for Use in CI Determination

| Biofuel | LUC (gCO<2>/MJ |
|---|---|

| | |
|---|---|
| Corn Ethanol | 19.8 |
| Sugarcane Ethanol | 11.8 |
| Soy Biomass-Based Diesel | 29.1 |
| Canola Biomass-Based Diesel | 14.5 |
| Grain Sorghum Ethanol | 19.4 |
| Palm Biomass-Based Diesel | 71.4 |

* Fiber in this case refers to corn and grain sorghum fiber exclusively.

(e) Accounting for life cycle emissions for all fuel pathways from manure feedstock. In calculating the carbon intensity of any fuel derived from manure feedstock, the Executive Officer shall include all upstream and downstream greenhouse gas emissions from all activities associated with manure production, including but not limited to feed emissions, mobile and stationary source combustion emissions, enteric emissions, emissions from composting digestate solids, emissions following land application, and indirect source emissions.

§ 95488.9. Special Circumstances for Fuel Pathway Applications.

(f) Carbon Intensities that Reflect Avoided Methane Emissions from Dairy and Swine Manure or Organic Waste Diverted from Landfill Disposal.

(1) A fuel pathway that utilizes biomethane from dairy cattle or swine manure digestion may be certified with a CI that reflects the reduction of greenhouse gas emissions achieved by the voluntary capture of methane, provided that:

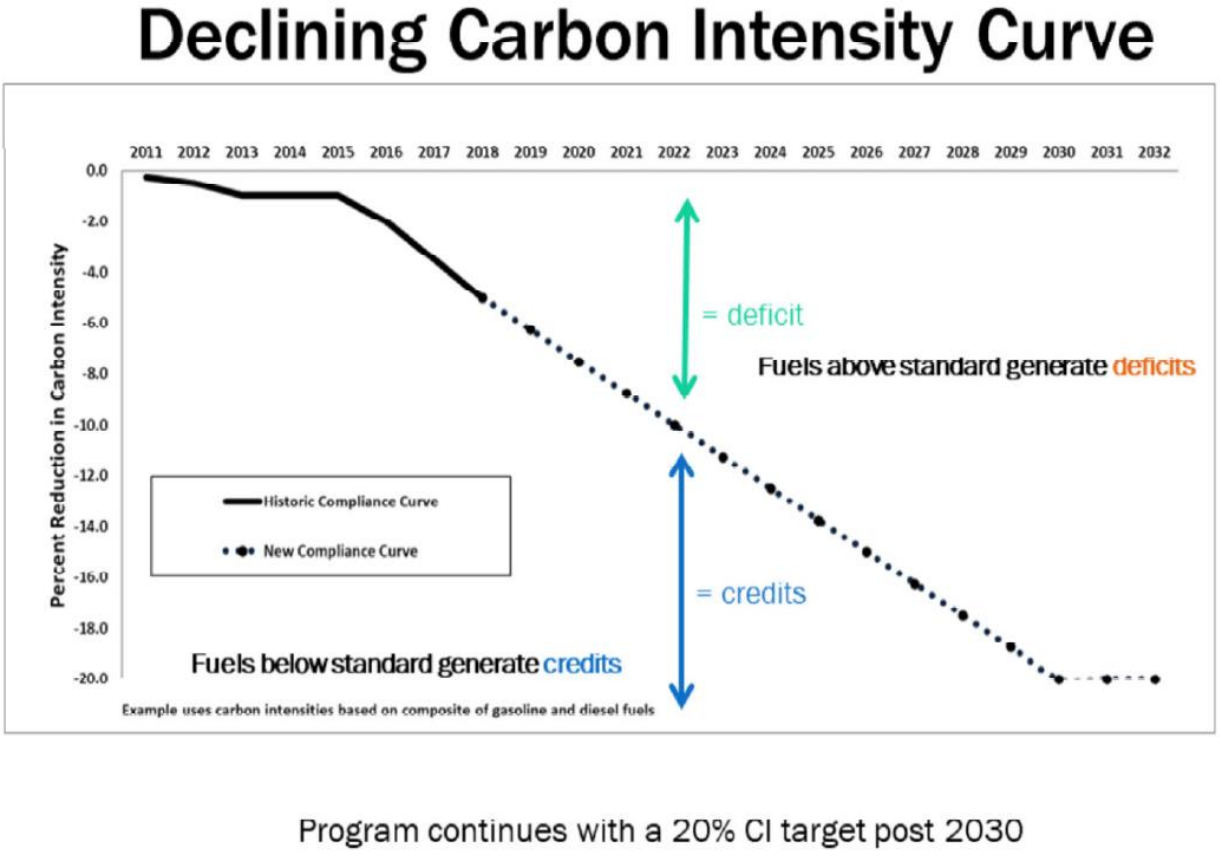
(A) A biogas control system, or digester, is used to capture biomethane from manure management on dairy cattle and swine farms that would otherwise be vented to the atmosphere as a result of livestock operations from those farms.

(B) The baseline quantity of avoided methane reflected in the CI calculation is additional to any legal requirement for the capture and destruction of biomethane, and any other greenhouse gas emission reduction that otherwise would occur.

(C) The fuel pathway derived from biomethane from dairy cattle or swine manure digestion pursuant to section 95488.3(e) does not (1) contribute any amount of nitrogen oxides, volatile organic compounds, sulfur oxides, ammonia, or particulate matter with an aerodynamic diameter of ten microns or less into the ambient air; (2) cause or contribute to groundwater or surface water pollution or degradation; (3) intensify water demand in areas medium and high priority water basins; or (4) intensify or exacerbate any negative local impacts including but not limited to odor and insects.

## C. APPENDIX C: TABLES AND FIGURES

**Figure 1:** Declining Annual Benchmark for the LCFS program.[219]




[219] CAL. AIR RES. BD., *LCFS Basics* (2019), *available at* https://ww2.arb.ca.gov/sites/default/files/2020-09/basics-notes.pdf (last visited Oct. 12, 2021).

**Table 1.** Credit Value Calculator from LCFS Data Dashboard.[220]

**Credit Value Calculator:**
**Estimated LCFS Premium at Sample LCFS Credit Prices**

**Alternative Fuel Premiums at Sample LCFS Credit Prices**
**($/gal gasoline-equivalent for fuels used as gasoline substitutes)**

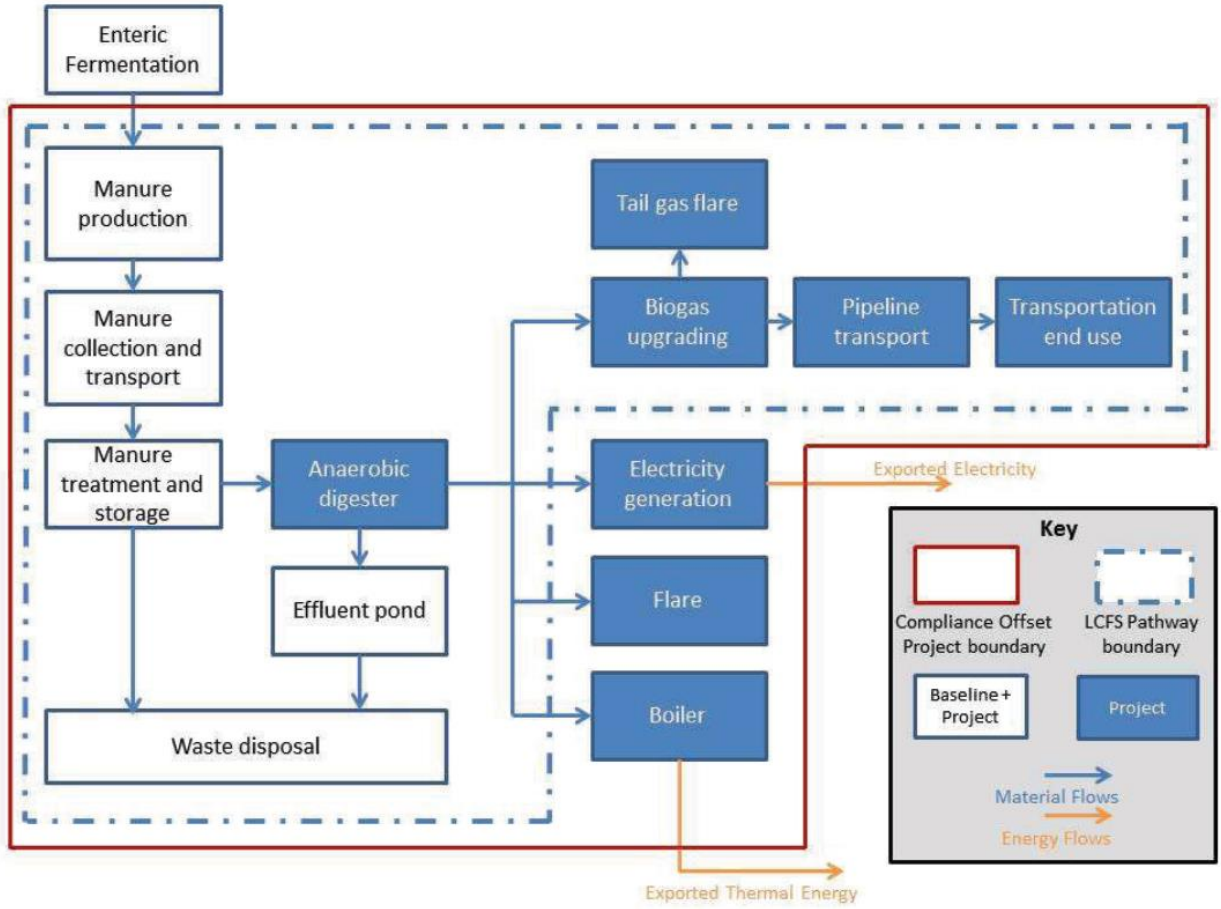
| CI Score (gCO2e/MJ) | Credit Price $196 | $80 | $100 | $120 | $160 | $200 |
|---|---|---|---|---|---|---|
| -273 | $8.31 | $3.39 | $4.24 | $5.09 | $6.79 | $8.48 |
| 10 | $1.89 | $0.77 | $0.96 | $1.16 | $1.54 | $1.93 |
| 20 | $1.66 | $0.68 | $0.85 | $1.02 | $1.36 | $1.70 |
| 30 | $1.44 | $0.59 | $0.73 | $0.88 | $1.17 | $1.46 |
| 40 | $1.21 | $0.49 | $0.62 | $0.74 | $0.99 | $1.23 |
| 50 | $0.98 | $0.40 | $0.50 | $0.60 | $0.80 | $1.00 |
| 60 | $0.75 | $0.31 | $0.38 | $0.46 | $0.62 | $0.77 |
| 70 | $0.53 | $0.22 | $0.27 | $0.32 | $0.43 | $0.54 |
| 80 | $0.30 | $0.12 | $0.15 | $0.18 | $0.25 | $0.31 |
| 90 | $0.07 | $0.03 | $0.04 | $0.04 | $0.06 | $0.07 |
| 100 | -$0.15 | -$0.06 | -$0.08 | -$0.09 | -$0.13 | -$0.16 |
| 110 | -$0.38 | -$0.16 | -$0.19 | -$0.23 | -$0.31 | -$0.39 |
| 120 | -$0.61 | -$0.25 | -$0.31 | -$0.37 | -$0.50 | -$0.62 |
| 130 | -$0.83 | -$0.34 | -$0.43 | -$0.51 | -$0.68 | -$0.85 |
| 140 | -$1.06 | -$0.43 | -$0.54 | -$0.65 | -$0.87 | -$1.08 |
| 150 | -$1.29 | -$0.53 | -$0.66 | -$0.79 | -$1.05 | -$1.32 |
| CaRFG* ($/gallon) 100.82 | -$0.139 | -$0.057 | -$0.071 | -$0.085 | -$0.113 | -$0.142 |

* Maximum pass-through cost for gasoline. Assumes a blend of CARBOB with 10 volume percent ethanol at a CI of 79.9 g/MJ. Ethanol at 79.9 g/MJ is assumed to receive no LCFS premium.

*Last Modified 05/31/2019*

[220] Data Dashboard, CAL. AIR RES. BD. Figure 7, *https://ww3.arb.ca.gov/fuels/lcfs/dashboard/dashboard.htm* (last visited Oct. 20, 2021).

**Figure 2.** CARB schematic of the system boundaries for upgraded biogas (biomethane) from Anaerobic digestion of Dairy Manure.[221]



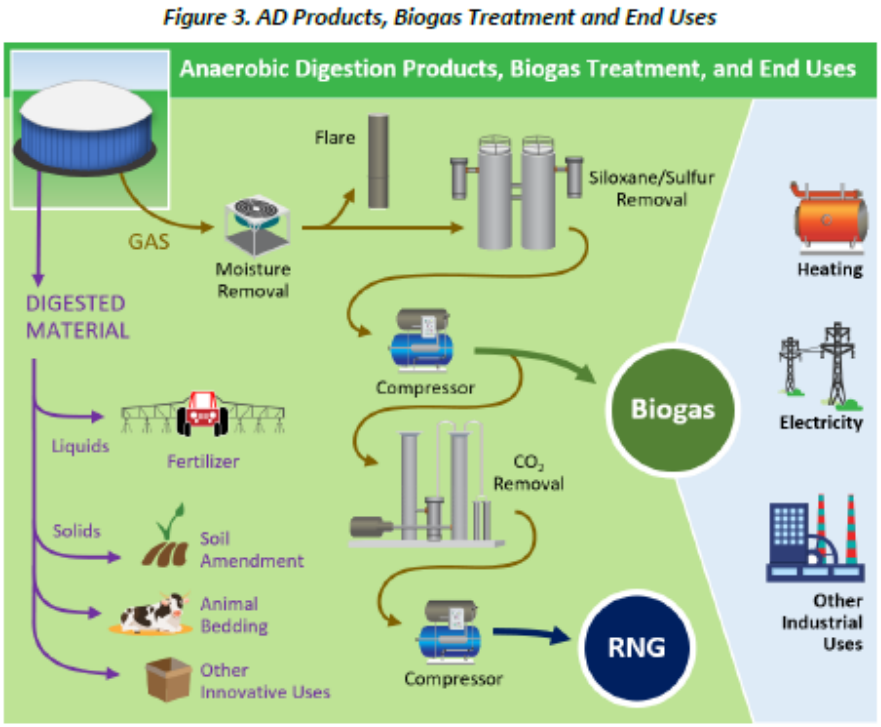

[221] CAL. AIR RES. BD., *supra* note 96 at 13.

**Figure 3.** Waste Management Hierarchy chart for manure management.[222]

| Waste Management Hierarchy | Attribute | Applicability in animal manure management |
|---|---|---|
| Avoidance | Most preferred option. Preventive. Use of less hazardous materials in the design and manufacture of products. Develop strategies for cleaner and environmentally friendly production | While the production of wastes cannot be completely eliminated in animal production, the production can be made cleaner and environmentally friendly |
| Reduction of wastes | Second most preferred option. Preventive. Actions to make changes in the type of materials being used for specific products. This approach contributes to effective savings of natural resources | Applicable |
| Reuse | Predominantly ameliorative and partly preventive. The waste is collected during the production phase and fed back into the production process. Reduce the amount of wastes generated and the cost of production. Desirable. | Applicable |
| Recycle | Predominantly ameliorative and partly preventive. The waste materials are collected and processed, and used in the production of new products. The process prevents pollution. Desirable. | Applicable |
| Energy recovery | Predominantly assimilative and partly ameliorative. This is also called waste to energy conversion. Wastes are converted to usable energy forms such as heat, light, electricity, etc. Desirable. | Applicable |
| Treatment | Predominantly assimilative and partly ameliorative. Desirable. | Applicable |
| Sustainable disposal | Disposal is the least preferred option in the waste management hierarchy and should be avoided. | Possible but not preferred |

[222] Gabriel Adebayo Malomo et al., *Sustainable Animal Manure Management Strategies and Practices*, 9 (Aug. 29, 2018) https://www.intechopen.com/books/agricultural-waste-and-residues/sustainable-animal-manure-management-strategies-and-practices.

**Figure 4.** Diagram of downstream uses of digested materials.[223]




[223] ENV'T. PROT. AGENCY, *An Overview of Renewable Natural Gas from Biogas* 4 (July 2020) https://www.epa.gov/sites/production/files/2020-07/documents/lmop_rng_document.pdf.

**Figure 5.** Rise in Average Monthly Credit Price since 2013.[224]




**Table 2.** The California dairy industry experienced negative average residuals in 2015 and 2016, indicating a lack of profit in these years.[225]

**Table 1.6:** California Dairy Farm Annual Unit Costs of Production by Category 2014-2017

| Dairy Input | 2014 $/cwt | 2015 $/cwt | 2016 $/cwt | 2017 $/cwt |
|---|---|---|---|---|
| Feed | $11.05 | $10.46 | $9.22 | $8.77 |
| Hired Labor | $1.56 | $1.70 | $1.74 | $1.87 |
| Herd Replacement | $1.37 | $2.12 | $2.10 | $1.88 |
| Operating Costs | $2.88 | $2.93 | $2.92 | $3.06 |
| Milk Marketing | $0.56 | $0.56 | $0.55 | $0.55 |
| **Total Costs** | **$17.42** | **$17.77** | **$16.53** | **$16.13** |
| **Average Mailbox Price** | **$22.37** | **$15.94** | **$15.56** | **$16.99** |
| **Price – Costs (Residual)** | **$4.95** | **-$1.83** | **-$0.97** | **$0.86** |

Source: CDFA California Dairy Cost of Production Annuals
https://www.cdfa.ca.gov/dairy/dairycop_annual.html

[224] AcMoody, *supra* note 128 at 4.
[225] Matthews, *supra* note 130 at 20.

**Figure 6.** Groundwater contamination sites in Kern County.[226]

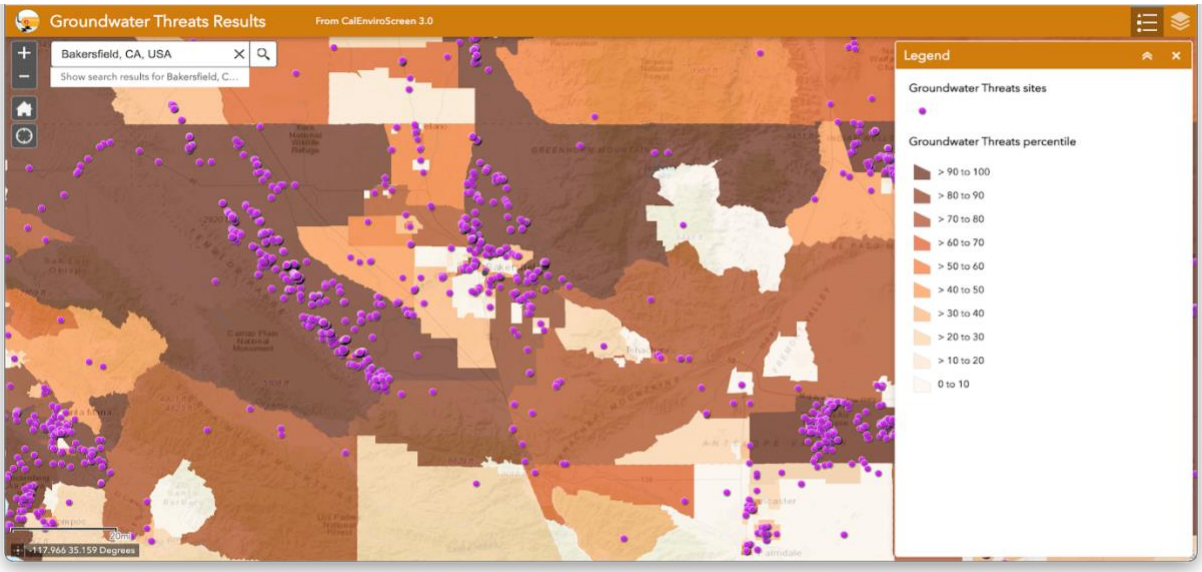
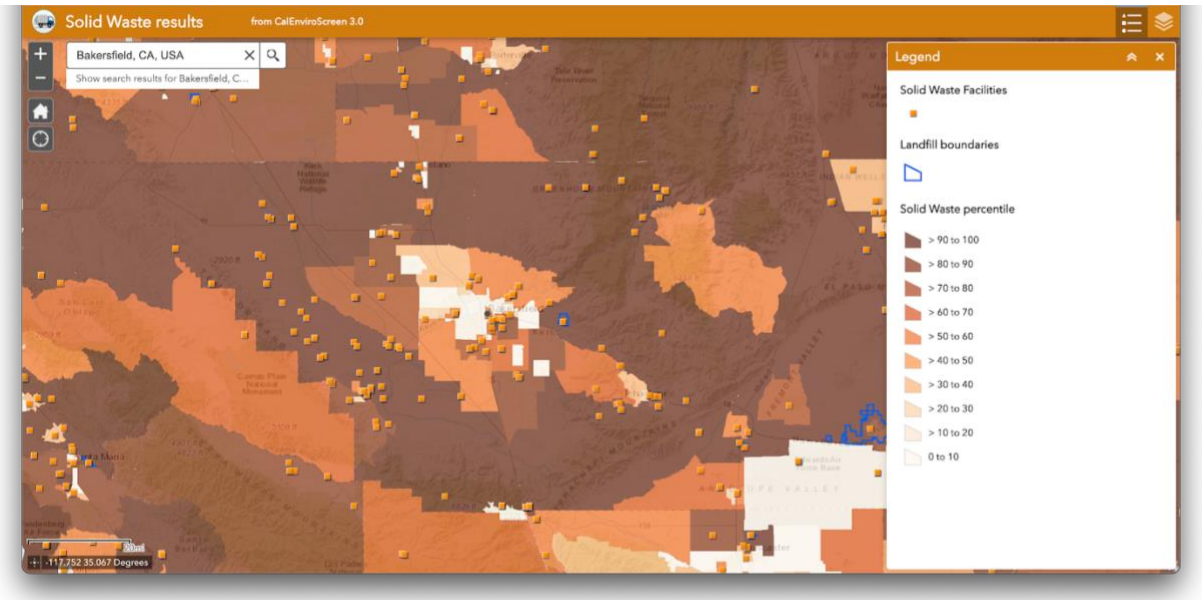
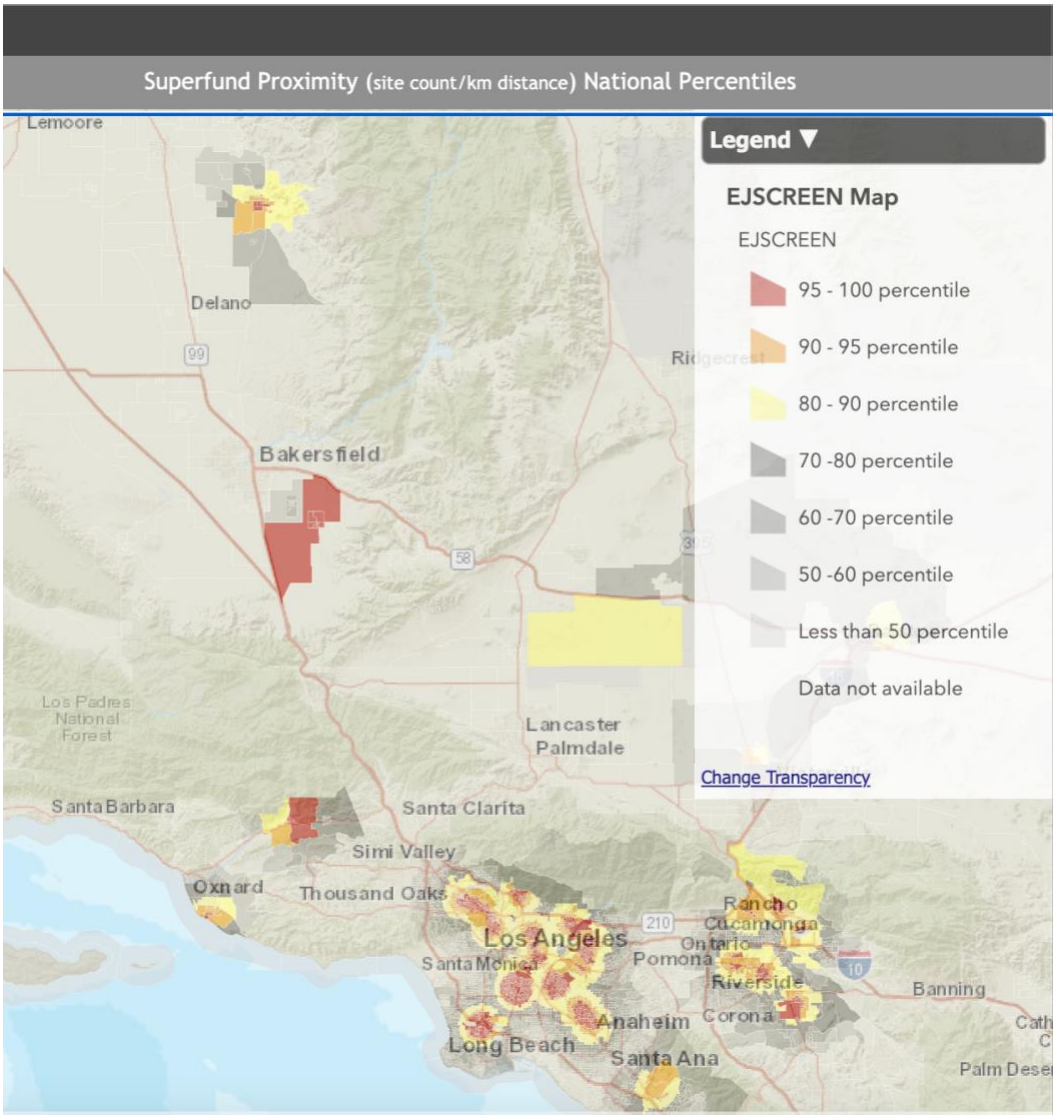



**Figure 7.** Solid waste contamination in Kern County.[227]




[226] CAL. OFFICE OF ENV'T HEALTH HAZARD ASSESSMENT, *supra* note 29.
[227] *Id.*

**Figure 8.** Superfund site near Bakersfield, CA.[228]




[228] *EJScreen*, ENV'T. PROT. AGENCY, https://www.epa.gov/ejscreen (last accessed Apr. 10, 2021).

**Table 3.** A list of the top counties that sell cow's milk ($ billions), the majority of which are in California.[229]

| Top Counties in Cow's Milk Sales ($ billions) | |
|---|---|
| Tulare, CA | 1.8 |
| Merced, CA | 1.1 |
| Gooding, ID | 0.7 |
| Stanislaus, CA | 0.7 |
| Kings, CA | 0.6 |
| Kern, CA | 0.5 |
| Yakima, WA | 0.4 |
| Lancaster, PA | 0.4 |
| Fresno, CA | 0.4 |
| San Joaquin, CA | 0.4 |

*Does not include counties withheld to avoid disclosing individual data.*

[229] U.S. DEP'T OF AGRIC., *Dairy Cattle and Milk Production* at 2 (Oct. 2014) https://www.nass.usda.gov/Publications/Highlights/2014/Dairy_Cattle_and_Milk_Production_Highlights.pdf.

**Table 4.** Demographic data on Kern, Kings, Madera, and San Joaquin Counties.[230]

| Fact | Kern County, California | Kings County, California | Madera County, California | San Joaquin County, California |
|---|---|---|---|---|
| Population estimates, July 1, 2019, (V2019) | 900,202 | 152,940 | 157,327 | 762,148 |
| Population estimates base, April 1, 2010, (V2019) | 839,621 | 152,974 | 150,834 | 685,306 |
| Population, percent change - April 1, 2010 (estimates base) to | 7.20% | 0.00% | 4.30% | 11.20% |
| Population, Census, April 1, 2010 | 839,631 | 152,982 | 150,865 | 685,306 |
| Persons under 5 years, percent | 7.60% | 7.60% | 7.30% | 6.90% |
| Persons under 18 years, percent | 28.80% | 27.00% | 27.40% | 26.80% |
| Persons 65 years and over, | 11.20% | 10.50% | 14.30% | 13.10% |
| Female persons, percent | 48.80% | 44.90% | 51.80% | 50.10% |
| White alone, percent | 82.30% | 80.80% | 85.90% | 66.10% |
| Black or African American alone, | 6.30% | 7.50% | 4.20% | 8.30% |
| American Indian and Alaska Native alone, percent | 2.60% | 3.20% | 4.40% | 2.00% |
| Asian alone, percent | 5.40% | 4.40% | 2.60% | 17.40% |
| Native Hawaiian and Other Pacific Islander alone, percent | 0.30% | 0.40% | 0.30% | 0.80% |
| Two or More Races, percent | 3.20% | 3.70% | 2.60% | 5.50% |
| Hispanic or Latino, percent | 54.60% | 55.30% | 58.80% | 42.00% |
| White alone, not Hispanic or Latino, percent | 32.80% | 31.30% | 33.20% | 30.50% |
| Veterans, 2015-2019 | 35,594 | 9,684 | 6,317 | 29,013 |
| Foreign born persons, percent, | 19.90% | 18.90% | 20.20% | 23.30% |
| Housing units, July 1, 2019, | 302,898 | 46,965 | 51,438 | 248,636 |
| Owner-occupied housing unit rate, 2015-2019 | 58.30% | 52.30% | 64.10% | 56.60% |
| Median value of owner-occupied housing units, 2015-2019 | 213,900 | 215,900 | 251,200 | 342,100 |
| Median selected monthly owner costs -with a mortgage, 2015-2019 | $1,527 | $1,459 | $1,551 | $1,907 |
| Median selected monthly owner costs -without a mortgage, 2015- | $452 | $446 | $478 | $523 |
| Median gross rent, 2015-2019 | $978 | $990 | $1,014 | $1,208 |
| Building permits, 2019 | 2,261 | 409 | 644 | 3,499 |
| Households, 2015-2019 | 270,282 | 43,452 | 44,881 | 228,567 |
| Persons per household, 2015- | 3.17 | 3.13 | 3.28 | 3.17 |
| Living in same house 1 year ago, percent of persons age 1 year+, | 86.10% | 81.90% | 87.90% | 86.80% |
| Language other than English spoken at home, percent of persons age 5 years+, 2015-2019 | 44.20% | 41.50% | 45.30% | 40.90% |
| High school graduate or higher, percent of persons age 25 years+, | 74.10% | 73.40% | 71.90% | 79.30% |
| Bachelor's degree or higher, percent of persons age 25 years+, | 16.40% | 14.70% | 14.60% | 18.80% |
| With a disability, under age 65 years, percent, 2015-2019 | 7.80% | 8.60% | 8.70% | 8.70% |
| Persons without health insurance, under age 65 years, | 9.00% | 8.50% | 10.70% | 7.80% |
| In civilian labor force, total, percent of population age 16 | 58.00% | 51.80% | 54.30% | 60.30% |
| In civilian labor force, female, percent of population age 16 | 52.40% | 51.50% | 47.90% | 53.60% |
| Total accommodation and food services sales, 2012 ($1,000) | 1,092,151 | 378,595 | 150,065 | 808,606 |
| Total health care and social assistance receipts/revenue, | 3,675,000 | 587,818 | 760,956 | 3,447,722 |
| Median household income (in 2019 dollars), 2015-2019 | $53,350.00 | $57,848.00 | $57,585.00 | $64,432.00 |
| Per capita income in past 12 months (in 2019 dollars), 2015- | $23,326.00 | $22,373.00 | $22,853.00 | $27,521.00 |
| Persons in poverty, percent | 19.00% | 16.00% | 17.60% | 13.60% |

[230] *Quick Facts*, U.S. CENSUS, https://www.census.gov/quickfacts/fact/table/US/PST045219 (last visited Apr. 10, 2021).

**Table 5.** Demographic data on Merced, Tulare, Fresno, and Stanislaus Counties.[231]

| Fact | Merced County, California | Tulare County, California | Fresno County, California | Stanislaus County, California |
|---|---|---|---|---|
| Population estimates, July 1, 2019, (V2019) | 277,680 | 466,195 | 999,101 | 550,660 |
| Population estimates base, April 1, 2010, (V2019) | 255,796 | 442,182 | 930,507 | 514,450 |
| Population, percent change - April 1, 2010 (estimates base) to July 1, 2019, (V2019) | 8.60% | 5.40% | 7.40% | 7.00% |
| Population, Census, April 1, 2010 | 255,793 | 442,179 | 930,450 | 514,453 |
| Persons under 5 years, percent | 7.70% | 7.80% | 7.60% | 7.10% |
| Persons under 18 years, percent | 29.30% | 30.50% | 28.20% | 27.00% |
| Persons 65 years and over, percent | 11.40% | 11.60% | 12.60% | 13.40% |
| Female persons, percent | 49.50% | 50.00% | 50.10% | 50.40% |
| White alone, percent | 82.20% | 88.20% | 76.60% | 83.30% |
| Black or African American alone, percent | 3.90% | 2.20% | 5.80% | 3.50% |
| American Indian and Alaska Native alone, percent | 2.50% | 2.80% | 3.00% | 2.00% |
| Asian alone, percent | 7.80% | 4.00% | 11.10% | 6.10% |
| Native Hawaiian and Other Pacific Islander alone, percent | 0.40% | 0.20% | 0.30% | 0.90% |
| Two or More Races, percent | 3.20% | 2.70% | 3.20% | 4.20% |
| Hispanic or Latino, percent | 61.00% | 65.60% | 53.80% | 47.60% |
| White alone, not Hispanic or Latino, percent | 26.50% | 27.70% | 28.60% | 40.40% |
| Veterans, 2015-2019 | 9,225 | 14,633 | 36,125 | 21,051 |
| Foreign born persons, percent, 2015-2019 | 26.30% | 21.80% | 21.20% | 20.30% |
| Housing units, July 1, 2019, (V2019) | 86388 | 151603 | 336473 | 182978 |
| Owner-occupied housing unit rate, 2015-2019 | 52.20% | 57.10% | 53.30% | 57.80% |
| Median value of owner-occupied housing units, 2015-2019 | 252,700 | 205,000 | 255,000 | 291,600 |
| Median selected monthly owner costs -with a mortgage, 2015-2019 | 1,493 | 1,420 | 1,631 | 1,702 |
| Median selected monthly owner costs -without a mortgage, 2015-2019 | $460.00 | $421.00 | $484.00 | $503.00 |
| Median gross rent, 2015-2019 | $1,021.00 | $942.00 | $998.00 | $1,155.00 |
| Building permits, 2019 | 918 | 1,872 | 3,393 | 699 |
| Households, 2015-2019 | 80,008 | 138,238 | 307,906 | 173,898 |
| Persons per household, 2015-2019 | 3.32 | 3.3 | 3.14 | 3.09 |
| Living in same house 1 year ago, percent of persons age 1 year+, 2015-2019 | 86.60% | 88.60% | 85.80% | 87.90% |
| Language other than English spoken at home, percent of persons age 5 years+, 2015-2019 | 53.30% | 51.30% | 44.60% | 42.90% |
| High school graduate or higher, percent of persons age 25 years+, 2015-2019 | 69.10% | 70.80% | 76.00% | 78.90% |
| Bachelor's degree or higher, percent of persons age 25 years+, 2015-2019 | 13.80% | 14.60% | 21.20% | 17.10% |
| With a disability, under age 65 years, percent, 2015-2019 | 9.10% | 8.20% | 9.20% | 9.00% |
| Persons without health insurance, under age 65 years, percent | 9.00% | 9.00% | 8.80% | 7.10% |
| In civilian labor force, total, percent of population age 16 years+, 2015-2019 | 59.60% | 59.00% | 60.90% | 60.90% |
| In civilian labor force, female, percent of population age 16 years+, 2015-2019 | 51.00% | 51.10% | 55.20% | 53.40% |
| Total accommodation and food services sales, 2012 ($1,000) | 232,910 | 451,880 | 1,226,169 | 705,698 |
| Total health care and social assistance receipts/revenue, 2012 ($1,000) | 788114 | 1610236 | 5325615 | 3634960 |
| Median household income (in 2019 dollars), 2015-2019 | $53,672.00 | $49,687.00 | $53,969.00 | $60,704.00 |
| Per capita income in past 12 months (in 2019 dollars), 2015-2019 | $23,011.00 | $21,380.00 | $24,422.00 | $26,258.00 |
| Persons in poverty, percent | 17.00% | 18.90% | 20.50% | 13.00% |

[231] *Id.*

**Table 6.** Quick facts on potential pathogens found in digestate and links for further information.[232]

| **Pathogen** | **Effects** | **For more information** |
|---|---|---|
| Cryptosporidium parvum | "[M]icroscopic parasite that causes the diarrheal disease cryptosporidiosis." | https://www.cdc.gov/parasites/crypto/index.html |
| Salmonella spp | "Most people with Salmonella infection have diarrhea, fever, and stomach cramps." | https://www.cdc.gov/salmonella/general/index.html |
| norovirus | "Norovirus is a very contagious virus that causes vomiting and diarrhea." | https://www.cdc.gov/norovirus/index.html |
| Streptococcus pyogenes | "[C]an cause both noninvasive and invasive disease, as well as nonsuppurative sequelae. " | https://www.cdc.gov/groupastrep/diseases-hcp/index.html |
| E. coli enteropathogenic (EPEC) | "[A]re gram-negative bacteria that inhabit the gastrointestinal tract. Most strains do not cause illness. Pathogenic E. coli are categorized into pathotypes on the basis of their virulence genes. Six pathotypes are associated with diarrhea | https://wwwnc.cdc.gov/travel/yellowbook/2020/travel-related-infectious-diseases/escherichia-coli-diarrheagenic |

[232] *Parasites – Cryptosporidium (also known as "Crypto")*, CDC, https://www.cdc.gov/parasites/crypto/index.html (last updated July 1, 2019); *Salmonella*, CDC, https://www.cdc.gov/salmonella/general/index.html (last updated Dec 5, 2019); *Norovirus*, CDC, https://www.cdc.gov/norovirus/index.html (last updated Mar. 5, 2021); *Group A Streptococcal (GAS) Disease*, CDC, https://www.cdc.gov/groupastrep/diseases-hcp/index.html (last updated May 7, 2020); Alison Winstead et al., *Escherichia coli, Diarrheagenic*, CDC, https://wwwnc.cdc.gov/travel/yellowbook/2020/travel-related-infectious-diseases/escherichia-coli-diarrheagenic (last updated July 1, 2021); J. L. Cloud et al., *Identification of Mycobacterium spp. by Using a Commercial 16S Ribosomal DNA Sequencing Kit and Additional Sequencing Libraries*, 40(2) J. Clinical Microbiology 400, 400 (Feb. 2002); *Typhoid Fever and Paratyphoid Fever*, CDC, https://www.cdc.gov/typhoid-fever/index.html (last updated Aug. 22, 2018); *Fact Sheet: Clostridium spp*, WickhamLaboratories, https://wickhamlabs.co.uk/technical-resource-centre/fact-sheet-clostridium-spp/ (last visited May 5, 2021); Listeria (Listeriosis), CDC, https://www.cdc.gov/listeria/symptoms.html (Dec. 12, 2016).

| | | |
|---|---|---|
| | (diarrheagenic) […] enteropathogenic E. coli (EPEC)" | |
| Mycobacterium spp. | "Mycobacterium species are a group of acid-fast, aerobic, slow-growing bacteria. The genus comprises more than 70 different species, of which about 30 have been associated with human disease (23)." | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC153382/#:~:text=Mycobacterium%20species%20are%20a%20group,the%20causative%20agent%20of%20tuberculosis |
| Salmonella typhi (followed by S. paratyphi) | "Typhoid fever and paratyphoid fever are life-threatening illnesses caused by Salmonella serotype Typhi and Salmonella serotype Paratyphi, respectively." | https://www.cdc.gov/typhoid-fever/index.html |
| Clostridium spp. | "Clostridia are one of the most commonly studied anaerobes that cause disease in humans". Some of the species of Clostridium can cause: botulism, overgrow in the intestine compromising the inherent gut flora (potentially leading to colitis), tetanus, gas gangrene (myonecrosis), and toxic shock syndrome. | https://wickhamlabs.co.uk/technical-resource-centre/fact-sheet-clostridium-spp/ |
| Listeria monocytogenes | "[C]an cause fever and diarrhea similar to other foodborne germs, but this type of Listeria infection is rarely diagnosed. Symptoms in people with invasive listeriosis, meaning the bacteria has spread beyond the gut, depend on whether the person is pregnant." | https://www.cdc.gov/listeria/symptoms.html |

*Attach. 2*

# TOLLING AGREEMENT

This Tolling Agreement ("Agreement") is entered into effective November 29, 2021, between ASSOCIATION OF IRRITATED RESIDENTS, FOOD & WATER WATCH, LEADERSHIP COUNSEL FOR JUSTICE & ACCOUNTABILITY, and ANIMAL LEGAL DEFENSE FUND (collectively, "Petitioners") and the CALIFORNIA AIR RESOURCES BOARD ("CARB").

## RECITALS

WHEREAS, on October 27, 2021, Petitioners filed the PETITION FOR RULEMAKING TO EXCLUDE ALL FUELS DERIVED FROM BIOMETHANE FROM DAIRY AND SWINE MANURE FROM THE LOW CARBON FUEL STANDARD PROGRAM ("Petition"), pursuant to Government Code § 11340.6.

WHEREAS, CARB acknowledged receipt of the Petition in a written letter to Petitioners sent on November 8, 2021.

WHEREAS, Government Code section 11340.7(a) provides thirty (30) days for CARB to respond to the merits of the Petition.

WHEREAS, on November 18, 2021, CARB requested that Petitioners enter into a 60-day tolling agreement to toll the deadline under Government Code section 11340.7(a) to allow CARB additional time to respond to the Petition and to provide time for Petitioners and CARB to reach common ground on matters alleged in the Petition.

WHEREAS, on November 24, 2021, Petitioners agreed to a 60-day tolling agreement to allow CARB additional time to respond to the Petition to conserve resources and potentially allow Petitioners and CARB to reach common ground.

WHEREAS, this Agreement memorializes the agreement reached by Petitioners and CARB on November 24, 2021.

NOW THEREFORE, in consideration of the mutual terms, covenants, conditions and promises contained herein, the Petitioners and CARB hereto agree as follows.

TERMS

1. All of the foregoing recitals are incorporated herein by reference.

2. Subject to any subsequent agreements between Petitioners and CARB, CARB shall respond to the Petition by January 28, 2022.

3. CARB and Petitioners shall engage in good faith discussions in an effort to reach common ground with respect to the issues raised in the Petition between November 29, 2021, and January 28, 2022.

4. Any statutes of limitations to challenge CARB's response to the Petition pursuant to Government Code § 11340.7(a) shall be tolled as of November 24, 2021, and shall be tolled until January 28, 2022.

CALIFORNIA AIR RESOURCES BOARD

Gabriel Monroe, Attorney for CARB



12/06/2021

ASSOCIATION OF IRRITATED RESIDENTS

Tom Frantz, President



12/06/2021

FOOD AND WATER WATCH

Tyler Lobdell, Staff Attorney



12/6/21

LEADERSHIP COUNSEL for JUSTICE AND ACCOUNTABILITY

Phoebe Seaton, Attorney for Leadership Counsel for Justice and Accountability



12/6/21

ANIMAL LEGAL DEFENSE FUND

Christine Ball-Blakely, Staff Attorney



12/6/21

*Attach. 3*












January 07, 2022

Submitted via ca.gov

Liane M. Randolph, Chair
California Air Resources Board
1001 I Street
Sacramento, CA 95814

Re: Public Workshop: Potential Future Changes to the LCFS Program

Dear Chair Randolph and CARB Staff,

The Association of Irritated Residents, Leadership Counsel for Justice & Accountability, Animal Legal Defense Fund, Food & Water Watch, and Public Justice (collectively "Commenters") thank you for hosting the December 7th, 2021, public workshop and for the opportunity to submit comments regarding changes to the LCFS program. On October 27, 2021, Commenters submitted the Petition for Rulemaking to Exclude All Fuels Derived from Biomethane from Dairy and Swine Manure from the Low Carbon Fuel Standard Program ("Petition"), provided here as Attachment A. The Petition lays out critical changes that CARB must implement to effectively reform the LCFS; first and foremost, by excluding factory farm "biogas" from the LCFS entirely. As presently implemented, the LCFS is incentivizing and rewarding the intentional and avoidable production of GHGs at factory farms, which in turn entrenches some of the worst practices used by factory farms that pollute air and water at the local, regional, and global levels. The wildly inflated and illusory factory farm gas credits that CARB certifies undermine the integrity of the LCFS program and contribute to the unlawful disproportionate impacts on California's lower income communities and communities of color

from both the factory farm industry as well as increased emissions from dirty transportation fuel providers.

Commenters submit the Petition for the record here and respectfully ask that CARB promptly initiate rulemaking in response. Numerous parties expressed opposition to CARB's suggestion that any LCFS rulemaking must wait for finalization of the 2022 Scoping Plan, and Commenters join that chorus. Waiting until 2024 or beyond to implement reforms to the LCFS in response to the Petition is unacceptable, unnecessary, and would constitute an abuse of discretion. Therefore, we request that CARB immediately initiate rulemaking in response to the Petition.

Commenters also request that CARB staff stay certification of factory farm gas tier 2 applications at least until CARB provides its formal response to the Petition and during any subsequent rulemaking. Commenters continue to oppose these applications because certification will lock in the market distortions and disproportionate impacts explained in detail in the Petition, violating both California and federal law. CARB is under no obligation to certify such applications by a date certain, and the serious flaws in the LCFS program's treatment of factory farm gas warrant delay while CARB addresses these program failures.

Thank you again for this opportunity to comment on potential changes to the LCFS. We look forward to CARB's response to the Petition and attendant rulemaking.

Respectfully,

Phoebe Seaton
Leadership Counsel for Justice & Accountability

Tom Frantz
Association of Irritated Residents

Christine Ball-Blakely
Animal Legal Defense Fund

Tyler Lobdell
Food & Water Watch

Brent Newell
Public Justice

# Attachment A: Petition for Rulemaking to Exclude All Fuels Derived from Biomethane from Dairy and Swine Manure from the Low Carbon Fuel Standard Program

**BEFORE THE CALIFORNIA AIR RESOURCES BOARD**

# PETITION FOR RULEMAKING TO EXCLUDE ALL FUELS DERIVED FROM BIOMETHANE FROM DAIRY AND SWINE MANURE FROM THE LOW CARBON FUEL STANDARD PROGRAM

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## PETITION FOR RULEMAKING

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# I. INTRODUCTION

The California Air Resources Board (CARB) allows inflated and non-additional credits derived from factory farm gas[1] to undermine the integrity of the Low Carbon Fuel Standard (LCFS) pollution trading scheme and exacerbate discriminatory environmental and public health harms in the San Joaquin Valley. The LCFS increases harmful pollution to air, water, and land in rural low-income and Latina/o/e communities; inflates factory farm gas reductions by excluding upstream and downstream emissions; allows non-additional reductions from other factory farm gas incentive programs to generate credits; fails to achieve reductions from transportation fuels when these inflated and non-additional factory farm credits justify excessive fossil fuel emissions; and perversely incentivizes increased greenhouse gas emissions and pollution from dairy and pig factory farms.

To remedy these deficiencies, the Association of Irritated Residents (AIR), Leadership Counsel for Justice & Accountability, Food & Water Watch, and Animal Legal Defense Fund petition the CARB for rulemaking to amend the LCFS to exclude all fuels derived from factory farm gas. In the alternative, CARB must reform the LCFS program to account for the full life cycle of factory farm gas emissions – including all upstream and downstream emissions from activities and inputs at dairy and pig facilities – and exclude non-additional emissions reductions that occur as a result of other factory farm gas incentives, including the Dairy Digester Research Development Program. CARB must also take steps to ensure that its policies and practices do not impose discriminatory harms on low-income and Latina/o/e communities in the San Joaquin Valley.

In 2006, the California Legislature determined that climate change posed "a serious threat to the economic well-being, public health, natural resources, and the environment of California."[2] To address these threats, CARB designed a range of programs that would monitor, regulate, and ultimately reduce greenhouse gas emissions, including the LCFS.[3] But as written and as implemented, the LCFS pathways for factory farm gas do not effectively reduce greenhouse gas emissions, violating CARB's obligation to achieve the maximum cost-effective and technologically feasible emissions reductions.

The LCFS intentionally promotes factory farm gas, a fusion of Big Ag and Big Oil & Gas, two of the industries most responsible for the climate crisis and whose entire business model relies on extraction and exploitation. Big Ag brought us polluted wells, foul air, antibiotic-resistant pathogens, methane-spewing manure lagoons, and workplace conditions that caused rampant outbreaks of COVID-19. Big Ag has driven family farmers off their farms, stripped wealth from our communities, and gutted our rural main streets. Big Oil & Gas brought us countless oil spills, tanker wrecks, pipeline explosions, and climate damage. There is no reason to entrust our future to the very industries responsible for the harms the LCFS seeks to address.

[1] Factory farm gas refers to the fuel the LCFS designates "biomethane from the anaerobic digestion of dairy and swine manure."
[2] CAL. HEALTH & SAFETY CODE § 38501.
[3] CAL. HEALTH & SAFETY CODE § 38510.

The results of CARB's embrace of these false solutions to the benefit of Big Ag and Big Oil & Gas are clear: due to the LCFS's deficient accounting of the emissions from factory farm gas, the program encourages increased production of the liquified manure necessary to generate factory farm gas, resulting in *more* intentionally created methane from new and expanding dairy and pig facilities. By propping up factory farm gas, the LCFS provides a new way for big corporations to get rich off a problem they created. In CARB's accounting of the carbon intensity of factory farm gas, the LCFS fails to include the full quantity of associated upstream and downstream greenhouse gas emissions, leading to an exaggerated negative carbon intensity value and a corresponding inflation of LCFS credit prices for factory farm gas. The resulting inflated credits do not encourage emissions reductions, instead, they reward factory farms for the production of toxic manure as though it were a cash crop. This "hot air" in the credit market, along with the award of credits for reductions from other incentive programs that would have occurred anyway, undermines the LCFS framework by allowing transportation fuel producers to emit more climate pollution based on illusory reductions.

No amount of corporate public relations spin, greenwashing, or deficient carbon intensity calculations can hide the fact that factory farm gas is created from massive harm. By incentivizing increased manure production and liquification, the LCFS program also fails to maximize additional environmental benefits in violation of the *Global Warming Solutions Act of 2006* (AB 32), and even increases the well-documented environmental and public health harms caused by pig and dairy factory farms. These facilities release enormous quantities of solid, liquid, and gaseous waste. In addition to greenhouse gas emissions, the waste from both pigs and dairy cows releases various co-pollutants including ammonia, hydrogen sulfide, volatile organic compounds (VOCs), and severe odor. The factory farm system relies on disposing the manure nitrogen on crops, which also leads to both nitrous oxide emissions and nitrate contamination of groundwater. Experience tells us that racism, exploitation, and extraction are embedded in the factory farm system – we know these harms are disproportionately imposed on Black, Indigenous, People of Color, and low-income communities around the country. In California, these harms discriminatorily impact low-income and Latina/o/e communities in the San Joaquin Valley in violation of state and federal law.[4]

CARB has an affirmative duty under Government Code section 11135 (CA 11135) and Title VI of the Civil Rights Act of 1964, 42 U.S.C. § 2000d, to ensure that its policies and practices do not have a discriminatory impact on the basis of race.[5] CARB has an affirmative duty under AB 32 to ensure that "activities undertaken to comply with the regulations do not disproportionately impact low-income communities" and to design regulations in a manner that is equitable.[6] Finally, Government Code section 12955 (CA 12955) prohibits any practice or program that has a discriminatory effect on members of protected classes with respect to housing opportunities, including with respect to the use and enjoyment of dwellings.[7] Furthermore, the

[4] Addressing discriminatory impacts resulting from the LCFS's inclusion of factory farm gas in other parts of the country where dairy and pig factory farms are concentrated is beyond the scope of this petition. However, CARB should also evaluate these potential impacts, given that the program includes applicants from around the country. CAL. AIR RES. BD., *LCFS Pathways Requiring Public Comments*, https://ww2.arb.ca.gov/resources/documents/lcfs-pathways-requiring-public-comments#t2.

[5] CAL. GOV'T CODE § 11135; 42 U.S.C. § 2000d.

[6] CAL. HEALTH & SAFETY CODE § 38562(b).

[7] CAL. GOV'T CODE § 12955.8; CAL. CODE REGS. TIT. 2 § 12161.

accountability our democracy depends on the public knowing the truth: who is benefiting, where the money is coming from, who is defining the problem, who is being impacted, and how they are harmed by the LCFS. By failing to even conduct a transparent disparity analysis of this highly-technical program, CARB impedes the public's ability to fairly evaluate CARB's choice to prop up Big Ag and Big Oil & Gas.

A people's government – our government – protects and serves the people's interests. It invests in food and climate solutions that create a healthy future for our children and grandchildren. It invests in good jobs that strengthen our rural communities. But CARB has created and implemented a pollution trading scheme that benefits polluters rather than uses the power granted by the people of California to prevent harms. On top of decades of discriminatory impacts in the San Joaquin Valley, California is facing the dire impacts of the climate crisis. We cannot afford a scheme that serves corporate interests over the people's needs.

To remedy these harms and to bring the LCFS regulation into compliance with state and federal law, the petitioners request that CARB amend section 95488.9 of the LCFS to exclude any "fuel pathway that utilizes biomethane from dairy and swine manure digestion."[8] In the alternative, petitioners request that CARB amend the LCFS regulation to (a) ensure that the life cycle analysis for biomethane from dairy and swine manure is expanded to include a full accounting of life cycle emissions; (b) amend section 95488.9 to ensure additionality of reductions; (c) properly classify methane from swine and dairy factory farms as intentionally occurring; (d) ensure compliance with state and federal civil rights law, including but not limited to conducting disparity analyses of LCFS pathways and credit trading; and (e) ensure the LCFS provides environmental benefits and does not degrade water quality and interfere with efforts to improve air quality in the San Joaquin Valley.

## II. BACKGROUND

### A. THE LCFS PROGRAM

AB 32 set a statewide target to reduce California's greenhouse gas emissions to 1990 levels by 2020.[9] In 2007, Governor Arnold Schwarzenegger issued Executive Order S-01-07, which directed CARB to adopt the LCFS pollution trading scheme to diversify California's transportation fuels and curb dependence on petroleum.[10] The California Office of Administrative Law approved the LCFS regulation in 2010 and the regulation has since undergone four rounds of amendments.[11]

According to CARB, "[T]he LCFS is designed to encourage the use of cleaner low-carbon transportation fuels in California, encourage the production of those fuels, and therefore, reduce

[8] CAL. CODE REGS. TIT. 17 § 95488.9.
[9] CAL. HEALTH & SAFETY CODE § 38550.
[10] CAL. EXEC. DEP'T, Exec. Order No. S-01-07, (Jan. 22, 2007), *available at* https://www.library.ca.gov/Content/pdf/GovernmentPublications/executive-order-proclamation/5107-5108.pdf; *see also generally,* CAL. HEALTH & SAFETY CODE § 38560.5 (requiring CARB to establish GHG reduction measures).
[11] CAL. CODE REGS. TIT. 17 § 95480 et seq.

greenhouse gas emissions and decrease petroleum dependence in the transportation sector."[12] The LCFS, like similar pollution trading schemes, constructs a market where credits and deficits that represent emissions in relation to a declining baseline can be traded. These tradeable LCFS credits provide a new revenue stream for producers of fuels that have been deemed low-carbon intensity with the goal of incentivizing increased production and displacing the use of more greenhouse gas-intensive fuels. The LCFS requires entities that produce conventional transportation fuels to report the carbon intensity of these fuels, while certain alternative fuel producers may opt into the program and demonstrate their fuel's carbon intensity in their application.[13]

Every year, CARB sets progressively lower benchmarks for the carbon intensity of fuels.[14] Transportation fuels with carbon intensity values above the annual benchmark generate deficits, and transportation fuels with carbon intensity values below the benchmark generate credits (see Figure 1, Appendix C).[15] While obligated parties are required to either meet the benchmark or purchase credits to offset the extra emissions associated with their fuel, voluntary parties that produce alternative, low-CI fuels are incentivized to participate because fuels with carbon intensities below the benchmark generate revenue through the sale of LCFS credits.[16]

The LCFS regulation defines "carbon intensity" as "the quantity of life cycle greenhouse gas emissions, per unit of fuel energy, expressed in grams of carbon dioxide equivalent per megajoule ($gCO_2e/MJ$)."[17] The emissions included in each fuel's carbon intensity calculation are usually bounded by "fuel pathways," defined as "the collective set of processes, operations, parameters, conditions, locations, and technologies throughout all stages that CARB considers appropriate to account for in the system boundary of a complete well-to-wheel analysis of [a given] fuel's life cycle greenhouse gas emissions."[18] Accurate and thorough life cycle analyses for each fuel and the accurate accounting of the baseline against which each fuel's carbon intensity is compared are independent and necessary preconditions for the program to identify which fuels to encourage to decrease net greenhouse gas emissions.

The LCFS classifies fuel pathways into three groups: Lookup Table, Tier 1, and Tier 2 pathways.[19] Regulated parties can register their fuels using the standard pathways in the Lookup

[12] *Low Carbon Fuel Standard: About,* CAL. AIR RES. BD., https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/about (last visited Oct. 12, 2021).
[13] CAL. CODE REGS. TIT. 17 §§ 95483-95483.1.
[14] CAL. CODE REGS. TIT. 17 § 95484.
[15] *Id.*
[16] CARB accounts for credits and implements credit transfers with the LCFS Reporting Tool and Credit Bank & Transfer System. CAL. AIR RES. BD., *LCFS Registration and Reporting*, https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/lcfs-registration-and-reporting (last visited Oct. 12, 2021).
[17] CAL. CODE REGS. TIT. 17 § 95481(a)(26). "Life Cycle Greenhouse Gas Emissions," in turn, is defined as "the aggregate quantity of greenhouse gas emissions (including direct emissions and significant indirect emissions, such as significant emissions from land use changes) as determined by the Executive Officer, related to the full fuel life cycle, including all stages of fuel and feedstock production and distribution, from feedstock generation or extraction through the distribution and delivery and use of the finished fuel to the ultimate consumer, where the mass values for all greenhouse gases are adjusted to account for their relative global warming potential. CAL. CODE REGS. TIT. 17 § 95481(a)(88).
[18] CAL. CODE REGS. TIT. 17 § 95481(a)(66).
[19] CAL. CODE REGS. TIT. 17 § 95488.1(a).

Table if the fuel produced "closely corresponds" to a Lookup Table pathway.[20] Tier 1 and Tier 2 pathways are open to voluntary applicants, including those seeking credit for factory farm gas. Tier 1 is for "the most common low carbon fuels" and uses a Simplified CI calculator, where Tier 2 is for "innovative, next generation fuel pathways," and uses the full CA-GREET3.0 model.[21] Tier 1 includes fuels like ethanol and biomethane anaerobic digesters of dairy and swine manure, among others.[22] Tier 2 includes fuels from sources not in Tier 1 as well as pathways included in Tier 1 that use "innovative production methods."[23] The majority of factory farm gas producers apply for Tier 2 pathways rather than the Tier 1 pathway.

Ten years after enacting AB 32, the California Legislature set a new target for greenhouse gas emissions in Senate Bill 32 (SB 32) – 40 percent below 1990 levels.[24] The Legislature stipulated, however, that SB 32 would only be operative if it also enacted Assembly Bill 197 (AB 197), which amended AB 32 in several ways.[25] AB 197 added Section 38562.5, which required that regulations promulgated to achieve emissions reductions beyond the statewide greenhouse gas limit, including the LCFS, consider the social costs of greenhouse gases, prioritize direct emissions reductions, and incorporate the requirements of Section 38562(b).[26] These requirements include crucial mandates to design the regulations in a manner that is equitable; ensure that activities taken to comply with the regulations "do not disproportionately impact low-income communities" and "do not interfere with, efforts to achieve and maintain federal and state ambient air quality standards and to reduce toxic air contaminant emissions;" and consider the overall societal benefits, including reductions in other air pollutants and other benefits to the environment.[27]

### B. THE SAN JOAQUIN VALLEY

California's San Joaquin Valley, as discussed in this petition, refers to eight counties that compose the valley floor from San Joaquin County in the north, to Kern County in the south. While disadvantaged communities within the region confront air pollution, toxic emissions, and unsafe drinking water at rates and degrees disproportionate to other communities in the state, the San Joaquin Valley is also home to resilient, diverse communities and networks that have worked together over decades to promote robust mutual aid networks, expand civic engagement, and lead

[20] CAL. CODE REGS. TIT. 17 § 95488.5(a)(1)-(6) ("Closely corresponds" means that the applicant's fuel pathway and a pathway on the Lookup Table are consistent in feedstock, production technology, the region in which the feedstock and fuel is produced, transport distance (if applicable), types and amount of thermal and electrical energy used in feedstock and finished fuel production, and that the CI of the entity's product is lower than or equal to the CI of the pathway in the lookup table.)

[21] CAL. AIR RES. BD., LCFS Guidance 19-01, Book and Claim Accounting for Low-CI Electricity 2, *available at* https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/guidance/lcfsguidance_19-01.pdf. While Tier 1 applicants provide a "discrete set of inputs" based on the specifics of their operations to be used by one of the pre-existing Tier 1 Simplified CI Calculators, Tier 2 applicants must conduct and submit a full life cycle analysis using the CA-GREET3.0 model for their own customized pathway. CAL. CODE REGS. TIT. 17 § 95488.3.

[22] CAL. CODE REGS. TIT. 17 § 95488.1(c).

[23] CAL. CODE REGS. TIT. 17 § 95488.1(d).

[24] CAL. HEALTH & SAFETY CODE § 38566.

[25] SB 32, 2016 CAL. LEGIS. SERV. CH. 249.

[26] AB 197, 2016 CAL. LEGIS. SERV. CH. 250.

[27] CAL. HEALTH & SAFETY CODE §§ 38562(2), (4), (6).

efforts from the household to the community level to model climate resilience and environmental stewardship.

The region is known for and, to a great extent, characterized by industrial agricultural operations, including large confined animal feeding operations. Decades of similar investment, land use, and economic development strategies have failed and continue to fail to prioritize the economic well-being and health of San Joaquin Valley residents, leading to severe income inequality, poverty, and environmental degradation despite the inherent assets of the region.

The "disadvantaged communities" of California, as defined pursuant to Senate Bill 535, are concentrated in the San Joaquin Valley.[28] Seven of the eight counties in the Valley (all except San Joaquin County) report mean income well below the 120% limit that defines low-income.[29] Every county in the San Joaquin Valley has lower household and per capita incomes, and higher poverty rates than California as a whole.[30] While median household income in California in 2019 was $75,235, countywide household median incomes for San Joaquin Valley Counties ranged from $49,687 to $64,432. The highest producing dairy counties in the state and in the San Joaquin Valley, Merced and Tulare, show median household incomes at $53,672 and $49.687 – both at 71 percent or below statewide median income.[31] Notably, nine of ten of the most recent applications for consideration for Low Carbon Fuel Standard Tier 2 Pathways from California factory farm gas were in Tulare County and Kern County. Kern County, like Merced and Tulare, faces disproportionately high poverty rates at 19 percent. Even this data likely inflates reported income level, because it may exclude the San Joaquin Valley's thousands of undocumented residents and residents of the Valley's unincorporated communities.[32]

San Joaquin Valley residents are disproportionately Latina/o/e as compared to California as a whole. All eight San Joaquin Valley Counties have higher Latino populations than the state,[33] with populations ranging from 42 percent to 65.6 percent, as compared to the state population with

[28] CAL. ENV'T PROT. AGENCY, *Designation of Disadvantaged Communities Pursuant to Senate Bill 535 (De León)* 1-32 (Apr. 2017), https://calepa.ca.gov/wp-content/uploads/sites/6/2017/04/SB-535-Designation-Final.pdf.
[29] Section 39711 of the Health and Safety Code sets the ceiling for low-income communities at 120% of the area median income. Additionally, Section 39711 designates communities with disproportionate environmental impacts and concentrations of low income, high unemployment, low educational attainment, and other burdensome socioeconomic factors as disadvantaged communities. All eight counties of the San Joaquin Valley fall within these categories. *See Maps & Data,* CAL. OFFICE OF ENV'T HEALTH HAZARD ASSESSMENT, https://oehha.ca.gov/calenviroscreen/maps-data (last visited Apr. 9, 2021) (flagging areas of California that exhibit high to low pollution burdening scores). *Income Limits*, U.S. DEP'T OF HOUSING AND URBAN DEV., https://www.huduser.gov/portal/datasets/il.html#2020_data (last updated Apr. 1, 2020) (choose 30% Income Limit for ALL Areas (Excel)); *FY 2020 State Income Limits* (2020), U.S. DEP'T OF HOUSING AND URBAN DEV., https://www.huduser.gov/portal/datasets/il/il20/State-Incomelimits-Report-FY20r.pdf.
[30] *Quick Facts*, U.S. CENSUS, https://www.census.gov/quickfacts/fact/table/POP645219 (last visited Oct. 12, 2021).
[31] Poverty rates in every single county in the San Joaquin Valley also exceed poverty rates in California, with Merced, Tulare facing 17 and 18.9 percent poverty rates (as compared to 11.8 percent at the statewide level). *Quick Facts*, U.S. CENSUS, https://www.census.gov/quickfacts/fact/table/POP645219 (last visited Oct. 12, 2021).
[32] 310,000 people live in low-income unincorporated communities in the San Joaquin Valley – "this is 70,000 more than what the Census Bureau included in its low-income Census Designated Places in the San Joaquin Valley." POLICYLINK, *California Unincorporated: Mapping Disadvantaged Communities in the San Joaquin Valley* 9 (2013), https://www.policylink.org/sites/default/files/CA%20UNINCORPORATED_FINAL.pdf.
[33] Latino is the term used by the U.S. Census.

39.4 percent of residents classified as Latino. At least seven of eight San Joaquin Valley communities have a lower proportion of white residents as compared to the state as a whole.[34] Merced and Tulare counties have white, non-Latino populations of 26.5 and 27.7 percent, and Latino populations of 65.6 and 61 percent, respectively.[35] Like Merced and Tulare, Kern County also demonstrates much higher Latino populations than the rest of the state, with a Latino population of 54.6 percent.

The disproportionately low-income and Latina/o/e residents of the San Joaquin Valley are exposed to the worst air quality in the state by most measures and lower income communities in the San Joaquin Valley are disproportionately subject to water contaminated with nitrates, arsenic, and 1,2,3 TCP, among others. The San Joaquin Valley is classified as an area that fails to meet several federal health-based standards for fine particulate matter ($PM_{2.5}$).[36] According to the American Lung Association, the San Joaquin Valley cities of Fresno-Madera-Hanford and Bakersfield are the second and third most polluted with respect to short-term exposure to $PM_{2.5}$.[37] The Valley cities of Bakersfield, Fresno-Madera-Hanford, and Visalia are the first, second, and third most polluted with respect to long-term exposure to $PM_{2.5}$.[38] The Valley also violates health-based standards for ozone.[39] Bakersfield, Visalia, and Fresno-Madera-Hanford are the second, third, and fourth most ozone-polluted cities in the in United States.[40] The San Joaquin Valley contains about half of California's 300 public water systems that currently serve unsafe drinking water.[41] Over the past three decades, nitrate levels in drinking water have exceeded the federal maximum contaminant level of 45 mg/L $NO_3$ (equivalent to 10 mg/L nitrate-N) in an estimated 24 to 40% of domestic wells in different counties in the San Joaquin Valley, compared to 10 to 15% of California's overall water supply.[42]

This pollution impacts the health and well-being of San Joaquin Valley residents.[43] Short-term exposure to $PM_{2.5}$ pollution causes premature death, decreased lung function, exacerbates respiratory disease such as asthma, and causes increased hospital admissions.[44] Long-term

[34] According to recent census data, 36.5 percent of the state population is classified as white, non-Latino, while 7 of the 8 counties in the San Joaquin Valley have white, non-Latino populations that range from only 26.5 to 33.2 percent. *Quick Facts*, U.S. CENSUS, https://www.census.gov/quickfacts/fact/table/POP645219 (last visited Oct. 12, 2021).
[35] *Quick Facts*, U.S. CENSUS, https://www.census.gov/quickfacts/fact/table/POP645219 (last visited Oct. 12, 2021).
[36] 80 FED. REG. 18,528 (April 7, 2015); 81 FED. REG. 2,993 (January 20, 2016); 80 FED. REG. 2,206, 2,217 (January 15, 2015).
[37] AM. LUNG ASSN., *State of the Air 2021* 37, *available at* https://www.lung.org/getmedia/17c6cb6c-8a38-42a7-a3b0-6744011da370/sota-2021.pdf.
38 *Id.* at 38.
[39] 75 FED. REG. 24409 (May 5, 2010); 77 FED. REG. 30088, 30092 (May 21, 2012).
[40] AM. LUNG ASSN., *supra* note 37 at 36.
[41] Del Real, J.A., *They Grow the Nation's Food, but They Can't Drink the Water*, N.Y. TIMES (May 21, 2019), https://www.nytimes.com/2019/05/21/us/california-central-valley-tainted-water.html.
[42] Eli Moore, et al., *The Human Costs of Nitrate-contaminated Drinking Water in the San Joaquin Valley*, PAC. INST., 11 (2011), https://pacinst.org/publication/human-costs-of-nitrate-contaminated-drinking-water-in-the-san-joaquin-valley/.
[43] The COVID-19 pandemic has made exposure to particulate matter even more dangerous, further highlighting the health risks associated with air pollution from factory farm dairies and factory farm gas. Xiao Wu et al., *Air pollution and COVID-19 mortality in the United States: Strengths and limitations of an ecological regression analysis*, 6 SCI. ADVANCES 1 at 1-2 (Nov. 4, 2020), https://advances.sciencemag.org/content/6/45/eabd4049.
[44] AM. LUNG ASSN., *supra* note 37 at 37-38.

exposure can cause asthma and decreased lung function in children, increased risk of death from cardiovascular disease, and increased risk of death from heart attacks.[45] Nitrates in drinking water can cause serious illness and death in infants ("blue baby syndrome") and are linked to pregnancy complications and birth defects, Sudden Infant Death Syndrome, and respiratory tract infections and a number of different cancers in adults and children.[46]

CARB has acknowledged that $PM_{2.5}$ exposure alone "is responsible for about 1,200 cases of premature death in the Valley each year."[47] San Joaquin Valley residents, who CalEnviroScreen designate a "sensitive population," experience higher rates of asthma, low birth weight, and cardiovascular disease compared to state incidence rates.[48] The California Institute for Rural Studies estimates that the costs of these air quality-related health harms total over $6 billion per year in the San Joaquin Valley.[49] This pollution also impacts residents' quality of life. For example, children in the San Joaquin Valley suffer from lack of access to outdoor recreation – on days with especially poor air quality, which occurred 40 days in Kern County in 2018, local authorities recommend that schools hold recess indoors.[50]

## III. CARB MUST EXCLUDE BIOMETHANE FROM DAIRY AND SWINE MANURE FROM THE LCFS OR IN THE ALTERNATIVE AMEND THE REGULATION TO ACCURATELY ACCOUNT FOR THE FULL CARBON INTENSITY OF THESE FUELS AND PROHIBIT CREDITS FROM NON-ADDITIONAL REDUCTIONS.

The LCFS violates sections 38560.5, 38562(b), 38562(d)(2), 38562.5 of the Health & Safety Code because it fails to achieve the maximum technologically feasible and cost-effective emissions reductions, fails to maximize additional environmental benefits, fails to ensure additionality of reductions, and exacerbates harms associated with industrial animal agriculture, including toxic air contaminants and dangerous water pollution. These failures prevent the state from maximizing greenhouse gas emissions reductions from transportation fuels and constitute a failure to use best scientific practices, as required by section 38562(e). Moreover, they harm San

[45] *Id*. at 38-39.
[46] WIS. DEP'T OF HEALTH SERV., *Infant Methemoglobinemia (Blue Baby Syndrome)*, https://www.dhs.wisconsin.gov/water/blue-baby-syndrome.htm (last updated Mar. 12, 2021).
[47] CAL. AIR RES. BD., *Clean-air plan for San Joaquin Valley first to meet all federal standards for fine particle pollution* (Jan. 24, 2019), https://ww2.arb.ca.gov/news/clean-air-plan-san-joaquin-valley-first-meet-all-federal-standards-fine-particle-pollution.
[48] *Indicators Overview*, CAL. OFFICE OF ENV'T HEALTH HAZARD ASSESSMENT, https://oehha.ca.gov/calenviroscreen/indicators#:~:text=Sensitive%20population%20indicators%20measure%20the,of%20their%20age%20or%20health (last visited Oct. 21, 2021); *see* AM. LUNG ASSN., *supra* note 37 at 23; Ashley E. Larsen et al., *Agricultural pesticide use and adverse birth outcomes in the San Joaquin Valley of California*, 6 NATURE COMMC'N 1, AT 4-8 (2007); Amy M. Padula et al., *Traffic-Related Air Pollution and Risk of Preterm Birth in the San Joaquin Valley of California*, 24(12) ANN EPIDEMIOL 1, 6-9; *see also* Robbin Marks, Nat. Res. Def. Council, *Cesspools of Shame: How Factory Farm Lagoons and Sprayfields Threaten Environmental and Public Health* (2001), https://www.nrdc.org/sites/default/files/cesspools.pdf.
[49] Lisa Kresge and Ron Strochlic, *Clearing the Air: Mitigating the Impact of Dairies on Fresno County's Air Quality and Public Health*, CAL. INST. FOR RURAL STUDIES 8, (Jul. 2007).
[50] Brendan Borrell, *California's Fertile Valley is Awash with Air Pollution*, MOTHERJONES (Dec. 10, 2018), https://www.motherjones.com/environment/2018/12/californias-fertile-valley-is-awash-in-air-pollution/. *See also Policies and Procedures for Poor Outdoor Air Quality Days*, SAN JOAQUIN VALLEY AIR POLLUTION CONTROL DIST., http://www.valleyair.org/programs/ActiveIndoorRecess/intro.htm (last visited Oct. 12, 2021).

Joaquin Valley communities with increased air and water pollution from factory farm dairies subsidized by the LCFS – harms the Legislature sought to address when it enacted AB 32 and AB 197.[51] For all of these reasons, CARB should amend the LCFS to exclude all fuels derived from biomethane from swine and dairy manure.[52] If CARB fails to do so, it must at a minimum amend the regulation to capture the full life cycle of associated greenhouse gas emissions in both the established Tier 1 pathway and the customized Tier 2 pathways and amend the regulation to ensure credited reductions are additional.[53]

### A. The fuel pathways for biomethane from dairy and swine manure fail to achieve the maximum technologically feasible and cost-effective emissions reductions.

AB 32 mandates that the early action measure regulations adopted by CARB "shall achieve the maximum technologically feasible and cost-effective reductions in greenhouse gas emissions from those sources or categories of sources, in furtherance of achieving the statewide greenhouse gas emissions limit."[54] CARB explicitly premised the adoption of the LCFS regulation on this mandate.[55] As written and in practice, however, the LCFS regulation does not incentivize, let alone achieve, the maximum emissions reductions in this sector due to the program's inflation of carbon intensity values for factory farm gas. These inflated credit values are the result of CARB's narrow interpretation of the life cycle emissions for factory farm gas. Moreover, CARB's failure to ensure that credited emissions reductions are additional to what otherwise would have occurred inject invalid credits into the overall market and allow fuel producers to emit more pollution.

By setting overly narrow system boundaries for the life cycle analysis of factory farm gas, the LCFS fails to account for emissions associated with a true "well-to-wheels" analysis, exaggerating the emissions reductions attributed to this fuel. AB 32 requires that market-based compliance mechanisms only credit "additional" emissions reductions, and thus exclude reductions already required by law or that otherwise would occur.[56] However, CARB has allowed the LCFS program to award credits generated from non-additional reductions at factory farms. Factory farm gas projects rely on multiple sources of revenue from grant programs, federal programs, and the Aliso Canyon settlement – all of this supplementary revenue renders reductions from factory farm gas projects either partially or fully non-additional, yet CARB has made no effort to prevent these non-additional credits from entering the market.

Because CARB has allowed grossly inflated carbon intensity scores to distort the market, and allowed non-additional reductions to generate credits, the LCFS perversely incentivizes bigger dairy and pig operations to generate more methane. As a result, credit revenue from dairy factory

[51] CAL. HEALTH & SAFETY CODE § 38501 (the Legislature named the "exacerbation of air quality problems, a reduction in the quality and supply of water to the state from the Sierra snowpack, a rise in sea levels resulting in the displacement of thousands of coastal businesses and residences, damage to marine ecosystems and the natural environment, and an increase in the incidences of infectious diseases, asthma, and other human health-related problems" as potential adverse impacts of climate change.)
[52] CAL. CODE REGS. TIT. 17 § 95488.3; CAL. CODE REGS. TIT. 17 § 95488.9(f)(1). *See* proposed amendments in Appendix A.
[53] *See* proposed amendments in Appendix B.
[54] CAL. HEALTH & SAFETY CODE § 38560.5.
[55] CAL. AIR RES. BD., RES. 19-27, (Nov. 21, 2019).
[56] CAL. HEALTH & SAFETY CODE § 38562(d)(2).

farm gas can be a more reliable income stream than milk revenue, propping up this high-emissions industry and further polluting nearby communities. Additionally, the financial windfall from these over-valued credits is traded to offset emissions from LCFS deficit holders. Together and separately, each of these violations undermines the LCFS program and constitutes a failure to achieve the maximum technologically feasible and cost-effective emissions reductions from transportation fuels in violation of AB 32.

### 1. The fuel pathways for biomethane from dairy and swine manure fail to incorporate life-cycle emissions, leading to inflated credits.

The LCFS over-values credits awarded to factory farm gas operations because the program omits significant emissions from the factory farm gas life cycle. Neither the established Tier 1 nor the customized Tier 2 pathways for biomethane from dairy and swine manure capture the greenhouse gas emissions associated with the full life cycle of factory farm gas. The pathways ignore both upstream and downstream emissions. In addition to setting overly narrow system boundaries, the factory farm gas life cycle analyses fail to properly account for the fact that the methane purportedly captured in the production of factory farm gas is intentionally created, resulting in an even more misleading accounting of associated climate harms. When the resulting inflated credits are traded, they allow LCFS deficit holders to achieve less than the required maximum technologically feasible and cost-effective reductions.

The LCFS requires a full "well-to-wheels" life cycle analysis to account for all emissions associated with a given fuel.[57] Such well-to-wheels accounting requires Tier 2 pathways to include "a description of all fuel production feedstocks used, including all pre-processing to which feedstocks are subject."[58] Likewise, applicants must provide:

> a detailed description of the calculation of the pathway CI. This description must provide clear, detailed, and quantitative information on process inputs and outputs, energy consumption, greenhouse gas emissions generation, and the final pathway carbon intensity, as calculated using CA-GREET3.0. Important intermediate values in each of the primary life cycle stages shall be shown. *Those stages include but are not limited to feedstock production and transport*; fuel production, fuel transport, and dispensing; co-product production, transport and use; waste generation, treatment and disposal; and fuel use in a vehicle.[59]

Feedstocks are the raw materials processed into fuel. The feedstock for factory farm gas is manure. Therefore, emissions from manure production and "pre-processing" must be included in the life cycle analysis for Tier 2 applicants. But the LCFS and CARB's implementation does not require their inclusion. For example, CalBioGas Kern Cluster's recent application begins the data-listing portion of its lifecycle analysis with the Dairy Livestock Input Data table.[60] This table does not provide an adequate analysis of the feedstock production energy input. In fact, this lifecycle

[57] CAL. CODE REGS. TIT. 17 § 95481(a)(66).
[58] CAL. CODE REGS. TIT. 17 § 95488.7(a)(2)(A)(2).
[59] CAL. CODE REGS. TIT. 17 § 95488.7(a)(2)(B) (emphasis added).
[60] CAL. AIR RES. BD., Low Carbon Fuel Standard Tier 2 Pathway Application B0198, *available at* https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0198_cover.pdf.

analysis contains no analysis pertaining to the emissions from the generation and processing of manure to produce the feedstock.

Accounting for the greenhouse gas emissions from the production and "pre-processing" of dairy or pig manure must include the inputs and infrastructure necessary to sustain a dairy cow or a pig: its food and water, the methane animals produce through enteric fermentation, the construction and maintenance of the lagoons required to hold manure, trucking livestock and other inputs, combustion of fuels at the dairy facility for electricity, and more. But the LCFS factory farm gas pathways only begin after the production of the manure itself, leaving out all upstream emissions generated formulating that manure.[61]

The regulation further enumerates that, "for fuels utilizing agricultural crops for feedstocks, the description [of feedstocks in the life cycle analysis report] shall include the agricultural practices used to produce those crops. This discussion shall cover energy and chemical use, typical crop yields, feedstock harvesting, transport modes and distances, storage, and pre-process (such as drying or oil extraction)."[62] In the Tier 2 pathways for ethanol production, this provision has been interpreted to include production and pre-processing of corn, the feedstock for ethanol. Similarly, the LCFS requires pathways that utilize organic material to "demonstrate that emissions are not significant beyond the system boundary of the fuel pathway," upon request.[63] Yet in the case of factory farm gas, none of the production and pre-processing of the feedstock is considered, making it an outlier in the LCFS program and out of compliance with section 95488.7.

The failure to include production and pre-processing of manure when calculating life cycle emissions is even more problematic because a common feed for dairy cows in California is distillers grains, a "co-product" of ethanol production. The designation of distillers grains as a "co-product" allows ethanol producers to split the emissions from corn production between the ethanol and distillers grains by weight, decreasing ethanol's carbon intensity in the LCFS analysis.[64] One ethanol industry blog noted that "the biggest factor for most of the low-CI scoring [ethanol] plants is the proportion of wet distillers grains sold locally."[65] Distillers grains are granted the "co-product" designation by virtue of the revenue they generate when sold as animal feed but because LCFS factory farm gas pathways do not account for production and pre-processing of manure, the emissions associated with distillers grains are never accounted for by the LCFS at all despite its

[61] CAL. AIR RES. BD., *Compliance Offset Protocol Livestock Projects* (Nov. 14, 2014), Table 4.1, Description of all GHG Sources, GHG Sinks, and GHG Reservoirs; *see also* CAL. AIR RES. BD., Response to Animal Defense Legal Fund Comment, https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/new_temp_carb_response.pdf (CARB arguing that "Emissions from existing CAFO operations are accounted for, but do not include emissions associated with enteric methane and animal feed use because these emissions should more appropriately be allocated to and associated with the preexisting underlying, non-fuel product stream, and are thus excluded from the system boundary in the Board approved Tier 1 Calculator.")

[62] CAL. CODE REGS. TIT. 17 § 95488.7(a)(2)(A)(2).

[63] CAL. CODE REGS. TIT. 17 § 95488.9(f)(2)(B).

[64] CAL. AIR RES. BD., *Tier 1 Simplified CI Calculator Instruction Manual: Starch and Fiber Ethano*l (Aug. 13, 2018), *available at* https://ww2.arb.ca.gov/resources/documents/lcfs-life-cycle-analysis-models-and-documentation.

[65] Susanne Retka Schill, *Meeting the California Low Carbon Challenge*, ETHANOL PROD. MAGAZINE (Feb. 8, 2016), http://ethanolproducer.com/articles/13000/meeting-the-california-low-carbon-challenge.

role in two transportation fuel life cycles.[66] Some ethanol plants also incorporate factory farm gas from dairies as a process fuel, further lowering the ethanol's carbon intensity.[67] These "negative" upstream emissions from factory farm gas and negative downstream emissions from the use of distillers grains as dairy feed both reduce the LCFS carbon intensity of ethanol, which would likely not receive credits otherwise.

While downstream emissions from distillers grains in ethanol production are accounted for by excluding them from that fuel's carbon intensity calculation, the by-product of dairy and swine factory farm gas, digestate – which would *increase* the carbon intensity of factory farm gas – remains largely unaccounted for, even though the LCFS requires all Tier 2 pathway application lifecycle analyses to include:

> a description of all co-products, byproducts, and waste products associated with production of the fuel. That description shall extend to all processing, such as drying of distiller's grains, applied to these materials after they leave the fuel production process, including processing that occurs after ownership of the materials passes to other parties.[68]

Demonstrably, any storage, land-application, or composting of digestate falls within the meaning of the term 'process,' but the LCFS does not require, and no factory farm gas lifecycle analyses include emissions from digestate.

The process of anaerobic digestion can result in "changes in the manure composition" that alter ammonia ($NH_3$) and nitrous oxide ($N_2O$) emissions, depending upon the management strategy used.[69] In the United States, liquid effluent from factory farm gas production is primarily applied to land as fertilizer and digestate solids are composted and then land applied or used for bedding on-farm (See Figure 4 in Appendix C).[70] Digestate land application and composting result in emissions of nitrous oxide, which has a global warming potential 265 to 298 times that of carbon dioxide.[71] A recent study found that digested solids that were composted released such significant

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[66] Somerville, Scott, Daniel A. Sumner, James Fadel, Ziyang Fu, Jarrett D. Hart, and Jennifer Heguy, *By-Product Use in California Dairy Feed Has Vital Sustainability Implications*, ARE UPDATE 24(2) (2020) 5, University of California Giannini Foundation of Agricultural Economics.

[67] For example, a Tier 2 ethanol pathway for a plant in Pixley, California uses biomethane from dairies as a process fuel to transform starch from corn into ethanol. *GFP Ethanol, LLC dba Calgren Renewable Fuels GREET Pathway for the Production of Ethanol from Corn and Fueled by NG and Biogas from Two Local Dairy Digesters* (Sept. 20, 2018), https://ww2.arb.ca.gov/sites/default/files/classic//fuels/lcfs/fuelpathways/comments/tier2/t2n-1279_report.pdf.

[68] CAL. CODE REGS. TIT. 17 § 95488.7(a)(2)(A)(8).

[69] Michael A. Holly et al., *Greenhouse gas and ammonia emissions from digested and separated dairy manure during storage and after land application Agriculture*, 239 ECOSYSTEMS AND ENV'T 410, 418 (Feb. 15, 2017), https://doi.org/10.1016/j.agee.2017.02.007.

[70] Ron Alexander, *Digestate Utilization in The U.S.*, 53 BIO CYCLE 56 (Jan. 2012), https://www.biocycle.net/digestate-utilization-in-the-u-s/. Mohanakrishnan Logan & Chettiyappan Visvanathan, *Management strategies for anaerobic digestate of organic fraction of municipal solid waste: Current status and future prospects*, 37 WASTE MGT. & RES. 27, 27 (Jan. 28, 2019), https://doi.org/10.1177/0734242X18816793.

[71] Holly, *supra* note 69 at 411. Alun Scott & Richard Blanchard, *The Role of Anaerobic Digestion in Reducing Dairy Farm Greenhouse Gas Emissions*, 13 SUSTAINABILITY 2 (Mar. 1, 2021) https://doi.org/10.3390/su13052612; *Understanding Global Warming Potentials*, ENV'T PROT. AGENCY, https://www.epa.gov/ghgemissions/understanding-global-warming-potentials (last visited Oct. 21, 2021).

nitrous oxide emissions relative to undigested manure solids that the climate benefits of the captured methane from the digestion process were cancelled out.[72] Additionally, many operators choose to store digestate in open-air lagoons. Open-air storage can release methane, potentially negating methane captured during digestion, as well as ammonia, which is harmful to nearby communities in the San Joaquin Valley and a $PM_{2.5}$ precursor.[73]

Despite the significant emissions associated with digestate and the high global warming potential of methane and nitrous oxide, the LCFS fails to fully account for this inevitable by-product of factory farm gas production. Digestate treatment and storage is within the Tier 1 system boundary for anaerobic digestion of dairy and swine manure (described as "effluent"), but the pathway does not contemplate emissions associated with effluent after storage.[74] In contrast to Tier 1, the Tier 2 system boundary in the CA GREET3.0 calculator includes emissions from "AD Residue Applied to Soil," in other words, digestate that is land applied.[75] In practice, however, digestate is not mentioned in several recent Tier 2 applications for cluster projects.[76] Further, in responding to a comment criticizing a project's lack of accounting for digestate emissions, the applicant responded in a letter to CARB that "land application of effluent is outside of the scope of the project."[77] These contradictory descriptions of the system boundary as related to digestate highlight an inconsistent approach to the quantification of emissions from digestate. Moreover, neither the pathways nor the project application materials seem to account for digestate uses other than land application. This excludes any emissions associated with the solids composting. By failing to account for downstream emissions associated with land application and the massive nitrous oxide emissions from solids composting, CARB's life cycle analysis omits significant greenhouse gas emissions from factory farm gas production and further inflates the factory farm gas credit value.

The factory farm gas life cycle analyses also fail to include downstream emissions associated with transport. The LCFS factory farm gas pathways mention, but do not require reporting of inputs to calculate emissions generated from the refining and transport of factory farm gas. For example, the Tier 1 Calculator for factory farm gas *can* quantify emissions leaked or

[72] Holly, *supra* note 69 at 414, 418.
[73] *See generally* Yun Li et al., *Manure digestate storage under different conditions: Chemical characteristics and contaminant residuals*, 639 SCI. OF THE TOTAL ENV'T 19 (Oct. 15, 2018), https://doi.org/10.1016/j.scitotenv.2018.05.128 (discussing the impacts of open storage).
[74] CAL. AIR RES. BD., Tier 1 Simplified CI Calculator Instruction Manual: Biomethane from Anaerobic Digestion of Dairy and Swine Manure (Aug. 13, 2018), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/ca-greet/tier1-dsm-im.pdf?_ga=2.63225775.1254208748.1633995805-239480191.1598055085.
[75] *LCFS Life Cycle Analysis Models and Documentation: California GREET3.0 Model,* CAL. AIR RES. BD., https://ww2.arb.ca.gov/resources/documents/lcfs-life-cycle-analysis-models-and-documentation (last visited July 29, 2021).
[76] *See* CAL. AIR RES. BD., *Fuel Pathway Table: Current Fuel Pathways*, *available at* https://ww2.arb.ca.gov/resources/documents/lcfs-pathway-certified-carbon-intensities (last visited Oct. 19, 2021).
[77] Letter from Michael D. Gallo, Gallo Cattle Company Regarding "Tier 2 Pathway Application: Application No. B0089" (June 26, 2020), on file with CAL. AIR RES. BD., https://ww2.arb.ca.gov/sites/default/files/classic//fuels/lcfs/fuelpathways/comments/tier2/b0089_response.pdf.

vented from the digester and associated pipeline infrastructure—but the applicant is not *required* to calculate it.[78]

In addition to the failure to account for various upstream and downstream emissions from factory farm gas production, the LCFS life cycle analyses do not address the fact that these emissions are associated with *intentionally created* methane. LCFS factory farm gas pathways are intended to credit "reduction[s] of greenhouse gas emissions achieved by the voluntary capture of methane" or "avoided methane emissions."[79] This structure is premised on the idea that the manure used to produce the gas is unavoidable waste, whose emissions would not otherwise be diverted. But the massive quantity of manure methane emissions that CARB seeks to mitigate is the result of the intentional liquification of the manure, one of multiple manure management methods. While necessary to produce factory farm gas, the production of vast quantities of liquified manure is by no means an inevitable result of dairy or pig farming.[80] Alternative manure management techniques are available. Techniques such as solid-liquid separation, scrape and vacuum collection of manure, composting, and pasture-based practices are all viable methods of manure management that would avoid the methane emissions caused by open-air lagoons of liquid manure. Preliminary findings from CARB's Dairy and Livestock Greenhouse Gas Emissions Working Group indicate that these methods of manure management may offer more cost-effective methane emissions reductions than anaerobic digestion and may deliver additional environmental and health benefits, such as reduced impact on water quality.[81] Avoiding manure generation and reducing the amount of manure that has to be managed is the best way to protect human and animal health, along with the environment (see Figure 3 in Appendix C on Waste Management Hierarchy).[82] But the LCFS program does the opposite of promoting dairy manure avoidance or even lower-emissions manure management practices. Instead, the LCFS program has created a new revenue stream for factory farms based on the manure itself – the source of the methane the program seeks to reduce – incentivizing the production and liquification of manure as though it were a cash crop.

Additionally, "even RNG from waste methane can have negative climate impacts relative to the most likely alternative of flaring, not venting, the methane."[83] Flaring, like other forms of combustion, converts methane to carbon dioxide, reducing the net emissions impact. Flaring is a ubiquitous, low cost means of reducing methane. Though flaring is not a sustainable means to

[78] CAL. AIR RES. BD., *Tier 1 Simplified CI Calculator Instruction Manual: Biomethane from Anaerobic Digestion of Dairy and Swine Manure* 1, 8–9, 13–14 (Aug. 13, 2018), https://ww2.arb.ca.gov/sites/default/files/classic//fuels/lcfs/ca-greet/tier1-dsm-im.pdf?_ga=2.153600376.1744114239.1608082460-1114251839.1598731081.

[79] CAL. CODE REGS. TIT. 17 § 95488.9(f).

[80] *Animal Agriculture in the U.S. – Trends in Production and Manure Management*, LIVESTOCK AND POULTRY ENV'T LEARNING CMTY. (Mar. 5, 2019), https://lpelc.org/animal-agriculture-in-the-u-s-trends-in-production-and-manure-management/.

[81] CAL. AIR RES. BD., *Findings and Recommendations: Subgroup 1: Fostering Markets for Non-digester Projects, Senate Bill 1383 Dairy and Livestock Working Group* 3 (Oct. 12, 2018), https://ww2.arb.ca.gov/sites/default/files/2020-11/dsg1_final_recommendations_11-26-18.pdf.

[82] A reduction of waste is the preferred management method in the Environmental Protection Agency's waste management hierarchy for decision-making. *Waste Management Hierarchy and Homeland Security Incidents,* ENV'T PROT. AGENCY, https://www.epa.gov/homeland-security-waste/waste-management-hierarchy-and-homeland-security-incidents (last visited Oct. 12, 2021).

[83] Emily Grubert, *At Scale, Renewable Natural Gas Systems Could be Climate Intensive: The Influence of Methane Feedstock and Leakage Rates*, 15 084041 ENV'T RES. LETTERS Aug. 2020, 2.

reduce emissions, it should be the baseline to which any emissions reductions associated with anaerobic digestion are compared.

Moreover, because factory farm gas can be sold as a fuel and used to generate significant supplemental revenue from LCFS credits, over time "it is not only possible but expected…to increase methane production beyond what would have happened anyway."[84] Any manure production that has been incentivized by LCFS credit revenue will also result in intentionally created methane, which according to one recent study, *is always GHG-positive*.[85]

Finally, the Agro-Ecological Zone Emissions Factor (AEZ-EF) used to measure emissions from land-use change by CA-GREET3.0, and therefore by Tier 2 applicants, fails to account for the full impacts from the industrial dairy and pig facilities producing factory farm gas.[86] CARB's Executive Officer may require fuel producers to include six specific "feedstock/finished biofuel combinations," in their calculations.[87] These feedstocks include corn, sugarcane, sorghum grain ethanol, soy, canola, and palm biomass-based diesel.[88] Apart from land-use change related to livestock grazing (which is rarely relevant to industrial livestock operations), the AEZ-EF model does not address the land-use change associated with industrial dairy farming which are required for the production of factory farm gas.[89]

The overly narrow life cycle analysis in the factory farm gas pathways not only undermines the program's capacity to incentivize reductions, but violates AB 32's mandate that "[T]he state board shall rely upon the best available economic and scientific information and its assessment of existing and projected technological capabilities when adopting the regulations required by this section."[90] Scientific literature provides a more complete account of greenhouse gases emitted during the life cycle of factory farm gas produced from dairy and pig facilities. These analyses incorporate emissions from feed production, enteric fermentation, farm management and operations, and the treatment, use, or disposal of digestate residues produced during anaerobic digestion in addition to manure management emissions.[91] Omitting these essential stages from the LCFS factory farm gas pathways neglects a significant portion of emissions involved in producing

[84] *Id.* at 5.
[85] *Id*. at 4.
[86] CAL. CODE REGS. TIT. 17 § 95488.3.
[87] CAL. CODE REGS. TIT. 17 § 95488.3(d).
[88] *Id*.
[89] Richard J. Pelvin et al., *Agro-ecological Zone Emission Factor (AEZ-F Model): A model of greenhouse gas emissions from land-use change for use with AEZ-based economic models* 3, 31 (Feb. 21, 2014), https://ww2.arb.ca.gov/sites/default/files/classic//fuels/lcfs/lcfs_meetings/aezef-report.pdf.
[90] CAL. HEALTH & SAFETY CODE § 38562 (e). In Resolution 19-27, CARB itself stated that the LCFS "was developed using the best available economic and scientific information and will achieve the maximum technologically feasible and cost-effective reductions in GHG emissions from transportation fuel used in California." CAL. AIR RES. BD., RES. 19-27, *supra* note 55.
[91] *See, e.g.,* E. M. Esteves et al., *Life cycle assessment of manure biogas production: A review,* 218 J. CLEAN PROD. 411–423 (2019), https://doi.org/10.1016/j.jclepro.2019.02.091; E. Cherubini et al., *Life cycle assessment of swine production in Brazil: a comparison of four manure management systems*, 87 J. CLEAN PROD. 68–77 (2015), https://doi.org/10.1016/j.jclepro.2014.10.035; V. Paolini et al., *Environmental impact of biogas: A short review of current knowledge*, 53, J. ENV'T SCI. HEALTH A 899–906 (2018), https://doi.org/10.1080/10934529.2018.1459076.

manure and, as a result, the pathway treats manure as if it is produced from thin air or as if lagoons of liquid manure occur naturally in the San Joaquin Valley. [92]

The LCFS regulation mandates a full accounting of the aggregate life cycle emissions from a given fuel. In CARB Resolution 19-27, the agency reiterated that the "[d]etermination of a fuel's energy demand and carbon intensity value is based on a "well-to-wheel" analysis, which includes production and processing, distribution, and vehicle operation.[93] And yet the factory farm gas pathways leave glaring gaps in the life cycle analysis beyond the narrow system boundaries. The premise that manure originates in manure lagoons ready for capture with no attendant emissions defies logic, yet CARB has embraced this to create an absurdly low carbon intensity value and inflated credit generating industry.

### 2. The fuel pathways for biomethane from dairy and swine manure fail to ensure that credited emissions reductions are additional to reductions that would have otherwise occurred.

The LCFS prohibits awarding credits for emissions reductions that are already required by law.[94] As a market-based compliance mechanism, however, the LCFS must also prohibit the award of credits for "any other greenhouse gas emission reduction that otherwise would occur."[95] While CARB promulgated the LCFS as an early action measure, CARB designed and implemented the LCFS as a market-based compliance mechanism. CARB itself described the LCFS as a market-based mechanism when promulgating amendments to the LCFS:

> The LCFS is a market-based approach designed to reduce the carbon intensity of transportation fuels by 10 percent by 2020, from a 2010 baseline. It is important to note that the Cap-and-Trade Program and the LCFS program have complementary, but not identical programmatic goals: Cap-and-Trade is designed to reduce greenhouse gasses from multiple sources by setting a firm limit on GHGs; the LCFS is designed to reduce the carbon intensity of transportation fuels. As a market-based, fuel-neutral program, the LCFS provides regulated parties with flexibility to achieve the most cost-effective approach for reducing transportation fuels' carbon intensity. . . .

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[92] A Naranjo et al., *Greenhouse Gas, Water, and Land Footprint Per Unit of Production of the California Dairy Industry Over 50 Years*, 103 J. DAIRY SCI. 3760–3773 (2020), https://www.journalofdairyscience.org/article/S0022-0302(20)30074-6/pdf; C. Alan Rotz et. al., *The Carbon Footprint of Dairy Production Systems Through Partial Life Cycle Assessment*, 93 J. DAIRY SCI. 1266–1282 (2010), https://doi.org/10.3168/jds.2009-2162; C. Alan Rotz, *Modeling Greenhouse Gas Emissions from Dairy Farms*, 101 J. DAIRY SCI. 6675–6690 (2018) https://www.sciencedirect.com/science/article/pii/S002203021731069X.

[93] CAL. AIR RES. BD., RES. 19-27, *supra* note 55; *see also* CAL. AIR RES. BD., *Appendix D: Draft Environmental Analysis* (Jan. 2, 2015), https://ww2.arb.ca.gov/sites/default/files/classic/regact/2015/lcfs2015/lcfs15appd.pdf.

[94] *See* CAL. CODE REGS. TIT. 17 § 95488.9(f)(1)(B) ("A fuel pathway that utilizes biomethane from dairy cattle or swine manure digestion may be certified with a CI that reflects the reduction of greenhouse gas emissions achieved by the voluntary capture of methane, provided that… the baseline quantity of avoided methane reflected in the CI calculation is additional to any legal requirement for the capture and destruction of biomethane.")

[95] CAL. HEALTH & SAFETY CODE § 38562(d)(2).

> ARB staff disagrees that the LCFS is fundamentally a command-and-control system. The LCFS is a fuel-neutral, market-based program that does not give preference to specific transportation fuels and instead bases compliance on a system of credits and deficits based on each fuel's carbon intensity. Carbon intensity (CI) is a measure of the GHG emissions associated with the various production, distribution, and consumption steps in the "life cycle" of a transportation fuel. It is difficult to respond with depth to this assertion because the commenter provides no specifics to support the claim that the LCFS is not market-based. Notably, the commenter does not describe what components of the program could be considered command-and-control.[96]

Additionally, CARB's descriptions of the LCFS program closely parallel the statute's definition of "market-based compliance mechanism." The defintion states in relevant part that a market-based compliance mechanism is: "A system of market-based declining annual aggregate emissions limitations for sources or categories of sources that emit greenhouse gases."[97] CARB explains that the LCFS has a "market for credit transactions," where "entities with credits to sell can opt to pledge credits into the market and entities needing credits must purchase their pro-rata share of these pledged credits."[98] CARB explains that credits are generated relative "to a declining CI benchmark for each year."[99] The LCFS exhibits many if not most of the features of a market-based compliance mechanism, including a Cap-and-Trade allowance-like system with yearly declinations,[100] transaction rules,[101] recordkeeping and auditing requirements,[102] an account system to manage credit transfers – the LCFS Reporting Tool and Credit Bank & Transfer System (LRT-CBTS),[103] and a portal that applicants must use to demonstrate compliance,[104] among others. In addition to CARB's interpretation, designation, and treatment of the program as a market-based

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[96] CAL. AIR RES. BD., *Final Statement of Reasons for Rulemaking, Including Summary of Comments and Agency Response* 679-681 (2015), *available at* https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2015/lcfs2015/fsorlcfs.pdf. *See also* CAL. AIR RES. BD., *Responses to Comments on the Draft Environmental Analysis for the Amendments to the Low Carbon Fuel Standard and Alternative Diesel Fuel Regulations* at B4-42 (2018), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2018/lcfs18/rtcea.pdf (CARB responding, "Because the LCFS is a market-based mechanism…"); CAL. AIR RES. BD., *Staff Discussion paper: Renewable Natural Gas from Dairy and Livestock Manure 6* (April 13, 2017), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/lcfs_meetings/041717discussionpaper_livestock.pdf (in which CARB staff note in 2017 discussion paper that additionality requirements for the LCFS *are* intended to be identical to those of the compliance offset protocol, "ensure any crediting is for GHG reductions resulting from actions not required by law or beyond business as usual").

[97] CAL. HEALTH & SAFETY CODE § 38505(k). Note that this is one of two definitions provided.

[98] CAL. AIR RES. BD., *LCFS Basics* (2019), *available at* https://ww2.arb.ca.gov/sites/default/files/2020-09/basics-notes.pdf (last visited Oct. 12, 2021).

[99] *Low Carbon Fuel Standard: About*, CAL. AIR RES. BD., https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/about (last visited Oct. 12, 2021).

[100] *See* CAL. CODE REGS. TIT. 17 §§ 95482 – 95486.

[101] *See* CAL. CODE REGS. TIT. 17 § 95491.

[102] *See* CAL. CODE REGS. TIT. 17 § 95491.1.

[103] CAL. CODE REGS. TIT. 17 § 95483.2(b). ("The LRT-CBTS is designed to support fuel transaction reporting, compliance demonstration, credit generation, banking, and transfers.").

[104] *See* CAL. AIR RES. BOARD, *Low Carbon Fuel Standard – Annual Reporting and Verification User Guide* 3-4 (Aug. 9, 2021), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/guidance/Reporting_and_Verification_User_Guide.pdf.

mechanism and the overall structure of the regulation evincing the same, the designation of California's LCFS as a market-based mechanism is ubiquitous in academic and technical literature.[105]

Because the LCFS is a market-based compliance mechanism, section 38562(d)(2) of the Health & Safety Code requires that CARB ensure greenhouse gas emissions reductions in the LCFS are "in addition to any greenhouse gas emission reduction otherwise required by law or regulation, and any other greenhouse gas emission reduction that otherwise would occur."[106] Additionality requirements are essential for market-based programs that operate with a declining emissions benchmark, like the LCFS. Because regulated parties are permitted to emit above the benchmark so long as they offset these emissions with the purchase of credits, the LCFS must ensure that credits reflect reductions that are additional to claim a net reduction. The additionality requirement enumerated in the LCFS currently is far too narrow. It requires only that reductions are "additional to any legal requirement for the capture and destruction of biomethane."[107] This weak language incorporates only one of the two prongs required by AB 32 and does not ensure that reductions are additional to those from other LCFS incentives. CARB should grant this petition and amend the LCFS to include the broader additionality requirement.

As implemented to date, the LCFS program allows generation, sale, and use of factory farm gas credits that are plainly not additional when the methane reductions attributed to these LCFS credits result from, and are attibuted to, other programs and revenue sources. The LCFS 1) allows the same emissions reductions to be counted and credited by multiple emission reductions programs; and 2) awards credits to facilities receiving public funding for anaerobic digesters and related infrastructure, even when that funding is contingent on the construction of this equipment.

Numerous state and federal funding opportunities, incentives, and other subsidies are available for anaerobic digestors at factory farms. The Aliso Canyon Mitigation Agreement that CARB negotiated with Southern California Gas Company (SoCalGas) legally requires SoCalGas to pay for methane reductions at factory farm dairies in California.[108] The parties intended the agreement to mitigate the harms from the most damaging man-made greenhouse gas leak in United States history – SoCalGas' ruptured well that released at least 109,000 metric tons of methane before it was sealed.[109] SoCalGas funds the construction of digesters, which are intended to mitigate the leaked methane, and receives "mitigation credits" for the associated emissions reductions. The conditions of the agreement legally require changes intended to reduce emissions

[105] *See, e.g.,* CENTER FOR CLIMATE AND ENERGY SOLUTIONS, *Policy Considerations for Emerging Carbon Programs* 2 (June 2016), https://www.c2es.org/wp-content/uploads/2016/06/emerging-carbon-programs.pdf (describing Low Carbon Fuel Standards as an example of a market-based policy option, specifically of a baseline-and-credit program); *Regional Activities*, NATIONAL LOW CARBON FUEL STANDARD PROJECT, https://nationallcfsproject.ucdavis.edu/regional-activities/ (stating California's "LCFS is a market-based mechanism") (last visited Oct. 12, 2021).
[106] CAL. HEALTH & SAFETY CODE § 38562(d)(2).
[107] CAL. CODE REGS. TIT. 17 § 95488.9(f)(1).
[108] *People v. Southern California Gas Company,* Case Nos. BC602973 & BC628120, Appendix A to Consent Decree, Mitigation Agreement, *available at* https://www.arb.ca.gov/html/aliso-canyon/aliso-canyon-mitigation-agreement.pdf?_ga=2.146452402.708596706.1633463951-1172357510.1559256345.
[109] CAL. AIR RES. BD., *Responses to Frequently Asked Questions: Aliso Canyon Litigation Mitigation Settlement*, https://ww3.arb.ca.gov/html/aliso-canyon/aliso-canyon-faqs.pdf?_ga=2.67705041.1139070712.1533833674-1489205872.1532954259.

and yet at least eight facilities that receive this funding have also applied for LCFS credits for biomethane production. California Bioenergy sought LCFS credits for the S&S, Moonlight, Hamstra, Trilogy, Maple, T&W, BV Dairy, and Western Sky dairies.[110] These eight dairies are among seventeen that participate in the Aliso Canyon Mitigation Agreement.[111] Under no circumstances should mitigation for the Aliso Canyon disaster simultaneously qualify for credits generated and used in the LCFS.

Furthermore, the Legislature has appropriated public funds from the Greenhouse Gas Reduction Fund (GGRF) for several years to secure climate benefits. The California DDRDP, funded through the GGRF, provides funding for factory farm gas infrastructure. The California Department of Food and Agriculture describes the DDRDP as "financial assistance for the installation of dairy digesters in California, which will result in reduced greenhouse gas emissions."[112] Since 2015, the DDRDP has funded 117 dairy projects through the DDRDP, for a total of $195,025,884, and for which the CDFA claims 21,023,793 MTCO2e of methane reductions.[113] CARB also claims these reductions in a report to the Legislature on the climate benefits from these grants.[114] At least eight of these dairy projects, and likely many more, have received DDRDP grants and sought LCFS credits. For instance, California Bioenergy sought LCFS credits for the S&S, Moonlight, Hamstra, Trilogy, Maple, T&W, BV Dairy, and Western Sky dairies, all of which received DDRDP grants.[115] Importantly, the DDRDP purports to limit how grant monies may be used, but it does not prohibit a project from generating LCFS credits.[116]

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[110] *See* CAL. AIR RES. BD., Low Carbon Fuel Standard Tier 2 Pathway Application B0185, *available at* https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0185_cover.pdf; CAL. AIR RES. BD., Low Carbon Fuel Standard Tier 2 Pathway Application B0198, *available at* https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0198_cover.pdf.

[111] CAL. AIR RES. BD., *Aliso Canyon Natural Gas Leak, List of dairies involved in the mitigation agreement*, https://www.arb.ca.gov/html/aliso-canyon/aliso-canyon-mitigation-project-dairy-sites.pdf?_ga=2.216890962.535652136.1632321175-1949797088.1632171356.

[112] *Dairy Digester Research & Development Program*, CAL. DEPT. OF FOOD & AG., https://www.cdfa.ca.gov/oefi/ddrdp/ (last visited Oct. 19, 2021).

[113] CAL. DEPT. OF FOOD & AG., *CDFA Dairy Digester Research and Development Program Flyer (Sept. 2021)*, *available at* https://www.cdfa.ca.gov/oefi/ddrdp/docs/DDRDP_flyer_2021.pdf. (A list of all project recipients can be found at CAL. DEPT. OF FOOD & AG., *Dairy Digester Research and Development Program Project-Level Data (Sept. 17, 2021),* https://www.cdfa.ca.gov/oefi/DDRDP/docs/DDRDP_Project_Level_Data.pdf.)

[114] CAL. CLIMATE INVESTMENTS, *2021 California Climate Investments Annual Report*, Table 2 (2021), *available at* http://ww2.arb.ca.gov/sites/default/files/cap-and-trade/auctionproceeds/2021_cci_annual_report.pdf.

[115] *See* CAL. AIR RES. BD., Low Carbon Fuel Standard Tier 2 Pathway Application B0185 *available at* https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0185_cover.pdf; CAL. AIR RES. BD., Low Carbon Fuel Standard Tier 2 Pathway Application B0198, *available at* https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0198_cover.pdf.

[116] *See 2020 DDRDP Request for Grant Applications,* CAL. DEPT. OF FOOD & AG., https://www.cdfa.ca.gov/oefi/DDRDP/docs/2020_DDRDP_RGA_Public_Comments.pdf (last visited Oct. 5, 2021) ("Once a project has been awarded funds, the project may not: • Change or alter their biogas end-use during the project term. • Change the herd size beyond the limits established by the existing dairy operation's permits during the project term. • Change ownership of the dairy and/or partnership entities… • Duplicate equipment or activities that will receive funding from the California Public Utilities Commission (CPUC) pilot project authorized by California Health and Safety Code Section 39730.7(d)(2) (e.g., interconnection costs). *Note: Biogas conditioning and clean-up costs are allowable under the DDRDP.* • Commercial dairy operations that have already accepted, or plan to accept a grant award by CDFA's Alternative Manure Management Program (AMMP).") (emphasis added). Note that by allowing DDRDP funds to cover upgrade costs and other costs that the CPUC incentives program cannot, the CDFA has ensured that factory farm gas projects can benefit from multiple funding sources.

Other public funds authorized by the Legislature subsidize factory farm gas projects seeking to interconnect with utility natural gas pipelines.[117] This additional source of funds quickly became oversubscribed, prompting the California Public Utilities Commission to double the size of the program, all paid for with proceeds from sales of Cap-and-Trade allowances.[118] The California Public Utilities Commission went a step further, proposing in 2017 that participants in the SB1383 dairy biomethane Pilot Program could avoid the costs associated with gas production equipment, specifically gathering lines and "treatment equipment."[119] In what would be a major break with California energy precedent, ratepayers got to foot the bill.[120]

Projects receiving public funds should not, under the principles of additionality, also generate LCFS credits that allow emissions elsewhere; in this situation public funds essentially allow a transportation fuel deficit holder to emit more greenhouse gases and allow the factory farm gas project to generate a financial windfall. Under no circumstances did the Legislature intend for this perverse result to occur.

This is not a hypothetical concern: CARB recently proposed approval of Tier 2 Pathway applications B0185 and B0198 for eight dairy digester projects that have received both Dairy

[117] *See* CAL. PUB. UTILITIES COMM'N, Decision Adopting the Standard Renewable Gas Interconnection and Operating Agreement, R.13-02-008 COM/CR6/jnf at 12 (Dec. 17, 2020), *available at* https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M356/K244/356244030.PDF ("D.15-06-029 created a $40 million monetary incentive program "to encourage potential biomethane producers to build and operate biomethane projects within California that interconnect with the utilities" in accordance with AB 1900 (Gatto, 2012). This monetary incentive program was subsequently codified by AB 2313 (Williams, 2016)…The $40 million approved by the CPUC for the monetary incentive program is currently fully subscribed and there is a wait list for an additional $38.5 million worth of project funding.").

[118] *See Id.* at 14 ("After weighing the benefit of increased biomethane capture and use against the modest reduction in the California Climate Credit necessary to fully fund all existing biomethane projects, including those on the waitlist, we find it appropriate to provide an additional $40 million in funding from Cap-and-Trade allowance proceeds for the monetary incentive program to fund the biomethane projects that are currently on the wait list, bringing total funding to $80 million.").

[119] Decision establishing the implementation and selection framework to implement the dairy biomethane pilots required by Senate Bill 1383 at 7-8 (Dec. 18, 2017), *available at* https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M201/K352/201352373.PDF (". . . [T]he biomethane producers should own and operate the digesters and the biogas collection lines and treatment equipment to remove hydrogen sulfide and water from the raw biogas. Although we do not allow utilities to own these facilities, the costs associated with the biogas collection lines and treatment equipment will be recovered from the transmission rates of utility ratepayers through a reimbursement to the dairy biomethane producer. Natural gas utilities will own and operate all facilities downstream of the biogas conditioning and upgrading facilities, including pipeline laterals from such facilities, to the point of receipt and any pipeline extensions.").

[120] *Id.* ("Historically the costs of gathering, gas conversion to pipeline quality specifications, transportation from a gas production site to a conversion facility, transportation from the conversion facility to the pipeline, and pipeline interconnection costs have been borne by California natural gas producers as part of the commodity cost of gas since the late 1980s, as 'gathering costs' that the CPUC has ruled should be assigned to gas producers . . . . For the purposes of the Dairy Pilots, and consistent with the language of SB 1383, we are allowing cost recovery of the biogas collection lines owned by dairy biomethane producers, and allowing utilities to own and operate pipelines that carry biomethane from biogas conditioning and upgrading facilities to existing utility transmission systems and the interconnection facilities, without changing the requirements of D.89-12-016 for non-renewable natural gas producers . . . .").

Digester Research Development Program (DDRDP) and Aliso Canyon settlement funds.[121] Both programs claim credit for the methane reductions associated with the digester projects. If the LCFS system grants credits for these same reductions and allows a deficit holder to use those credits to demonstrate compliance with the LCFS, the reductions will be without question not additional. This absurd result allows excessive emissions and CARB must grant this petition to ensure LCFS program integrity.[122]

A wide range of other state and federal financial assistance is available to factory farms to support the construction and implementation of factory farm gas systems. This public financing comes in the form of grants, "production incentive payments, low-interest financing, tax exemptions and incentives, and permitting assistance."[123] The California Energy Commission provides funding for factory farm gas development through its Natural Gas Research and Development program.[124] The program provides $100 million annually to various fuel transportation projects, including factory farm gas.[125] The Environmental Quality Incentives Program (EQIP) is a federal program that provides matching funds for agricultural operations to contract with Natural Resources Conservation Service to develop technology or infrastructure with environmental benefits, including the construction of anaerobic digestion infrastructure.[126] The Rural Energy for America Program also provides federal funds to develop factory farm gas systems. *See* 7 U.S.C. § 8107.

The LCFS is demonstrably and avowedly a market-based compliance mechanism and is thus properly subject to the requirements of section 38562(d)(2). As the forgoing demonstrates,

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[121] These dairy digester projects also may participate in the California Public Utilities Commission pilot projects, as California Bioenergy projects, which would confer additional public funds. *See* CAL. PUB. UTILITIES COMM'N, Press Release: CPUC, CARB, and Department of Food and Agriculture Select Dairy Biomethane Proejcts to Demonstrate Connection to Gas Pipelines (December 3, 2018), *available at* https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M246/K748/246748640.PDF.

[122] This has caused confusion in Tier 2 application comments. For example, in comments on several applications, the Chair of the Board for the Kings County Board of Supervisors commented to ask how these applicants could participate in the LCFS without double counting reductions, given that they also participated in bioMAT. CARB did not respond to the comments. *See* CAL. AIR RES. BD., Comment Log Display, Doug Verboon, Comment 61 for Public Comments for LCFS Pathway Applications (tier2lcfspathways-ws) - 2nd Workshop (Nov. 25, 2020), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0106_verboon_comments.pdf (commenting on Tier 2 Application B0106); CAL. AIR RES. BD., Comment Log Display, Doug Verboon, Comment 60 for Public Comments for LCFS Pathway Applications (tier2lcfspathways-ws) - 2nd Workshop (Nov. 25, 2020), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0105_verboon_comments.pdf (commenting on Tier 2 Application B0105); CAL. AIR RES. BD., Comment Log Display, Doug Verboon, Comment 59 for Public Comments for LCFS Pathway Applications (tier2lcfspathways-ws) - 2nd Workshop (Nov. 25, 2020), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b104_verboon_comments.pdf (commenting on Tier 2 Application B0104).

[123] CAL. DAIRY CAMPAIGN, *Economic Feasibility of Dairy Digester Clusters in California: A Case Study* 45, (June 2013) https://archive.epa.gov/region9/organics/web/pdf/cba-session2-econ-feas-dairy-digester-clusters.pdf.

[124] *Natural Gas Research and Development Program*, CAL. ENERGY. COMM'N., https://www.energy.ca.gov/sites/default/files/2019-05/naturalgas_faq.pdf (last visited Oct. 18, 2021).

[125] *Clean Transportation Program*, CAL. ENERGY. COMM'N., https://www.energy.ca.gov/programs-and-topics/programs/clean-transportation-program (last visited Oct. 18, 2021).

[126] Environmental Quality Incentives Program, NAT'L RES. CONS. SERVICE, https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/.

private and public funding either have been or could be used to reduce methane emissions from pig and dairy facilities.[127] The LCFS should not allow fuel producers to generate credits from such non-additional reductions that deficit holders then use to justify their excess emissions, undermining the integrity of the LCFS program.

### 3. CARB's crediting of non-additional reductions and the inflated credit value from CARB's failure to account for the full quantity of life-cycle emissions both incentivize increased manure generation and manure liquification and constitute a failure to achieve the maximum technologically feasible and cost-effective greenhouse gas emissions.

Including inflated credits and credits for non-additional reductions contravenes the fundamental purpose of the LCFS: to reduce greenhouse gas emissions associated with transportation fuels. Inflated credits and credits for non-additional reductions have the effect of increasing manure generation and liquification, and its associated greenhouse gas emissions. Additionally, by purchasing inflated credits, deficit generators can more easily meet their compliance obligations without reducing their emissions. As a result of these deficiencies, the LCFS fails to achieve the maximum technologically feasible and cost-effective emissions reductions.

The factory farm gas industry is currently made profitable by the LCFS and similar programs. In fact, "[w]ell over 50% of the revenue from most projects generating credits comes from the [LCFS and Federal RIN] credits."[128] A recent report by a private investment firm on the promising growth prospects for factory farm gas concluded that "operators are not in the business of producing RNG, they are in the business of monetizing RNG's environmental attributes through various federal and state programs."[129] This is by design: the goal of the LCFS factory farm gas pathways is to incentivize the development of factory farm gas as an alternative fuel. This goal assumes incentivizing development of factory farm gas will result in a net decrease in manure methane emissions. But this assumption – the result of the deficient life cycle analysis and inclusion of non-additional reductions – is mistaken.

Increased profitability and growth of the factory farm gas industry does not necessarily entail a reduction in manure methane emissions from participating factory farms. Due to the poor design of the LCFS pathways for factory farm gas, the program encourages not only capture of manure methane, as intended, but increased production of that methane. Revenue from LCFS credits is an increasingly enticing source of potential profit for many factory farms. In the case of

[127] For this reason, LCFS credits also should not be issued to facilities that already operate digesters to produce low-CI electricity but seek to convert to producing biomethane, as no truly additional emissions reductions occur upon switching fuel production pathways.

[128] Annie AcMoody & Paul Sousa, *Western United Dairies, Interest in California Dairy Manure Methane Digesters Follows the Money*, CoBANK, at 4, (Aug. 2020), https://www.cobank.com/documents/7714906/7715329/Interest-in-California-Dairy-Manure-Methane-Digesters-Follows-the-Money-Aug2020.pdf/be11d7d6-80df-7a7e-0cbd-9f4ebe730b25?t=1603745079998.

[129] STIFEL EQUITY RESEARCH, *Energy & Power – Biofuels: Renewable Natural Gas, A Game-Change in the Race for Net-Zero* (March 8, 2021), *available at* https://static1.squarespace.com/static/53a09c47e4b050b5ad5bf4f5/t/60ad5a8802a04b71ca252414/1621973643907/Stifel+RNG+Analysis.pdf.

industrial dairy operations, these inflated credits provide certainty for operators seeking to maintain or expand herd sizes by providing significant additional income to supplement volatile milk revenue.[130] In 2017, CARB itself "assume[d] that California's LCFS credits [would] contribute revenue of $865,000" (assuming $100 per metric ton of $CO_2$).[131] The average LCFS credit price has increased significantly since this estimate was made, with 2020 prices hovering around $200 per metric ton of $CO_2$ (see Figure 5 in Appendix C). As a result, LCFS credits can be a more reliable income stream than milk. The LCFS not only encourages the development of factory farm gas systems but entrenches the underlying factory farms and even incentives expansion of these operations – the very sources of manure methane the factory farm gas credits are intended to reduce.

LCFS credits derive their value from recipients' ability to sell these credits to LCFS participants that generate deficits. Deficit-generating facilities include producers of conventional, high carbon intensity fuels such as gasoline and diesel fuels. This means that the life cycle analysis deficiencies and granting of credits for non-additional reductions not only incentivize increased emissions from factory farms, but also function to allow emissions in other transportation fuel industries.

Additionally, because economies of scale for anaerobic digesters favor larger herd sizes, factory farm gas producers have an incentive to produce more liquid manure, by either increasing herd size or participating in a digester cluster. This is the case for factory farm gas from both cows and pigs. In California, where most digesters use manure from lagoons to produce gas for pipeline transport, the technology requires a minimum of 2,000 cows to be economically feasible.[132] Scale is central to making the technology investment profitable, and "each additional 1,000 cows reduce the cost per cow of digester projects by 15-20%."[133] EPA AgSTAR admits that most methane digesters "are not economically viable until greater than 10,000 hogs are incorporated."[134]

The programmatic distortions described in parts III(A)(1) and (2) will drive the expansion of factory farms to supply factory farm gas, intentionally creating greenhouse gas emissions and localized pollution. CARB should rescind the factory farm gas pathways and preclude factory farm

[130] The milk price that dairy farmers receive has fluctuated considerably over the past two decades while costs have remained relatively constant. In 2015 and 2016, dairies experienced negative average residuals (see Table 2 in Appendix C). In 2017, annual milk revenue from "a farm with 2,000 cows producing 230 hundredweight per cow per year (the average in the San Joaquin Valley)" totaled nearly $7.6 million based on the milk price of $16.50 per hundredweight. After factoring in 2017 cost estimates by the California Department of Food and Agriculture (CDFA), the "net revenue at the typical dairy in the southern San Joaquin Valley amounted to zero." *See* Justin Ellerby, CAL. CENTER FOR COOP. DEV., *Challenges and Opportunities for California's Dairy Economy* 5 (2010); William Matthews and Daniel Sumner, *Contributions of the California Dairy Industry to the California Economy in 2018*, UNIV. OF CAL. AGRIC. ISSUES CENTER 17-18 (2019), https://aic.ucdavis.edu/wp-content/uploads/2019/07/CMAB-Economic-Impact-Report_final.pdf; Hyunok Lee. & Daniel A. Sumner, *Dependence on policy revenue poses risks for investments in dairy digester,* 72 CAL. AG. 226-235, 231 (2018), https://doi.org/10.3733/ca.2018a0037.

[131] Hyunok Lee & Daniel A. Sumner, *supra* note 130 at 232.

[132] GLOBAL DATA POINT, *California Incentives Spur Dairy Manure Methane Digester Developments*, GALE: BUSINESS INSIGHTS (Doc. No. A631672444) (Aug. 6, 2020).

[133] *Id*.

[134] ENV'T PROT. AGENCY, *AgSTAR, Project Development Handbook: A Handbook for Developing Anaerobic Digestion/Biogas Systems on Farms in the United States* 7-2, n. 58, https://www.epa.gov/sites/default/files/2014-12/documents/agstar-handbook.pdf (3rd Ed.).

gas from the LCFS program. In the alternative, CARB must amend the regulation to ensure that the carbon intensity values account for the full life cycle of dairy and pig facility emissions, including production and pre-processing of manure feedstock and downstream emissions associated with digestate land application and composting, and prohibit credits from non-additional reductions.

### B. The fuel pathways for biomethane from dairy and swine manure fail to maximize additional environmental benefits and interfere with efforts to improve air quality.

The California Legislature directed CARB to design regulations in a manner that considers overall societal benefits, including other benefits to the environment and public health, and ensure that activities taken pursuant to the regulations do not interfere with the state's efforts to improve air quality.[135] The Legislature also declared, in enacting AB 32, that it intended that CARB design reduction measures in a manner that "maximizes additional environmental and economic cobenefits for California, and complements the state's efforts to improve air quality."[136] But so long as the LCFS program includes factory farm gas and incentivizes factory farm expansions and the resulting air pollution, it cannot maximize environmental benefits or improve air quality. Moreover, given these impacts, CARB has not adequately considered overall societal costs in the regulation's design.

Monetizing a waste stream, like manure, does not eliminate that waste. The material impacts of manure (and later digestate) remain, whether or not it generates revenue for confined animal feeding operations. Nearby communities must still contend with the harms from the production, transportation, storage, and processing of this waste. If anything, monetizing a waste stream like manure exacerbates these harms by disincentivizing waste reduction. Incentivizing larger herd sizes and the liquification of more manure exacerbates existing pollution to air, water, and land, and the associated public health harms from industrial dairy and pig facilities, in addition to increased greenhouse gas emissions.[137] Additionally, factory farm gas technology creates new and additional environmental and public health harms, including through the storage, composting, and land application of digestate.

The 3.9 million residents of the San Joaquin Valley face increased health risks from breathing polluted air.[138] Industrial dairy operations emit the ammonia that contributes to the some

[135] CAL. HEALTH & SAFETY CODE § 38562(b)(4) ("Ensure that activities undertaken pursuant to the regulations complement, and do not interfere with, efforts to achieve and maintain federal and state ambient air quality standards and to reduce toxic air contaminant emissions."); CAL. HEALTH & SAFETY CODE § 38562(b)*(*6) ("Consider overall societal benefits, including reductions in other air pollutants, diversification of energy sources, and other benefits to the economy, environment, and public health."). *See also* CAL. HEALTH & SAFETY CODE § 38562.5 (making section 38562(b) applicable to regulations adopted to achieve reductions beyond the statewide greenhouse gas emissions limit).

[136] CAL. HEALTH & SAFETY CODE § 38501.

[137] *EPA Activities for Cleaner Air - San Joaquin Valley,* U.S. ENV'T PROT. AGENCY, https://www.epa.gov/sanjoaquinvalley/epa-activities-cleaner-air (last updated Mar. 6, 2019).

[138] Rory Carroll, *Life in San Joaquin valley, the place with the worst air pollution in America*, THE GUARDIAN (May 13, 2016), https://www.theguardian.com/us-news/2016/may/13/california-san-joaquin-valley-porterville-pollution-poverty.

of the worst long-term and short-term $PM_{2.5}$ pollution in the United States, which causes health problems such as asthma and has been linked to premature death as described *supra* in part II.[139] Industrial dairies are also the largest source of volatile organic compounds (VOCs), which contribute to the Valley's ozone (smog) air pollution crisis.[140] The digestate from factory farm gas production can emit even more hazardous VOCs during storage. An analysis of digestate from pig manure identified nearly 50 VOCs, 22 of which are labeled hazardous by the EPA.[141] Of these 22 hazardous VOCs, "8 were identified to be or likely to be carcinogenic, and 14 were identified to be harmful to other human organs or systems."[142]

Biogenic and anthropogenic emissions of VOCs and nitrogen oxides (NOx) both form ground-level ozone, the concentration of which is "directly affected by temperature, solar radiation, wind speed and other meteorological factors."[143] VOCs from corn silage at dairies alone would be the largest source in the Valley, with such emissions forming more ozone than the VOCs emitted by passenger vehicles.[144] Breathing in ground-level ozone can trigger a variety of dangerous health problems like throat irritation, chest pain, and congestion. It can also lead to severe lung damage, making infants and the elderly more vulnerable to health effects.[145] Ozone causes respiratory inflammation, increased hospital admissions for respiratory illness, decreased lung function, enhanced respiratory symptoms for people with asthma, increased school absenteeism, and premature mortality.[146] Evidence indicates that "adverse public health effects occur following exposure to elevated levels of ozone, particularly in children and adults with lung disease."[147] The San Joaquin Valley is classified as an extreme ozone nonattainment area for the 1997 and 2008 8-hour ozone standards.[148]

Industrial dairies are also the largest source of ammonia.[149] Factory farm gas production adds even more ammonia to San Joaquin Valley air: ammonia emissions from digestate increased 81% relative to raw manure.[150] Anaerobic digestion causes this increase in ammonia emissions, "due to an increased concentration of ammoniacal nitrogen."[151] In addition to its unpleasant odor,

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[139] *Id*.
[140] *See* SAN JOAQUIN VALLEY AIR POLLUTION CONTROL DIST., *2016 Plan for the 2008 8-Hour Ozone Standard, Appendix B*, *available at* http://valleyair.org/Air_Quality_Plans/Ozone-Plan-2016/b.pdf.
[141] Yu Zhang et al., *Characterization of Volatile Organic Compound (VOC) Emissions from Swine Manure Biogas Digestate Storage*, 10 ATMOSPHERE 1, 7 (2019), https://doi.org/10.3390/atmos10070411.
[142] *Id.* at 8.
[143] 73 FED. REG. 16436, 16437 (March 27, 2008).
[144] *See* Cody J. Howard, et al., *Reactive Organic Gas Emissions from Livestock Feed Contribute Significantly to Ozone production in Central California*, 44 ENV'T SCI. TECHNOL. 7 2309–2314 (2010), https://pubs.acs.org/doi/abs/10.1021/es902864u.
[145] *Id*.
[146] 73 Fed. Reg. 16436, 16440 (March 27, 2008).
[147] 83 FED. REG. 61346, 61347 (November 29, 2018).
[148] 75 FED. REG. 24409 (May 5, 2010); 77 FED. REG. 30088, 30092 (May 21, 2012).
[149] SAN JOAQUIN VALLEY AIR CONTROL DIST., 2018 Plan for the 1997, 2006, and 2012 PM2.5 Standards, Appendix B and Appendix G, *available at* http://valleyair.org/pmplans/documents/2018/pm-plan-adopted/B.pdf and http://valleyair.org/pmplans/documents/2018/pm-plan-adopted/G.pdf.
150 *See* Holly, et al., *Greenhouse gas and ammonia emissions from digested and separated dairy manure during storage and after land disposal*, AG., ECOSYSTEMS AND ENV'T 239 (2017) 410–419, https://www.researchgate.net/publication/313731233_Greenhouse_gas_and_ammonia_emissions_from_digested_and_separated_dairy_manure_during_storage_and_after_land_application.
[151] *Id.*

which degrades quality of life for nearby residents, ammonia "is corrosive and can be a powerful irritant to skin, eyes, and digestive and respiratory tissues."[152] Ammonia also reacts with oxides of nitrogen to form ammonium nitrate, the most significant component of the San Joaquin Valley's $PM_{2.5}$ pollution problem.[153] Homes located within a quarter mile of a dairy confined animal feeding operation have experienced higher concentrations of both ammonia and particulate matter.[154] In addition to the harms of PM2.5 describes above, larger particles of dust pollution from factory farm dairies also carry harmful allergens and endotoxins to nearby homes.[155] Endotoxins are a "powerful inflammatory agent" that can interact with other components and lead to respiratory issues, and allergens can worsen asthma symptoms.[156] A study in rural Washington found that higher exposure to pollution from confined animal feeding operations was associated with degraded lung function in children with asthma living nearby.[157]

Depending on the physical characteristics (temperature, pH, total solid content) and the speed and frequency of the mixing process used to treat it, digestate from factory farm gas production can release dangerous concentrations of hydrogen sulfide.[158] High hydrogen sulfide emission levels are associated with a total solid content of seven percent, "which is the most appropriate for pumping and mixing of dairy manure."[159] Increasing the speed and frequency of mixing while in storage can also contribute to higher hydrogen sulfide emissions from digestate.[160] These emissions can have severe impacts on human health, particularly farm workers, and can even lead to death.[161] Furthermore, hydrogen sulfide may be detected on fields where manure is sprayed for fertilizer, and the gaseous substance can be dispersed by the wind.[162] Hydrogen sulfide gas is a respiratory tract irritant and in higher concentrations or with longer exposure, it can cause a pulmonary edema.[163] The acute symptoms of hydrogen sulfide exposure include nausea, headaches, delirium, disturbed equilibrium, tremors, convulsions, and skin and eye irritation.[164]

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[152] D'Ann L. Williams et al., *Airborne cow allergen, ammonia and particulate matter at homes vary with distance to industrial scale dairy operations: an exposure assessment*, 10 ENV'T HEALTH 1, 3 (2011), https://doi.org/10.1186/1476-069X-10-72.
[153] SAN JOAQUIN VALLEY AIR CONTROL DIST., *2018 Plan for the 1997, 2006, and 2012 PM2.5 Standards*, Appendix B and Appendix G, *available at* http://valleyair.org/pmplans/documents/2018/pm-plan-adopted/B.pdf and http://valleyair.org/pmplans/documents/2018/pm-plan-adopted/G.pdf.
[154] D'Ann Williams et al., *Cow allergen (Bos d2) and endotoxin concentrations are higher in the settled dust of homes proximate to industrial-scale dairy operations*, 26 J. EXPOSURE SCI. ENV'T EPIDEMIOLOGY 42, 46 (2016) https://doi.org/10.1038/jes.2014.57.
[155] *Id.*
[156] *Id.* at 42.
[157] Christine Loftus et al., *Estimated time-varying exposures to air emissions from animal feeding operations and childhood asthm*a, 223 INT. J. OF HYGIENE AND ENV'T HEALTH 192 (2020) https://doi.org/10.1016/j.ijheh.2019.09.003.
[158] Fetra J. Andriamanohiarisoamanana et al., *Effects of handling parameters on hydrogen sulfide emission from stored dairy manure*, 154 J. ENV'T MGMT. 110, 112-115 (2011), https://doi.org/10.1016/j.jenvman.2015.02.003.
[159] *Id.* at 115.
[160] *Id.* at 114.
[161] *Id.* at 110.
[162] *See* Agency for Toxic Substances and Disease Registry, Toxicological Profile for Hydrogen Sulfide and Carbonyl Sulfide, DEP'T OF HEALTH AND HUMAN SERVICES 27-138 (2016), https://www.atsdr.cdc.gov/toxprofiles/tp114.pdf; *See also* Amy Schultz et al., *Residential proximity to concentrated animal feeding operations and allergic and respiratory disease*, 130 ENV'T INT. 104911, 1 (2019), https://doi.org/10.1016/j.envint.2019.104911.
[163] *See* Agency for Toxic Substances and Disease Registry, *supra* note 162 at 27-138.
[164] *Id.*

Finally, inhalation of high concentrations or long-term exposure to hydrogen sulfide can result in extremely rapid unconsciousness and eventual death.[165]

Factory farm dairies also pollute the San Joaquin Valley's groundwater, primarily through the disposal of manure by land application on crops, which causes severe public health impacts to nearby communities. The Valley contains about half of California's 300 public water systems that currently serve unsafe drinking water.[166] This number does not include private wells and water systems serving fewer than 15 households. Unsafe water systems are concentrated in small towns and unincorporated communities.[167] Common pollutants in water from factory farm runoff include nitrogen, phosphorus, heavy metals, and pharmaceuticals.[168]

Nitrate contamination of water resources is one of the most widely documented environmental impacts in California's dairy-producing regions. Most nitrate contamination comes from chemical fertilizers and animal manure applied to fields.[169] Nitrogen application often far exceeds the crops' rate of nutrient intake and the soil's ability to absorb nutrients, which then leach into groundwater.[170] A study by University of California Davis found that 96% of nitrate pollution in the region comes from nitrogen applied to cropland, a third of which is in the form of animal manure.[171] The 2019 Central Valley Dairy Representative Monitoring Program reported that nitrate concentrations exceeded the maximum contaminant level in groundwater at all of the 42 dairy facilities.[172] The program identified the application of manure to crop fields as the main source of groundwater contamination, while finding other unaccounted nitrogen sources – too many cows – at the dairy facilities contributing to the excessive nitrate contamination.[173]

Between 1999 and 2008, seven out of eight counties in the San Joaquin Valley had above-average rates of Sudden Infant Death Syndrome which can be caused by nitrate contamination. 70% of San Joaquin Valley households believed their tap water to be unsafe when surveyed in 2011, and nitrate pollution still appears to be rising.[174] A 2016 study that mapped out the mass flows of nitrogen in the San Joaquin Valley, estimated that the health costs of total nitrate leaching to groundwater caused $500 million per year in health damages.[175] Application of biogas digestate, either as a liquid or composted solids,[176] will continue the trend in nitrate contamination in the San

[165] *Id.*
[166] J.A. Del Real, *They Grow the Nation's Food, but They Can't Drink the Water*, N.Y. TIMES (May 21, 2019), https://www.nytimes.com/2019/05/21/us/california-central-valley-tainted-water.html.
[167] *Id*.
[168] JoAnn Burkholder et al., *Impacts from Waste from Concentrated Animal Feeding Operations on Water Quality*, 115 ENV'T HEALTH PERSPECTIVES 308, 308 (2007), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1817674/.
[169] *The Sources and Solutions: Agriculture*, U.S. ENV'T PROT. AGENCY, https://www.epa.gov/nutrientpollution/sources-and-solutions-agriculture (last updated July 30, 2020).
[170] *Id.*
[171] Harter et al., *Addressing Nitrate in California's Drinking Water with a Focus on Tulare Lake Basin and Salinas Valley Groundwater*, CENTER FOR WATERSHED SCI., UNIV. CAL., DAVIS, 17 (2012).
[172] CENTRAL VALLEY DAIRY REP. MONITORING PROG., *Summary Representative Monitoring Report* at 8 (Revised 2020).
[173] *Id*.
[174] *Id*. at 28.
[175] Ariel I. Horowitz et al., *A multiple metrics approach to prioritizing strategies for measuring and managing reactive nitrogen in the San Joaquin Valley of California*, 11 ENV'T RES. LETTERS 1, 11 (2016).
[176] Roger Nkoa, *Agricultural benefits and environmental risks of soil fertilization with anaerobic digestates: A review*, 34 AGRON. SUSTAIN. DEV. 473, 473–492 (2014).

Joaquin Valley in particular, compounding the increase from the LCFS's subsidizing increased manure production.

In addition to the emissions from digestate storage and land application, certain Tier 2 anaerobic digester facilities generate additional air pollutants using factory farm gas to power internal combustion engines that generate electricity onsite.[177] According to a 2015 study commissioned by CARB, this form of electricity generation produces criteria air pollutants, like NOx and particulate matter.[178] Furthermore, the study found this technology would increase NOx emissions by 10 percent, exacerbating air quality in the Valley, in violation of CARB's duty to ensure that its programs do not interfere with efforts to reduce air pollution.[179] The San Joaquin Valley Unified Air Pollution Control District also documents criteria pollutant emissions from electricity generation from factory farm gas.

For example, the Lakeview Dairy Biogas project in Kern County uses two internal combustion engines to produce over 1,000 kW of electricity on-site.[180] And this project, as permitted by the Air District with required pollution control technology, still emits 4.58 tons/year of NOx, 1.98 tons/year of PM10, and 3.18 tons/year of VOC.[181] Compared to a natural gas combined cycle plant in Avenal permitted by the Air District, the Lakeview digester project produces much higher levels of NOx, SOx, and VOC emissions per unit of electricity generated.[182] However, unlike the natural gas plant, Lakeview Dairy Biogas is not required to purchase offset emission reduction credits for the toxic air pollution emitted.[183] This facility *increases* air pollution. But California Bioenergy also sought for LCFS credits under a Tier 2 pathway application for the Lakeview Dairy project.[184] By allowing polluting facilities like Lakeview Dairy to generate credits for "renewable" natural gas, despite the harmful health impacts associated with emissions from the use of factory farm gas to generate electricity, CARB ignores its statutory obligation not to "interfere with, efforts to achieve and maintain federal and state ambient air quality standards and to reduce toxic air contaminant emissions."[185]

Because the LCFS has resulted in and will continue to incentivize an increase in dangerous pollution to the air, water, and land of the San Joaquin Valley, it fails to comply with section

[177] Arnaud Marjollet, *District Notice of Preliminary Decision*, San Joaquin Valley: Air Pollution Control (Mar. 22, 2016), http://www.valleyair.org/notiCes/Docs/2016/03-22-16_(S-1143770)/S-1143770.pdf; *see also* CAL. AIR RES. BD., Staff Summary, Tier 2 Pathway Application B0104, Lakeview Dairy, https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0104_summary.pdf.
[178] Marc Carreras-Sospedra et al., *Assessment of the Emissions and Energy Impacts of Biomass and Biogas Use in California* at 9-10 (Feb. 2015), https://ww2.arb.ca.gov/sites/default/files/classic//research/apr/past/11-307.pdf.
[179] *Id*. at 4, 13.
[180] Arnaud Marjollet, *supra* note 177.
[181] *Id*. at 14.
[182] Brent Newell, *Comments filed to California Energy Commission*, 4 (July 11, 2017), *available at* https://efiling.energy.ca.gov/GetDocument.aspx?tn=220110&DocumentContentId=29811; Arnaud Marjollet, *supra* note 177 at 20.
[183] *Id*.
[184] CAL. AIR RES. BD., Staff Summary, Tier 2 Pathway Application B0104, Lakeview Dairy, https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0104_summary.pdf.
[185] CAL. HEALTH & SAFETY CODE § 38562 (b).

38562(b) (4) and (6) of the Health and Safety Code. Additionally, the LCFS program violates the Legislature's intent, expressed in section 38501(h) of the Health and Safety Code, to maximize additional environmental benefits. CARB should grant this petition and exclude factory farm gas from the program to address these violations.

## IV. CARB MUST EVALUATE AND AMEND THE LCFS TO REMEDY ITS DISPROPORTIONATE ADVERSE AND CUMULATIVE IMPACTS ON LOW-INCOME AND LATINA/O/E COMMUNITIES IN VIOLATION OF STATE AND FEDERAL LAW.

CA 11135 and Title VI of the Civil Rights Act impose an affirmative duty on CARB to ensure that its policies and practices do not have a discriminatory impact on the basis of race.[186] CA 12955 additionally prohibits any practice or program that has a discriminatory effect on members of protected classes with respect to housing opportunities, including with respect to the use and enjoyment of dwellings.[187] AB 32 requires CARB to ensure any activities undertaken in compliance with the statute do not disproportionately impact low-income populations, consider the social costs of greenhouse gas emissions, and design regulations in a manner that is equitable. CARB must assess and prevent the disparate impacts imposed by the LCFS to avoid further harm to communities and to comply with California and federal law.

### A. LCFS credits and the subsequent trading of those credits incentivize activities that result in public health and environmental harms in disproportionately low-income and Latina/o/e communities, particularly in the San Joaquin Valley.

The LCFS harms communities that are disproportionately Latina/o/e and low-income. These harms stem from (1) the generation of revenue for factory farms in proportion to the amount of manure they produce, (2) the encouragement of anaerobic digestion resulting in additional environmental harms related to digestate, and (3) allowing credits to offset emissions and toxic air pollutants elsewhere in California. Each of these harms impact disproportionately low-income and Black, Indigenous, or People of Color communities.

In California, the award of LCFS credits for factory farm gas and the harms these credits incentivize are concentrated in the San Joaquin Valley.[188] Part III(A)(3) shows how the LCFS has the effect of exacerbating existing adverse impacts from factory farms by incentivizing increased production and liquification of manure. Part III(B) describes the extensive environmental and public health harms associated with the increase in liquified manure, as well as the new harms

[186] CAL. GOV'T CODE § 11135; 42 U.S.C. § 2000d.
[187] CAL. GOV'T CODE § 12955.8; CAL. CODE REGS. TIT. 2 § 12161.
[188] The San Joaquin Valley hosts 89% of the state's dairy cow population, and all but one of its counties are ranked nationally for milk sales (See Table 3, Appendix C). CAL. DEP'T OF FOOD AND AGRIC., Small Dairy Climate Action Plan 1 (2018), https://www.cdfa.ca.gov/oefi/research/docs/CDFA_Summary_of_Final_Report.pdf; *See* Lori Pottinger, *California's Dairy Industry Faces Water Quality Challenges*, Public Institute of California (May 20, 2019), https://www.ppic.org/blog/californias-dairy-industry-faces-water-quality-challenges/ (all 117 DDRDP projects are in the Valley).

from digestate. Incentivizing expansion of factory farms may also negatively affect community and economic growth.[189] Part II shows that San Joaquin Valley communities impacted by these new and exacerbated harms are disproportionately Latina/o/e and disproportionately low-income. Part II also describes the preexisting cumulative harms impacting these communities: San Joaquin Valley residents experience "the worst" air pollution nationally, and high levels of drinking water and groundwater contamination, largely due to agricultural runoff.[190]

The LCFS's market-based structure shapes the distribution of adverse impacts imposed by its incentives. In addition to the harmful activities incentivized at credit-generating factory farm gas facilities, the LCFS facilitates harm by the deficit-generating facilities that purchase credits. In order to provide for the trading of credits and deficits, LCFS treats greenhouse gas emissions as fungible. This approach allows CARB to justify the greenhouse gas emissions from gasoline and diesel, for example, in excess of the program's benchmark when the producers of these fuels purchase the equivalent credits. This is viewed by CARB as a positive attribute of the LCFS program because it "lets the market decide" how to achieve the targeted emissions reductions. But treating emissions as fungible ignores the localized impacts of co-pollutants associated with the production, transport, and combustion of various transportation fuels. These harms do not disappear simply because a gasoline producer pays to justify its polluting practices. The sale of factory farm gas credits to LCFS deficit generators prolongs their ability to pollute, rather than make direct emissions reductions.

Given that LCFS deficit generators include producers of conventional fuels, such as gasoline, diesel, and compressed natural gas, there is good reason to believe that LCFS deficit generating industries may disproportionately harm low-income and Black, Indigenous, and People of Color – specifically Latina/o/e – communities. The vast majority of California oil and gas production is concentrated in the San Joaquin Valley and around Los Angeles.[191] California communities living in proximity to oil and gas extraction are known to be disproportionately low income and Latina/o/e.[192] In the San Joaquin Valley, the oil and gas industries are concentrated in Kern County, where residents are subject to the cumulative harms of petrochemical extraction in

[189] Research indicates that "concentration and industrialization of agricultural production removes more money from the community of which the farm is located than when smaller farms operate in the area." CHELSEA MACMULLAN, HUMANE SOC'Y OF THE U.S., DAIRY CAFOS IN CALIFORNIA'S SAN JOAQUIN VALLEY at 26 (2007), https://www.humanesociety.org/sites/default/files/archive/assets/pdfs/farm/macmullan_apa-2007_final.pdf. The ratio of payroll versus emissions produced by concentrated factory farm dairies ranks worse than the petroleum industry. *Id*. at 27. Additionally, factory farm dairy employees face greater health risks because of their proximity to air pollutants and bacteria. Working in the industry has been associated with respiratory diseases such as Chronic Bronchitis, Occupational Asthma, and Pharyngitis. *Id*. at 29. Lack of access to healthcare due to language barriers or undocumented status likely exacerbates these harms. *Id*.

[190] *See* Carroll, *supra* note 138; *see also* Burkholder, *supra* note 168 at 308.

[191] Judith Lewis Mernit, *The Oil Well Next Door: California's Silent Health Hazard*, YALE ENV'T 360 (March 31, 2021), https://e360.yale.edu/features/the-oil-well-next-door-californias-silent-health-hazard ("Kern County, as the southern end of the San Joaquin Valley, produces 70 percent of California' oil; the bulk of the rest comes out of Los Angeles.")

[192] *See, e.g.* Kyle Ferrar, *People and Production: Reducing Risk in California Extraction,* FRACTRACKER ALLIANCE, (Dec. 17, 2020), https://www.fractracker.org/2020/12/people-and-production/; John C. Fleming et al., *Disproportionate Impacts of Oil and Gas Extraction on Already "Disadvantaged" California Communities: How State Data Reveals Underlying Environmental Injustice*, https://www.essoar.org/doi/pdf/10.1002/essoar.10501675.1 (concluding that 77% of permits for oil and gas wells were issued in "communities with a higher-than-average percentage of residents living in poverty and/or communities with a majority non-white population").

addition to those of factory farm dairies. As noted in part II, Kern County has seen a recent increase in LCFS applications for factory farm gas pathways. Residents of Kern County already experience higher than average rates of Chronic Lower Respiratory Disease (CLRD), asthma, and respiratory system cancers.[193] The death rate from CLRD in Kern County from 2013 to 2016 was twelve times higher than the state's CLRD death rate during the same time period.[194] Exacerbation of CLRD cases is a primary reason for CLRD-related deaths.[195] In 2015 to 2016, 31.1% of children in Kern County had been diagnosed with asthma at some point in their life, compared to 15.2% of children statewide and 13.7% and 10.3% in Los Angeles County and Sacramento County, respectively.[196]

In addition to emissions from extraction and refining of these polluting fuels, LCFS credits can also be used to offset emissions from the combustion. The co-pollutants from these emissions likely impose disproportionate adverse impacts on low-income and Black, Indigenous, and People of Color communities in California. A 2014 analysis found that exposure to $PM_{2.5}$ from cars, trucks, and buses "is not equally distributed" across California.[197] More specifically, the analysis concluded that on average, "African American, Latino, and Asian Californians are exposed to more $PM_{2.5}$ pollution from cars, trucks, and buses than white Californians. These groups are exposed to $PM_{2.5}$ pollution 43, 39, and 21 percent higher, respectively, than white Californians."[198] Additionally, "[T]he lowest-income households in the state live where $PM_{2.5}$ pollution is 10 percent higher than the state average, while those with the highest incomes live where PM2.5 pollution is 13 percent below the state average."[199] Given that California's major diesel trucking corridors, Interstate 5 and State Highway 99, both run north-south directly through the San Joaquin Valley,[200] emissions from combustion of deficit-generating transportation fuels may well impose additional cumulative impacts on the same communities impacted by dairy factory farms as well as fossil fuel extraction and refining.

[193] Yongping Hao et al., *Ozone, Fine Particulate Matter, and Chronic Lower Respiratory Disease Mortality in the United States*, 192(3) AM. J. OF RESPIRATORY AND CRITICAL CARE MED. 337, 337–341, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4937454/.
[194] Nick Perez, *Despite decades of cleanup, respiratory disease deaths plague California county*, ENV'T HEALTH NEWS (Dec. 4, 2018) https://www.ehn.org/chronic-respiratory-disease-california-2621765230/pollution-persists.
[195] Elizabeth Oelsner et al., *Classifying Chronic Lower Respiratory Disease Events in Epidemiologic Cohort Studies*, 13 ANNALS OF THE AM. THORACIC SOC'Y 1057, 1057 (July 2016) https://doi.org/10.1513/AnnalsATS.201601-063OC.
[196] *Summary: Asthma*, KIDSDATA, https://www.kidsdata.org/topic/45/asthma/summary?gclid=Cj0KCQiAst2BBhDJARIsAGo2ldWxDuxZNs3gzxS4Qj3s048YVqkp4LWQ_nwYs7DSID4FDRTTdSsgq1waAgyxEALw_wcB (last visited Oct. 21, 2021).
[197] UNION OF CONCERNED SCI., *Inequitable Exposure to Air Pollution from Vehicles in California 1 (Feb. 2019)*, https://www.ucsusa.org/sites/default/files/attach/2019/02/cv-air-pollution-CA-web.pdf
[198] *Id.*
[199] *Id.* at 2.
[200] David Lighthall and John Capitman, *The Long Road to Clean Air in the San Joaquin Valley: Facing the Challenge of Public Engagement* 8 (Dec. 2007), CENTRAL VALLEY HEALTH POL'Y INST., https://chhs.fresnostate.edu/cvhpi/documents/cvhpi-air-quality-report07.pdf

### B. CARB must amend the LCFS regulation to come into compliance with CA 11135, CA 12955, and Title VI of the Civil Rights Act of 1964 and to prevent further discrimination.

CARB has an affirmative duty under CA 11135 to ensure that its policies and practices do not disproportionately impact residents on the basis of race, color, national origin, or ethnic group identification.[201] CA 11135's prohibition on discrimination applies to the LCFS because it meets the criteria of a program that is "conducted, operated, or administered" by CARB, a California state agency.[202] CA 12955 prohibits activities that limit housing opportunities for members of protected classes, including activities and programs that interfere with the use and enjoyment of one's dwelling or that results in the location of toxic, polluting, and/or hazardous land uses in a manner that adversely impacts the enjoyment of residence, land ownership, tenancy, or any other land use benefit related to residential use. The state is subject to the prohibitions included in the Fair Employment and Housing Act.[203] Title VI of the Civil Rights Act of 1964 and implementing regulations prohibit disparate impact discrimination on the basis of race by recipients of federal funds.[204] As a recipient of federal funding, CARB is subject to Title VI.[205]

As described above, the LCFS exacerbates harms in some San Joaquin Valley communities twice over: once when it incentives the expansion of factory farm dairies and anaerobic digestion, and again when the resulting credits are sold to justify the pollution from conventional transportation fuel production, distribution, and combustion. Some (and likely all) of these harms are imposed on communities that are disproportionately Latina/o/e. Additionally, the LCFS has the effect of defeating one of the objectives of AB 32 on a discriminatory basis: to maximize additional environmental benefits and complement efforts to reduce air pollution.

Not only are there "equally effective alternative practices" to achieve the goal of reducing transportation emissions, there are alternative practices that are demonstrably both more effective and less discriminatory.[206] Reducing net greenhouse gas emissions from transportation fuels is an important and legitimate goal. Sadly, the LCFS factory farm gas pathways fail to accomplish it. Therefore, California's greenhouse gas emissions targets provide no credible justification for the LCFS's discriminatory impacts. Moreover, there are other, less harmful agricultural practices that CARB could encourage to reduce net emissions. Rather than monetize the source of greenhouse gas emissions and related co-pollutants, CARB could encourage the direct reduction of emissions at their source by supporting practices such as solid-liquid separation, scrape and vacuum

[201] CAL. GOV'T CODE § 11135.
[202] *Id*.
[203] CA Legis. 352 (2021), CAL. LEGIS. SERV. CH. 352 (A.B. 948), amending CAL. GOVT CODE 12955; 2 CCR 12005(v); 2 CCR 12060.
[204] 42 U.S.C. §2000d; 40 C.F.R. §7.
[205] CARB has received funds EPA, including, for example, over $11.8 million in 2020 to administer the Diesel Emissions Reduction Act. Soledad Calvino, *U.S. EPA awards over $11.8 million for clean diesel projects in California*, U.S. ENV'T PROT. AGENCY (San Francisco), Aug. 30, 2020, News Release, https://www.epa.gov/newsreleases/us-epa- awards-over-118-million-clean-diesel-projects-california.
[206] *See, e.g., Elston v. Talladega Count.*, 997 F. 2d at 1413.

collection of manure, composting, and pasture-based practices. Similarly, there are less harmful policy tools that could be used to produce these reductions.[207]

CARB bears the duty to evaluate the potentially discriminatory impacts of its policies and practices and to prevent these harms in the first place, which it failed to do in the design of the LCFS regulation and fails to do on an ongoing basis. To bring the LCFS into compliance with its civil right obligations, CARB must cease and desist from operating the LCFS program in such a way that results in unlawful, discriminatory impacts as proscribed by CA Gov't Code Sections 11135 and 12955, et seq., and Title VI of the Civil Rights Act of 1964. To this end, CARB must a) conduct a disparity analysis to evaluate the program and b) amend the LCFS regulation to ensure that it does not continue to disproportionately harm low-income and Latina/o/e communities. A disparity analysis must include an evaluation of the distribution of impacts from incentives created by credit generation, direct emissions from deficit generators facilitated by the trading of LCFS credits, and the distribution of emissions from the combustion of these fuels.[208]

### C. CARB failed to design the LCFS regulation in a manner that is equitable and fails on an ongoing basis to consider the social costs of greenhouse gas emissions and ensure that the LCFS does not disproportionately impact low-income communities.

AB 32 mandated several safeguards to ensure equity and protect low-income communities in California from potential adverse impacts associated with the act's implementation. Section 38562(b)(2) of California Health and Safety Code requires that CARB design regulations "in a manner that is equitable" and "[ensure] that activities undertaken to comply with the regulations do not disproportionately impact low-income communities" to the extent feasible.[209] Section 38562(b)(2) also mandates that CARB "consider overall societal benefits, including reductions in other air pollutants, diversification of energy sources, and other benefits to the economy, environment, and public health."[210] Section 38562.5 further mandates that, "when adopting rules and regulations pursuant to this division to achieve emissions reductions beyond the state greenhouse gas emissions limit and to protect the state's most impacted and disadvantaged

[207] Environmental justice critiques of pollution trading schemes for their tendency to result in localized pollution that disproportionately impacts low-income and people of color communities are longstanding. *See, e.g., Environmental Justice Advocates Blast Emissions Trading Guide*, 10 INSIDE EPA'S CLEAN AIR REPORT 9, 6-7 (April 29, 1999), *available at* https://www.jstor.org/stable/48520963; Lily N. Chinn, *Can the Market Be Fair and Efficient? An Environmental Justice Critique of Emissions Trading*, 26 *Ecol. L. Quart.* 1 (1999), http://www.jstor.org/stable/24114004; Letter to the Biden-Harris Transition Team Re: EPA Administrator Appointment from Over 70 Environmental Justice Groups (December 2, 2020), *available at* https://1bps6437gg8c169i0y1drtgz-wpengine.netdna-ssl.com/wp-content/uploads/2020/12/2020-12-2-Nichols-letter.pdf.

[208] LCFS fuels originating from factory dairy farms include electricity, renewable natural gas, hydrogen, bio-compressed natural gas, bio-liquefied natural gas, and bio-liquefied-regasified-and recompressed (Bio-L-CNG). CAL. CODE REGS. TIT. 17, § 95481 (defining biogas, biomethane, and all LCFS fuels produced from biomethane).

[209] CAL. HEALTH & SAFETY CODE § 38562(b)(2). See also *Ass'n of Irritated Residents v. State Air Res. Bd.*, 206 Cal. App. 4th 1487, 1489 (2012).

[210] CAL. HEALTH & SAFETY CODE § 38562.

communities," the state board shall consider social costs.[211] CARB is currently out of compliance with each of these mandates and, accordingly, must cease and desist operation of the LCFS factory farm gas pathways unless and until it comes into compliance.

Section 38562(b)(2)'s charge to protect "low-income communities" includes "persons and families whose income does not exceed 120 percent of the area median income, adjusted for family size [...] in accordance with adjustment factors adopted and amended from time to time by the United States Department of Housing and Urban Development pursuant to Section 8 of the United States Housing Act of 1937."[212] Area median income covers "the median family income of a geographic area of the state."[213] The residents of the San Joaquin Valley are precisely the low-income communities Sections 38562 seek to protect. As demonstrated above, the LCFS factory farm gas pathways have a disproportionate adverse impact on the basis of race and income, demonstrating CARB's failure to have designed the regulations in a manner that is equitable.

Finally, 38562(b)(2) requires consideration of overall societal benefits. CARB must amend the LCFS regulation to account for this and remedy these violations to come into compliance with AB 32. In Section 38562.5 of California Health and Safety Code, social costs means "an estimate of the economic damages, including, but not limited to, changes in net agricultural productivity; impacts to public health; climate adaptation impacts, such as property damages from increased flood risk; and changes in energy system costs, per metric ton of greenhouse gas emission per year."[214] The greenhouse gas emissions and associated co-pollutants from the production of factory farm gas has significant socials costs to public health, as discussed extensively in parts III and IV(B). Amending the LCFS to account for a serious consideration of the social costs of the emissions associated with both factory farm gas and the conventional fuels that generate deficits would not only bring CARB into compliance with Section 38562.5, but it would assist CARB in understanding and evaluating the inequitable distribution of adverse impacts in a manner that supports civil rights compliance, a described above.

## V. CARB'S LACK OF TRANSPARENCY DENIES THE PUBLIC THE ABILITY TO REVIEW AND CHALLENGE EXISTING REGULATIONS, INCLUDING THE LCFS PATHWAYS FOR BIOMETHANE FROM DAIRY AND SWINE MANURE.

Meaningful public participation and advocacy regarding the impacts of the LCFS program have been hindered by CARB's lack of transparency. Locations of facilities purchasing the credits generated by factory farm dairies in the San Joaquin Valley are unknown to the public and attempts to obtain trading data through the California Public Records Act has produced only heavily redacted records. Without readily available trading data, it is difficult to determine potential disparate impacts caused by both the incentives produced by credit generation and the offsetting role of credit trading within the LCFS program. Community groups and advocates should not have

[211] CAL. HEALTH & SAFETY CODE § 38562.5. Note that the 2018 amendments made the LCFS generate reductions beyond the statewide limit.
[212] CAL. HEALTH & SAFETY CODE § 50093.
[213] *Id*.
[214] CAL. HEALTH & SAFETY CODE § 38506.

to seek out this information to conduct their own analyses of CARB's potentially discriminatory policies. CARB's control over the trading data places the agency in the best position to assess the disparate impact produced by the LCFS. Moreover, CARB has a clear, affirmative duty to comply with AB 32, CA 11135, and Title VI and prevent a disparate impact from its policies and practices.

## VI. CONCLUSION

Since the Legislature enacted AB 32 in 2006, both the predicted and actual climate change-related harms have become more dire.[215] The methane generated by factory farm dairies in California alone accounts for approximately 45 percent of the state's total methane emissions that contribute to these harms.[216] And the Intergovernmental Panel on Climate Change recently declared a climate code red when it called for strong, sustained, and rapid methane reductions to stabilize our climate.[217]

CARB must grant this petition and reform the LCFS. Rather than allow factory farm gas reductions to substitute for emissions increases from the transportation sector, CARB should amend the LCFS to exclude factory farm gas from this pollution trading scheme.[218] If CARB instead decides to continue allowing Big Oil & Gas to offset their transportation fuel emissions with factory farm gas, then CARB must (1) ensure that the LCFS does not inflict disparate impacts in violation of CA 11135, CA 12955, and Title VI of the Civil Rights Act; and (2) adopt all alternative LCFS amendments requested here to ensure LCFS integrity and protections for rural communities.

CARB must take this opportunity to reform a pollution trading scheme that has gone off the rails. The LCFS incentivizes more of that which it purports to control, allows inflated and illusory credits from factory farm gas to authorize more emissions from transportation fuel, refuses to acknowledge the truth that liquefied manure is intentionally created and not somehow naturally occurring awaiting only abatement, and authorizes non-additional credits generated at projects receiving massive incentives from public funds and the Aliso Canyon settlement agreement. This pollution trading scheme merely shifts emissions; it benefits Big Oil & Gas to allow more pollution from their transportation fuels. It benefits, entrenches, and expands the industrial dairy and pig industry with a revenue stream more valuable than milk. And it benefits the gas utilities that

[215] *See, e.g.*, Thomas Fuller and Christopher Flavelle, *A Climate Reckoning in Fire-Stricken California*, N.Y. TIMES (Sept. 10, 2020), https://www.nytimes.com/2020/09/10/us/climate-change-california-wildfires.html; Christopher Flavelle, *How California Became Ground Zero for Climate Disasters*, N.Y. TIMES (Sept. 20, 2020), https://www.nytimes.com/2020/09/20/climate/california-climate-change-fires.html; Nadja Popovich, *How Severe Is the Western Drought? See For Yourself.*, N.Y. TIMES (Sept. 20, 2020), https://www.nytimes.com/interactive/2021/06/11/climate/california-western-drought-map.html.

[216] CAL. AIR RES. BD., Short-Lived Climate Pollutant Reduction Strategy 56, Figure 4 (March 2017), https://ww2.arb.ca.gov/sites/default/files/2020-07/final_SLCP_strategy.pdf.

[217] IPCC, *Climate Change 2021: the Physical Science Basis, which represents the findings of Working Group I and its contribution to the Sixth Assessment Report*, *available at* https://www.ipcc.ch/report/ar6/wg1/.

[218] Petitioners do not suggest that methane from industrial dairy and pig facilities should be unabated. CARB has authority to adopt mandatory regulations to achieve up to a 40 percent reduction from manure methane emissions pursuant to Health & Safety Code § 39730.5.

desperately attempt to perpetuate the combustion of gas in the face of a future where electrified buildings and transportation are the only routes to achieve California's climate goals. San Joaquin Valley communities should not suffer the discriminatory effects of CARB's pollution trading scheme, and CARB should grant this petition and deliver environmental justice.

Respectfully Submitted this 27th of October, 2021,

Ruthie Lazenby
Vermont Law School
Environmental Justice Clinic

Brent Newell
Public Justice

Phoebe Seaton
Leadership Counsel for
Justice & Accountability

Tom Frantz
Association of Irritated Residents

Tarah Heinzen
Tyler Lobdell
Food & Water Watch

Cristina Stella
Christine Ball-Blakely
Animal Legal Defense Fund

# I. APPENDICES

## A. APPENDIX A: PROPOSED AMENDMENTS TO THE LCFS TO REMOVE ALL FUELS DERIVED FROM BIOMETHANE FROM DAIRY AND SWINE MANURE

§ 95488.3. Calculation of Fuel Pathway Carbon Intensities

(a) Calculating Carbon Intensities. Fuel pathway applicants and the Executive Officer will evaluate all pathways based on life cycle greenhouse gas emissions per unit of fuel energy, or carbon intensity, expressed in gCO2e/MJ. For this analysis, the fuel pathway applicant must use CA-GREET3.0 model (including the Simplified CI Calculators derived from that model) or another model determined by the Executive Officer to be equivalent or superior to CA-GREET3.0.

(b) CA-GREET3.0. The CA-GREET3.0 model (August 13, 2018) contains emission factors for calculating greenhouse gas emissions from site-specific inputs to fuel pathways and standard values for parts of the life cycle not included in applicant-specific data submission. The model is open source and publicly available at http://www.arb.ca.gov/fuels/lcfs/lcfs.htm and is incorporated herein by reference. CA-GREET3.0 includes contributions from the Oil Production Greenhouse Gas Estimator (OPGEE2.0) model (for emissions from crude extraction) and Global Trade Analysis Project (GTAP-BIO) together with the Agro-Ecological Zone Emissions Factor (AEZ-EF) model for land use change (LUC).

Tier 1 Simplified CI Calculators, which incorporate emission factors and life cycle inventory data from the CA-GREET3.0 model, are used to calculate carbon intensities for Tier 1 pathways. The eight Simplified CI Calculators listed below are publicly available at http://www.arb.ca.gov/fuels/lcfs/lcfs.htm and are incorporated herein by reference:

(1) Tier 1 Simplified CI Calculator for Starch and Fiber* Ethanol (August 13, 2018)

(2) Tier 1 Simplified CI Calculator for Sugarcane-derived Ethanol (August 13, 2018)

(3) Tier 1 Simplified CI Calculator for Biodiesel and Renewable Diesel (August 13, 2018)

(4) Tier 1 Simplified CI Calculator for LNG and L-CNG from North American Natural Gas (August 13, 2018)

(5) Tier 1 Simplified CI Calculator for Biomethane from North American Landfills (August 13, 2018)

(6) Tier 1 Simplified CI Calculator for Biomethane from Anaerobic Digestion of Wastewater Sludge (August 13, 2018)

~~(7) Tier 1 Simplified CI Calculator for Biomethane from Anaerobic Digestion of Organic Waste (August 13, 2018)~~

© OPGEE2.0. The OPGEE2.0 model is used to generate carbon intensities for crude oil used in the production of ultra-low sulfur diesel (ULSD) and California Reformulated Gasoline Blendstock for Oxygenate Blending (CARBOB).

(d) Accounting for Land Use Change. The Executive Officer calculates LUC effects for certain crop-based biofuels using the GTAP model (modified to include agricultural data and termed GTAP-BIO) and the AEZ-EF model. LUC values for six feedstock/finished biofuel combinations are provided in Table 6 below. The Executive Officer may use the same modeling framework to assess LUC values for other fuel or feedstock combinations, not currently found in Table 6, as part of processing a pathway application. Alternatively, the Executive Officer may require a fuel pathway applicant to use one of the values in Table 6, if the Executive Officer deems that value appropriate to use for a fuel or feedstock combination not currently listed in Table 6.

Table 6. Land Use Change Values for Use in CI Determination

| Biofuel | LUC (gCO<2>/MJ |
|---|---|
| Corn Ethanol | 19.8 |
| Sugarcane Ethanol | 11.8 |
| Soy Biomass-Based Diesel | 29.1 |
| Canola Biomass-Based Diesel | 14.5 |
| Grain Sorghum Ethanol | 19.4 |
| Palm Biomass-Based Diesel | 71.4 |

* Fiber in this case refers to corn and grain sorghum fiber exclusively.

§ 95488.9. Special Circumstances for Fuel Pathway Applications.

(f) Carbon Intensities that Reflect Avoided Methane Emissions from Dairy and Swine Manure or Organic Waste Diverted from Landfill Disposal.

(1) A fuel pathway that utilizes biomethane from dairy cattle or swine manure digestion ~~may~~ shall not be certified. ~~With a CI that reflects the reduction of greenhouse gas emissions achieved by the voluntary capture of methane, provided that:~~

~~(A) A biogas control system, or digester, is used to capture biomethane from manure management on **dairy** cattle and swine farms that would otherwise be vented to the atmosphere as a result of livestock operations from those farms.~~

~~(B) The baseline quantity of avoided methane reflected in the CI calculation is additional to any legal requirement for the capture and destruction of biomethane.~~

## B. APPENDIX B: PROPOSED AMENDMENTS TO REFORM THE LCFS PATHWAYS FOR BIOMETHANE FROM DAIRY AND SWINE MANURE

§ 95488.3. Calculation of Fuel Pathway Carbon Intensities

(a) Calculating Carbon Intensities. Fuel pathway applicants and the Executive Officer will evaluate all pathways based on life cycle greenhouse gas emissions per unit of fuel energy, or carbon intensity, expressed in gCO2e/MJ. For this analysis, the fuel pathway applicant must use CA-GREET3.0 model (including the Simplified CI Calculators derived from that model) or another model determined by the Executive Officer to be equivalent or superior to CA-GREET3.0.

(b) CA-GREET3.0. The CA-GREET3.0 model (August 13, 2018) contains emission factors for calculating greenhouse gas emissions from site-specific inputs to fuel pathways and standard values for parts of the life cycle not included in applicant-specific data submission. The model is open source and publicly available at http://www.arb.ca.gov/fuels/lcfs/lcfs.htm and is incorporated herein by reference. CA-GREET3.0 includes contributions from the Oil Production Greenhouse Gas Estimator (OPGEE2.0) model (for emissions from crude extraction) and Global Trade Analysis Project (GTAP-BIO) together with the Agro-Ecological Zone Emissions Factor (AEZ-EF) model for land use change (LUC).

Tier 1 Simplified CI Calculators, which incorporate emission factors and life cycle inventory data from the CA-GREET3.0 model, are used to calculate carbon intensities for Tier 1 pathways. The eight Simplified CI Calculators listed below are publicly available at http://www.arb.ca.gov/fuels/lcfs/lcfs.htm and are incorporated herein by reference:

(1) Tier 1 Simplified CI Calculator for Starch and Fiber* Ethanol (August 13, 2018)

(2) Tier 1 Simplified CI Calculator for Sugarcane-derived Ethanol (August 13, 2018)

(3) Tier 1 Simplified CI Calculator for Biodiesel and Renewable Diesel (August 13, 2018)

(4) Tier 1 Simplified CI Calculator for LNG and L-CNG from North American Natural Gas (August 13, 2018)

(5) Tier 1 Simplified CI Calculator for Biomethane from North American Landfills (August 13, 2018)

(6) Tier 1 Simplified CI Calculator for Biomethane from Anaerobic Digestion of Wastewater Sludge (August 13, 2018)

(7) Tier 1 Simplified CI Calculator for Biomethane from Anaerobic Digestion of Organic Waste (August 13, 2018)

(c) OPGEE2.0. The OPGEE2.0 model is used to generate carbon intensities for crude oil used in the production of ultra-low sulfur diesel (ULSD) and California Reformulated Gasoline Blendstock for Oxygenate Blending (CARBOB).

(d) Accounting for Land Use Change. The Executive Officer calculates LUC effects for certain crop-based biofuels using the GTAP model (modified to include agricultural data and termed GTAP-BIO) and the AEZ-EF model. LUC values for six feedstock/finished biofuel combinations are provided in Table 6 below. The Executive Officer may use the same modeling framework to assess LUC values for other fuel or feedstock combinations, not currently found in Table 6, as part of processing a pathway application. Alternatively, the Executive Officer may require a fuel pathway applicant to use one of the values in Table 6, if the Executive Officer deems that value appropriate to use for a fuel or feedstock combination not currently listed in Table 6.

Table 6. Land Use Change Values for Use in CI Determination

| Biofuel | LUC (gCO<2>/MJ |
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| Soy Biomass-Based Diesel | 29.1 |
| Canola Biomass-Based Diesel | 14.5 |
| Grain Sorghum Ethanol | 19.4 |
| Palm Biomass-Based Diesel | 71.4 |

* Fiber in this case refers to corn and grain sorghum fiber exclusively.

(e) Accounting for life cycle emissions for all fuel pathways from manure feedstock. In calculating the carbon intensity of any fuel derived from manure feedstock, the Executive Officer shall include all upstream and downstream greenhouse gas emissions from all activities associated with manure production, including but not limited to feed emissions, mobile and stationary source combustion emissions, enteric emissions, emissions from composting digestate solids, emissions following land application, and indirect source emissions.

§ 95488.9. Special Circumstances for Fuel Pathway Applications.

(f) Carbon Intensities that Reflect Avoided Methane Emissions from Dairy and Swine Manure or Organic Waste Diverted from Landfill Disposal.

(1) A fuel pathway that utilizes biomethane from dairy cattle or swine manure digestion may be certified with a CI that reflects the reduction of greenhouse gas emissions achieved by the voluntary capture of methane, provided that:

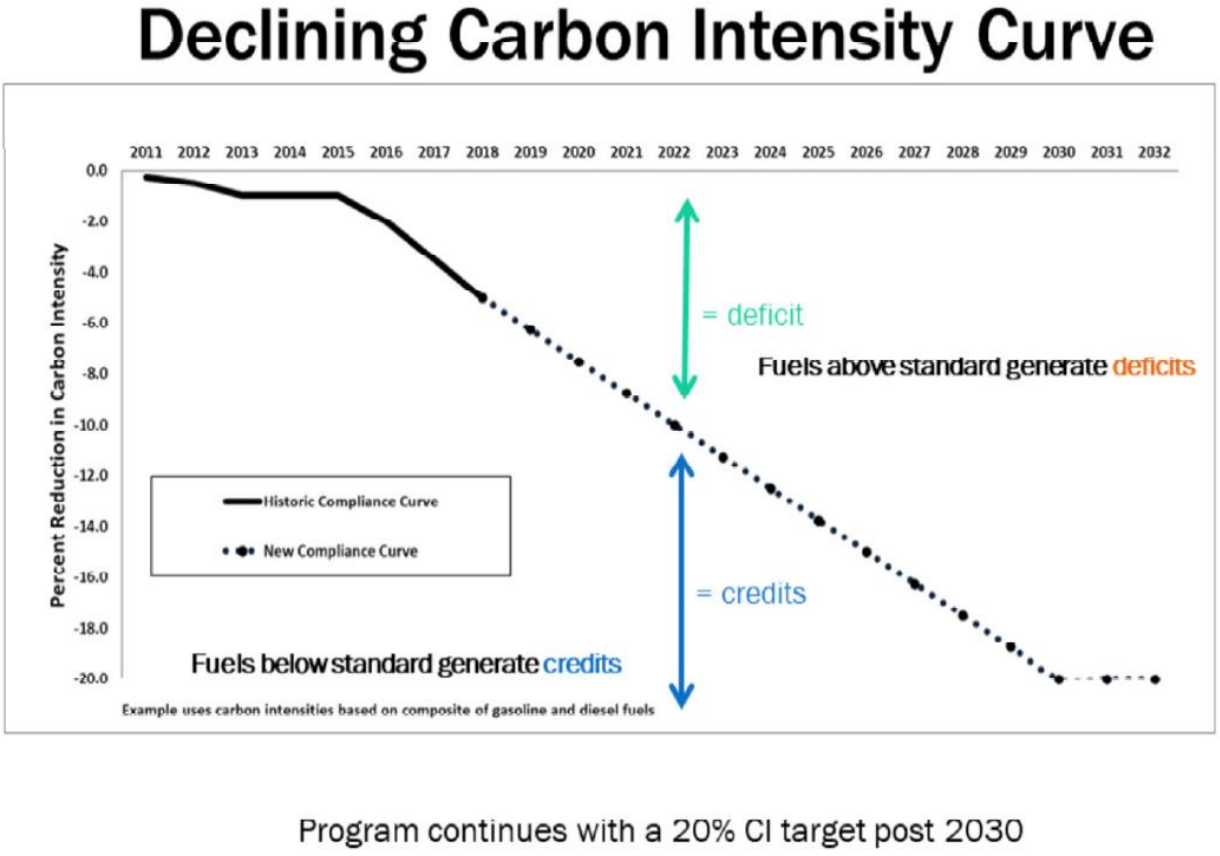
(A) A biogas control system, or digester, is used to capture biomethane from manure management on dairy cattle and swine farms that would otherwise be vented to the atmosphere as a result of livestock operations from those farms.

(B) The baseline quantity of avoided methane reflected in the CI calculation is additional to any legal requirement for the capture and destruction of biomethane, and any other greenhouse gas emission reduction that otherwise would occur.

(C) The fuel pathway derived from biomethane from dairy cattle or swine manure digestion pursuant to section 95488.3(e) does not (1) contribute any amount of nitrogen oxides, volatile organic compounds, sulfur oxides, ammonia, or particulate matter with an aerodynamic diameter of ten microns or less into the ambient air; (2) cause or contribute to groundwater or surface water pollution or degradation; (3) intensify water demand in areas medium and high priority water basins; or (4) intensify or exacerbate any negative local impacts including but not limited to odor and insects.

## C. APPENDIX C: TABLES AND FIGURES

**Figure 1:** Declining Annual Benchmark for the LCFS program.[219]




[219] CAL. AIR RES. BD., *LCFS Basics* (2019), *available at* https://ww2.arb.ca.gov/sites/default/files/2020-09/basics-notes.pdf (last visited Oct. 12, 2021).

**Table 1.** Credit Value Calculator from LCFS Data Dashboard.[220]

**Credit Value Calculator:**
**Estimated LCFS Premium at Sample LCFS Credit Prices**

**Alternative Fuel Premiums at Sample LCFS Credit Prices**
**($/gal gasoline-equivalent for fuels used as gasoline substitutes)**

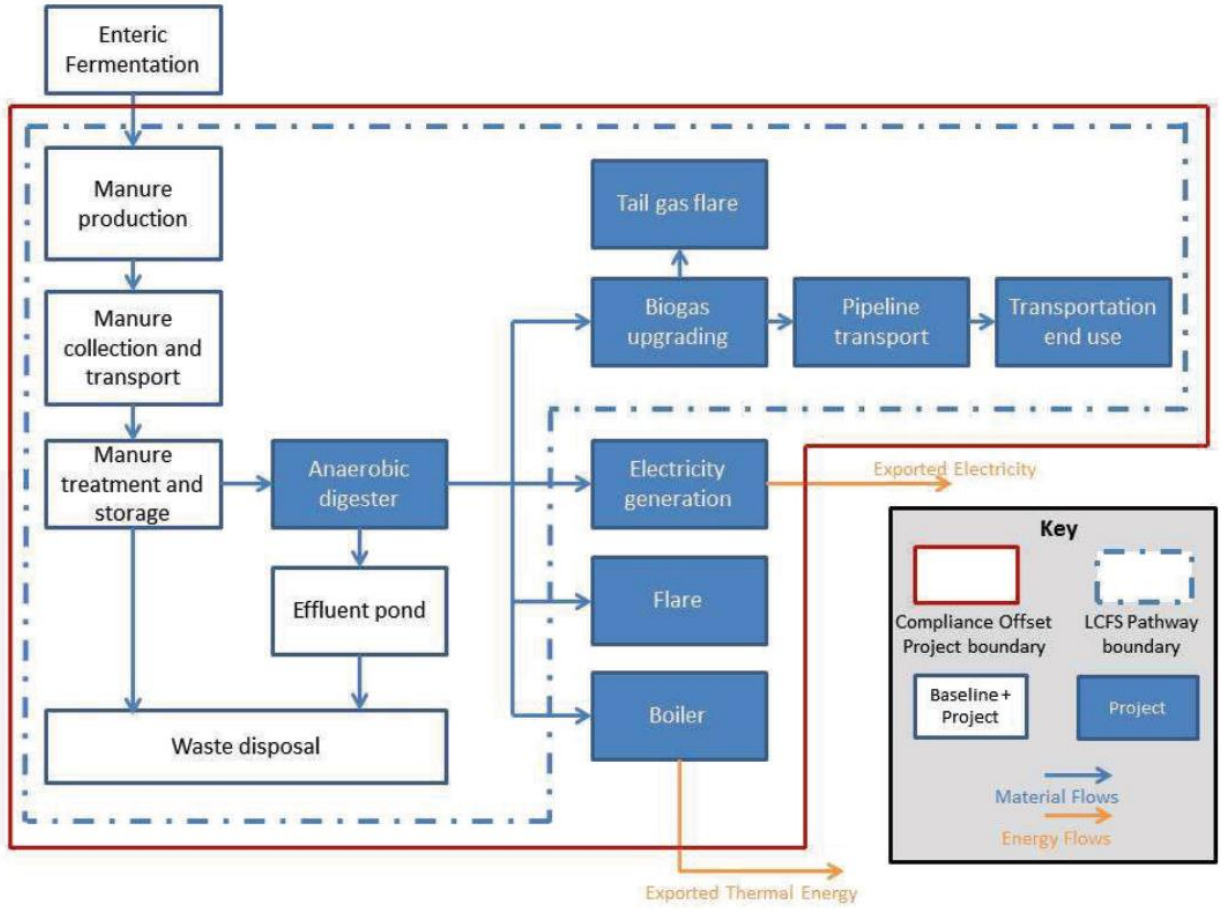
| CI Score (gCO2e/MJ) | Credit Price $196 | $80 | $100 | $120 | $160 | $200 |
|---|---|---|---|---|---|---|
| -273 | $8.31 | $3.39 | $4.24 | $5.09 | $6.79 | $8.48 |
| 10 | $1.89 | $0.77 | $0.96 | $1.16 | $1.54 | $1.93 |
| 20 | $1.66 | $0.68 | $0.85 | $1.02 | $1.36 | $1.70 |
| 30 | $1.44 | $0.59 | $0.73 | $0.88 | $1.17 | $1.46 |
| 40 | $1.21 | $0.49 | $0.62 | $0.74 | $0.99 | $1.23 |
| 50 | $0.98 | $0.40 | $0.50 | $0.60 | $0.80 | $1.00 |
| 60 | $0.75 | $0.31 | $0.38 | $0.46 | $0.62 | $0.77 |
| 70 | $0.53 | $0.22 | $0.27 | $0.32 | $0.43 | $0.54 |
| 80 | $0.30 | $0.12 | $0.15 | $0.18 | $0.25 | $0.31 |
| 90 | $0.07 | $0.03 | $0.04 | $0.04 | $0.06 | $0.07 |
| 100 | -$0.15 | -$0.06 | -$0.08 | -$0.09 | -$0.13 | -$0.16 |
| 110 | -$0.38 | -$0.16 | -$0.19 | -$0.23 | -$0.31 | -$0.39 |
| 120 | -$0.61 | -$0.25 | -$0.31 | -$0.37 | -$0.50 | -$0.62 |
| 130 | -$0.83 | -$0.34 | -$0.43 | -$0.51 | -$0.68 | -$0.85 |
| 140 | -$1.06 | -$0.43 | -$0.54 | -$0.65 | -$0.87 | -$1.08 |
| 150 | -$1.29 | -$0.53 | -$0.66 | -$0.79 | -$1.05 | -$1.32 |
| CaRFG* ($/gallon) 100.82 | -$0.139 | -$0.057 | -$0.071 | -$0.085 | -$0.113 | -$0.142 |

* Maximum pass-through cost for gasoline. Assumes a blend of CARBOB with 10 volume percent ethanol at a CI of 79.9 g/MJ. Ethanol at 79.9 g/MJ is assumed to receive no LCFS premium.

*Last Modified 05/31/2019*

[220] Data Dashboard, CAL. AIR RES. BD. Figure 7, *https://ww3.arb.ca.gov/fuels/lcfs/dashboard/dashboard.htm* (last visited Oct. 20, 2021).

**Figure 2.** CARB schematic of the system boundaries for upgraded biogas (biomethane) from Anaerobic digestion of Dairy Manure.[221]



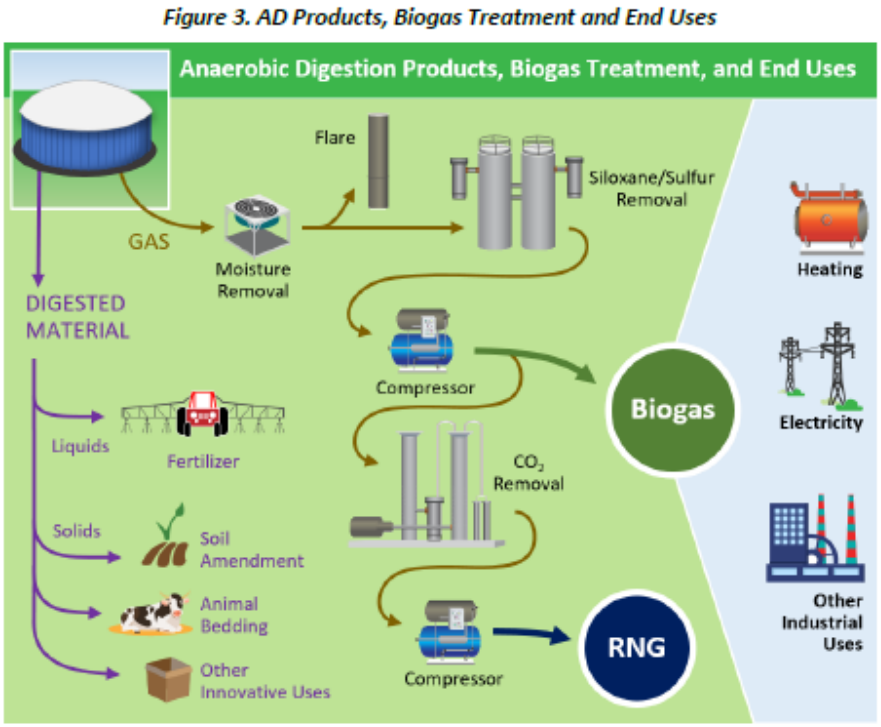

[221] CAL. AIR RES. BD., *supra* note 96 at 13.

**Figure 3.** Waste Management Hierarchy chart for manure management.[222]

| Waste Management Hierarchy | Attribute | Applicability in animal manure management |
|---|---|---|
| Avoidance | Most preferred option. Preventive. Use of less hazardous materials in the design and manufacture of products. Develop strategies for cleaner and environmentally friendly production | While the production of wastes cannot be completely eliminated in animal production, the production can be made cleaner and environmentally friendly |
| Reduction of wastes | Second most preferred option. Preventive. Actions to make changes in the type of materials being used for specific products. This approach contributes to effective savings of natural resources | Applicable |
| Reuse | Predominantly ameliorative and partly preventive. The waste is collected during the production phase and fed back into the production process. Reduce the amount of wastes generated and the cost of production. Desirable. | Applicable |
| Recycle | Predominantly ameliorative and partly preventive. The waste materials are collected and processed, and used in the production of new products. The process prevents pollution. Desirable. | Applicable |
| Energy recovery | Predominantly assimilative and partly ameliorative. This is also called waste to energy conversion. Wastes are converted to usable energy forms such as heat, light, electricity, etc. Desirable. | Applicable |
| Treatment | Predominantly assimilative and partly ameliorative. Desirable. | Applicable |
| Sustainable disposal | Disposal is the least preferred option in the waste management hierarchy and should be avoided. | Possible but not preferred |

[222] Gabriel Adebayo Malomo et al., *Sustainable Animal Manure Management Strategies and Practices*, 9 (Aug. 29, 2018) https://www.intechopen.com/books/agricultural-waste-and-residues/sustainable-animal-manure-management-strategies-and-practices.

**Figure 4.** Diagram of downstream uses of digested materials.[223]




[223] ENV'T. PROT. AGENCY, *An Overview of Renewable Natural Gas from Biogas* 4 (July 2020) https://www.epa.gov/sites/production/files/2020-07/documents/lmop_rng_document.pdf.

**Figure 5.** Rise in Average Monthly Credit Price since 2013.[224]




**Table 2.** The California dairy industry experienced negative average residuals in 2015 and 2016, indicating a lack of profit in these years.[225]

**Table 1.6:** California Dairy Farm Annual Unit Costs of Production by Category 2014-2017

| Dairy Input | 2014 $/cwt | 2015 $/cwt | 2016 $/cwt | 2017 $/cwt |
|---|---|---|---|---|
| Feed | $11.05 | $10.46 | $9.22 | $8.77 |
| Hired Labor | $1.56 | $1.70 | $1.74 | $1.87 |
| Herd Replacement | $1.37 | $2.12 | $2.10 | $1.88 |
| Operating Costs | $2.88 | $2.93 | $2.92 | $3.06 |
| Milk Marketing | $0.56 | $0.56 | $0.55 | $0.55 |
| **Total Costs** | **$17.42** | **$17.77** | **$16.53** | **$16.13** |
| **Average Mailbox Price** | **$22.37** | **$15.94** | **$15.56** | **$16.99** |
| **Price – Costs (Residual)** | **$4.95** | **-$1.83** | **-$0.97** | **$0.86** |

Source: CDFA California Dairy Cost of Production Annuals
https://www.cdfa.ca.gov/dairy/dairycop_annual.html

[224] AcMoody, *supra* note 128 at 4.
[225] Matthews, *supra* note 130 at 20.

**Figure 6.** Groundwater contamination sites in Kern County.[226]

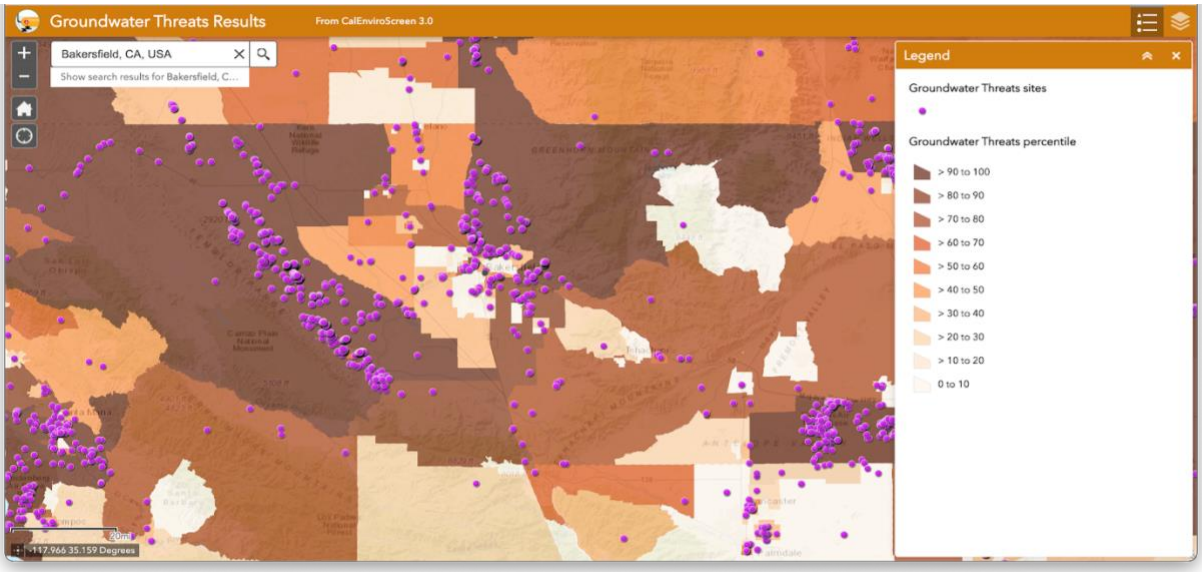
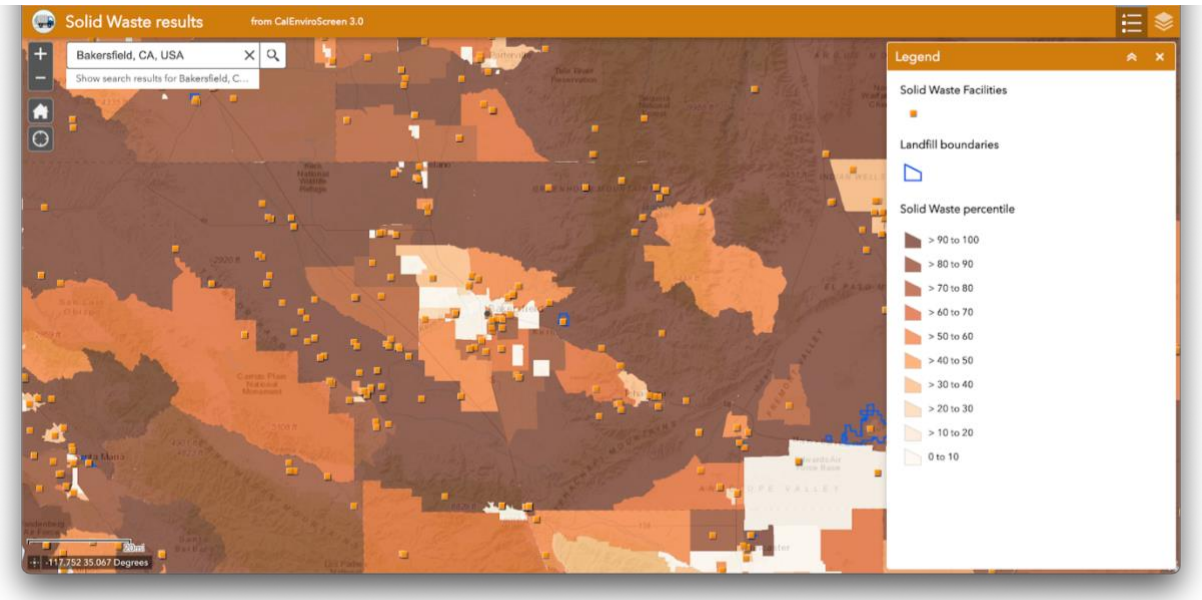
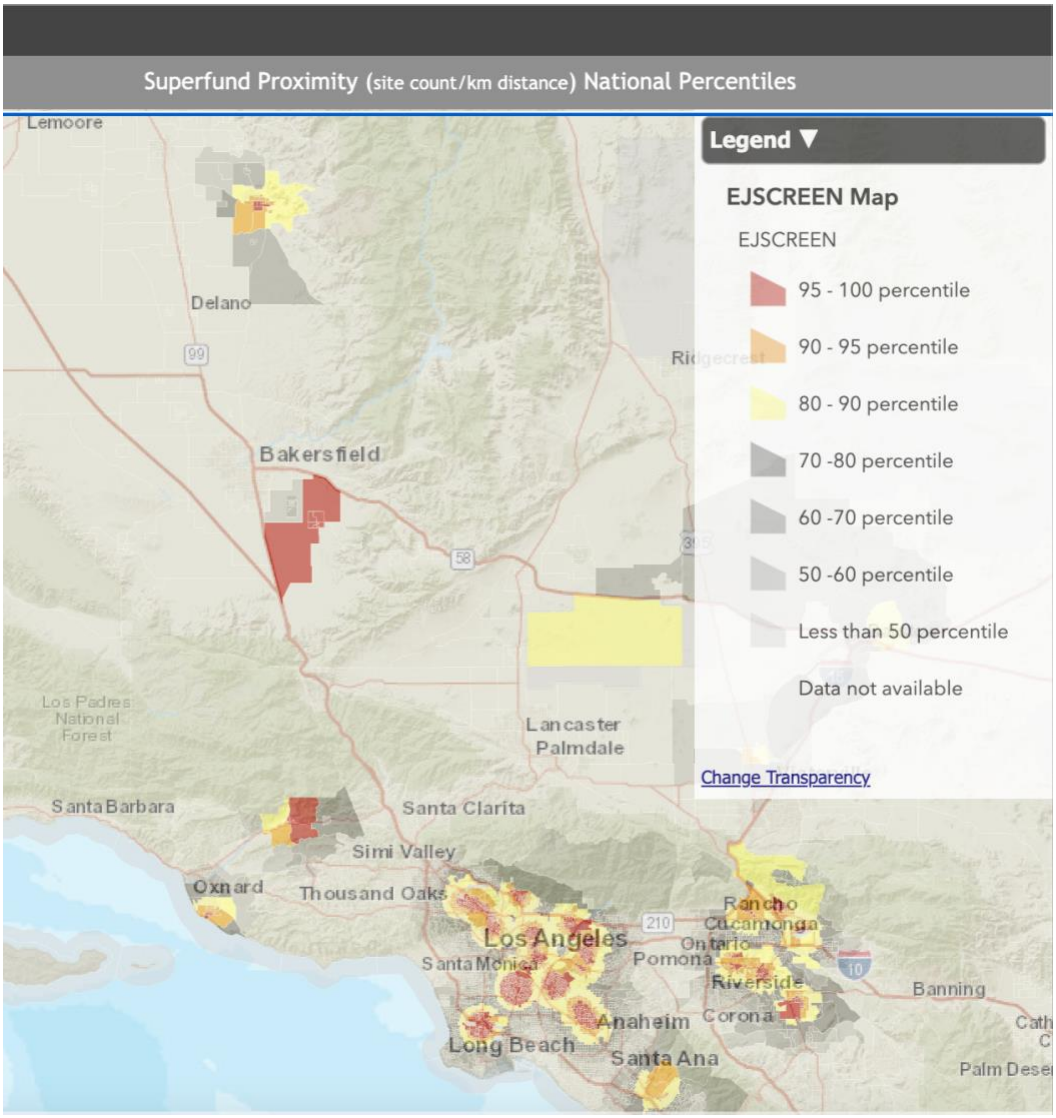



**Figure 7.** Solid waste contamination in Kern County.[227]




[226] CAL. OFFICE OF ENV'T HEALTH HAZARD ASSESSMENT, *supra* note 29.
[227] *Id.*

**Figure 8.** Superfund site near Bakersfield, CA.[228]




[228] *EJScreen*, ENV'T. PROT. AGENCY, https://www.epa.gov/ejscreen (last accessed Apr. 10, 2021).

**Table 3.** A list of the top counties that sell cow's milk ($ billions), the majority of which are in California.[229]

| Top Counties in Cow's Milk Sales ($ billions) | |
|---|---|
| Tulare, CA | 1.8 |
| Merced, CA | 1.1 |
| Gooding, ID | 0.7 |
| Stanislaus, CA | 0.7 |
| Kings, CA | 0.6 |
| Kern, CA | 0.5 |
| Yakima, WA | 0.4 |
| Lancaster, PA | 0.4 |
| Fresno, CA | 0.4 |
| San Joaquin, CA | 0.4 |

*Does not include counties withheld to avoid disclosing individual data.*

[229] U.S. DEP'T OF AGRIC., *Dairy Cattle and Milk Production* at 2 (Oct. 2014) https://www.nass.usda.gov/Publications/Highlights/2014/Dairy_Cattle_and_Milk_Production_Highlights.pdf.

**Table 4.** Demographic data on Kern, Kings, Madera, and San Joaquin Counties.[230]

| Fact | Kern County, California | Kings County, California | Madera County, California | San Joaquin County, California |
|---|---|---|---|---|
| Population estimates, July 1, 2019, (V2019) | 900,202 | 152,940 | 157,327 | 762,148 |
| Population estimates base, April 1, 2010, (V2019) | 839,621 | 152,974 | 150,834 | 685,306 |
| Population, percent change - April 1, 2010 (estimates base) to | 7.20% | 0.00% | 4.30% | 11.20% |
| Population, Census, April 1, 2010 | 839,631 | 152,982 | 150,865 | 685,306 |
| Persons under 5 years, percent | 7.60% | 7.60% | 7.30% | 6.90% |
| Persons under 18 years, percent | 28.80% | 27.00% | 27.40% | 26.80% |
| Persons 65 years and over, | 11.20% | 10.50% | 14.30% | 13.10% |
| Female persons, percent | 48.80% | 44.90% | 51.80% | 50.10% |
| White alone, percent | 82.30% | 80.80% | 85.90% | 66.10% |
| Black or African American alone, | 6.30% | 7.50% | 4.20% | 8.30% |
| American Indian and Alaska Native alone, percent | 2.60% | 3.20% | 4.40% | 2.00% |
| Asian alone, percent | 5.40% | 4.40% | 2.60% | 17.40% |
| Native Hawaiian and Other Pacific Islander alone, percent | 0.30% | 0.40% | 0.30% | 0.80% |
| Two or More Races, percent | 3.20% | 3.70% | 2.60% | 5.50% |
| Hispanic or Latino, percent | 54.60% | 55.30% | 58.80% | 42.00% |
| White alone, not Hispanic or Latino, percent | 32.80% | 31.30% | 33.20% | 30.50% |
| Veterans, 2015-2019 | 35,594 | 9,684 | 6,317 | 29,013 |
| Foreign born persons, percent, | 19.90% | 18.90% | 20.20% | 23.30% |
| Housing units, July 1, 2019, | 302,898 | 46,965 | 51,438 | 248,636 |
| Owner-occupied housing unit rate, 2015-2019 | 58.30% | 52.30% | 64.10% | 56.60% |
| Median value of owner-occupied housing units, 2015-2019 | 213,900 | 215,900 | 251,200 | 342,100 |
| Median selected monthly owner costs -with a mortgage, 2015-2019 | $1,527 | $1,459 | $1,551 | $1,907 |
| Median selected monthly owner costs -without a mortgage, 2015- | $452 | $446 | $478 | $523 |
| Median gross rent, 2015-2019 | $978 | $990 | $1,014 | $1,208 |
| Building permits, 2019 | 2,261 | 409 | 644 | 3,499 |
| Households, 2015-2019 | 270,282 | 43,452 | 44,881 | 228,567 |
| Persons per household, 2015- | 3.17 | 3.13 | 3.28 | 3.17 |
| Living in same house 1 year ago, percent of persons age 1 year+, | 86.10% | 81.90% | 87.90% | 86.80% |
| Language other than English spoken at home, percent of persons age 5 years+, 2015-2019 | 44.20% | 41.50% | 45.30% | 40.90% |
| High school graduate or higher, percent of persons age 25 years+, | 74.10% | 73.40% | 71.90% | 79.30% |
| Bachelor's degree or higher, percent of persons age 25 years+, | 16.40% | 14.70% | 14.60% | 18.80% |
| With a disability, under age 65 years, percent, 2015-2019 | 7.80% | 8.60% | 8.70% | 8.70% |
| Persons without health insurance, under age 65 years, | 9.00% | 8.50% | 10.70% | 7.80% |
| In civilian labor force, total, percent of population age 16 | 58.00% | 51.80% | 54.30% | 60.30% |
| In civilian labor force, female, percent of population age 16 | 52.40% | 51.50% | 47.90% | 53.60% |
| Total accommodation and food services sales, 2012 ($1,000) | 1,092,151 | 378,595 | 150,065 | 808,606 |
| Total health care and social assistance receipts/revenue, | 3,675,000 | 587,818 | 760,956 | 3,447,722 |
| Median household income (in 2019 dollars), 2015-2019 | $53,350.00 | $57,848.00 | $57,585.00 | $64,432.00 |
| Per capita income in past 12 months (in 2019 dollars), 2015- | $23,326.00 | $22,373.00 | $22,853.00 | $27,521.00 |
| Persons in poverty, percent | 19.00% | 16.00% | 17.60% | 13.60% |

[230] *Quick Facts*, U.S. CENSUS, https://www.census.gov/quickfacts/fact/table/US/PST045219 (last visited Apr. 10, 2021).

**Table 5.** Demographic data on Merced, Tulare, Fresno, and Stanislaus Counties.[231]

| Fact | Merced County, California | Tulare County, California | Fresno County, California | Stanislaus County, California |
|---|---|---|---|---|
| Population estimates, July 1, 2019, (V2019) | 277,680 | 466,195 | 999,101 | 550,660 |
| Population estimates base, April 1, 2010, (V2019) | 255,796 | 442,182 | 930,507 | 514,450 |
| Population, percent change - April 1, 2010 (estimates base) to July 1, 2019, (V2019) | 8.60% | 5.40% | 7.40% | 7.00% |
| Population, Census, April 1, 2010 | 255,793 | 442,179 | 930,450 | 514,453 |
| Persons under 5 years, percent | 7.70% | 7.80% | 7.60% | 7.10% |
| Persons under 18 years, percent | 29.30% | 30.50% | 28.20% | 27.00% |
| Persons 65 years and over, percent | 11.40% | 11.60% | 12.60% | 13.40% |
| Female persons, percent | 49.50% | 50.00% | 50.10% | 50.40% |
| White alone, percent | 82.20% | 88.20% | 76.60% | 83.30% |
| Black or African American alone, percent | 3.90% | 2.20% | 5.80% | 3.50% |
| American Indian and Alaska Native alone, percent | 2.50% | 2.80% | 3.00% | 2.00% |
| Asian alone, percent | 7.80% | 4.00% | 11.10% | 6.10% |
| Native Hawaiian and Other Pacific Islander alone, percent | 0.40% | 0.20% | 0.30% | 0.90% |
| Two or More Races, percent | 3.20% | 2.70% | 3.20% | 4.20% |
| Hispanic or Latino, percent | 61.00% | 65.60% | 53.80% | 47.60% |
| White alone, not Hispanic or Latino, percent | 26.50% | 27.70% | 28.60% | 40.40% |
| Veterans, 2015-2019 | 9,225 | 14,633 | 36,125 | 21,051 |
| Foreign born persons, percent, 2015-2019 | 26.30% | 21.80% | 21.20% | 20.30% |
| Housing units, July 1, 2019, (V2019) | 86388 | 151603 | 336473 | 182978 |
| Owner-occupied housing unit rate, 2015-2019 | 52.20% | 57.10% | 53.30% | 57.80% |
| Median value of owner-occupied housing units, 2015-2019 | 252,700 | 205,000 | 255,000 | 291,600 |
| Median selected monthly owner costs -with a mortgage, 2015-2019 | 1,493 | 1,420 | 1,631 | 1,702 |
| Median selected monthly owner costs -without a mortgage, 2015-2019 | $460.00 | $421.00 | $484.00 | $503.00 |
| Median gross rent, 2015-2019 | $1,021.00 | $942.00 | $998.00 | $1,155.00 |
| Building permits, 2019 | 918 | 1,872 | 3,393 | 699 |
| Households, 2015-2019 | 80,008 | 138,238 | 307,906 | 173,898 |
| Persons per household, 2015-2019 | 3.32 | 3.3 | 3.14 | 3.09 |
| Living in same house 1 year ago, percent of persons age 1 year+, 2015-2019 | 86.60% | 88.60% | 85.80% | 87.90% |
| Language other than English spoken at home, percent of persons age 5 years+, 2015-2019 | 53.30% | 51.30% | 44.60% | 42.90% |
| High school graduate or higher, percent of persons age 25 years+, 2015-2019 | 69.10% | 70.80% | 76.00% | 78.90% |
| Bachelor's degree or higher, percent of persons age 25 years+, 2015-2019 | 13.80% | 14.60% | 21.20% | 17.10% |
| With a disability, under age 65 years, percent, 2015-2019 | 9.10% | 8.20% | 9.20% | 9.00% |
| Persons without health insurance, under age 65 years, percent | 9.00% | 9.00% | 8.80% | 7.10% |
| In civilian labor force, total, percent of population age 16 years+, 2015-2019 | 59.60% | 59.00% | 60.90% | 60.90% |
| In civilian labor force, female, percent of population age 16 years+, 2015-2019 | 51.00% | 51.10% | 55.20% | 53.40% |
| Total accommodation and food services sales, 2012 ($1,000) | 232,910 | 451,880 | 1,226,169 | 705,698 |
| Total health care and social assistance receipts/revenue, 2012 ($1,000) | 788114 | 1610236 | 5325615 | 3634960 |
| Median household income (in 2019 dollars), 2015-2019 | $53,672.00 | $49,687.00 | $53,969.00 | $60,704.00 |
| Per capita income in past 12 months (in 2019 dollars), 2015-2019 | $23,011.00 | $21,380.00 | $24,422.00 | $26,258.00 |
| Persons in poverty, percent | 17.00% | 18.90% | 20.50% | 13.00% |

[231] *Id.*

**Table 6.** Quick facts on potential pathogens found in digestate and links for further information.[232]

| **Pathogen** | **Effects** | **For more information** |
|---|---|---|
| Cryptosporidium parvum | "[M]icroscopic parasite that causes the diarrheal disease cryptosporidiosis." | https://www.cdc.gov/parasites/crypto/index.html |
| Salmonella spp | "Most people with Salmonella infection have diarrhea, fever, and stomach cramps." | https://www.cdc.gov/salmonella/general/index.html |
| norovirus | "Norovirus is a very contagious virus that causes vomiting and diarrhea." | https://www.cdc.gov/norovirus/index.html |
| Streptococcus pyogenes | "[C]an cause both noninvasive and invasive disease, as well as nonsuppurative sequelae. " | https://www.cdc.gov/groupastrep/diseases-hcp/index.html |
| E. coli enteropathogenic (EPEC) | "[A]re gram-negative bacteria that inhabit the gastrointestinal tract. Most strains do not cause illness. Pathogenic E. coli are categorized into pathotypes on the basis of their virulence genes. Six pathotypes are associated with diarrhea | https://wwwnc.cdc.gov/travel/yellowbook/2020/travel-related-infectious-diseases/escherichia-coli-diarrheagenic |

[232] *Parasites – Cryptosporidium (also known as "Crypto")*, CDC, https://www.cdc.gov/parasites/crypto/index.html (last updated July 1, 2019); *Salmonella*, CDC, https://www.cdc.gov/salmonella/general/index.html (last updated Dec 5, 2019); *Norovirus*, CDC, https://www.cdc.gov/norovirus/index.html (last updated Mar. 5, 2021); *Group A Streptococcal (GAS) Disease*, CDC, https://www.cdc.gov/groupastrep/diseases-hcp/index.html (last updated May 7, 2020); Alison Winstead et al., *Escherichia coli, Diarrheagenic*, CDC, https://wwwnc.cdc.gov/travel/yellowbook/2020/travel-related-infectious-diseases/escherichia-coli-diarrheagenic (last updated July 1, 2021); J. L. Cloud et al., *Identification of Mycobacterium spp. by Using a Commercial 16S Ribosomal DNA Sequencing Kit and Additional Sequencing Libraries*, 40(2) J. Clinical Microbiology 400, 400 (Feb. 2002); *Typhoid Fever and Paratyphoid Fever*, CDC, https://www.cdc.gov/typhoid-fever/index.html (last updated Aug. 22, 2018); *Fact Sheet: Clostridium spp*, WickhamLaboratories, https://wickhamlabs.co.uk/technical-resource-centre/fact-sheet-clostridium-spp/ (last visited May 5, 2021); Listeria (Listeriosis), CDC, https://www.cdc.gov/listeria/symptoms.html (Dec. 12, 2016).

| | | |
|---|---|---|
| | (diarrheagenic) […] enteropathogenic E. coli (EPEC)" | |
| Mycobacterium spp. | "Mycobacterium species are a group of acid-fast, aerobic, slow-growing bacteria. The genus comprises more than 70 different species, of which about 30 have been associated with human disease (23)." | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC153382/#:~:text=Mycobacterium%20species%20are%20a%20group,the%20causative%20agent%20of%20tuberculosis |
| Salmonella typhi (followed by S. paratyphi) | "Typhoid fever and paratyphoid fever are life-threatening illnesses caused by Salmonella serotype Typhi and Salmonella serotype Paratyphi, respectively." | https://www.cdc.gov/typhoid-fever/index.html |
| Clostridium spp. | "Clostridia are one of the most commonly studied anaerobes that cause disease in humans". Some of the species of Clostridium can cause: botulism, overgrow in the intestine compromising the inherent gut flora (potentially leading to colitis), tetanus, gas gangrene (myonecrosis), and toxic shock syndrome. | https://wickhamlabs.co.uk/technical-resource-centre/fact-sheet-clostridium-spp/ |
| Listeria monocytogenes | "[C]an cause fever and diarrhea similar to other foodborne germs, but this type of Listeria infection is rarely diagnosed. Symptoms in people with invasive listeriosis, meaning the bacteria has spread beyond the gut, depend on whether the person is pregnant." | https://www.cdc.gov/listeria/symptoms.html |

*Attach. 4*

*Sent via email and U.S. certified mail:*

January 26, 2022

Ruthie Lazenby
Clinical Legal Fellow
Environmental Justice Clinic
Vermont Law School
164 Chelsea Street, PO Box 96
South Royalton, VT 05068
*rlazenby@vermontlaw.edu*

Brent Newell
Senior Attorney
Public Justice
475 14th Street, Suite 610
Oakland CA 94612
*bnewell@publicjustice.net*

Re: Petition for Rulemaking to Exclude All Fuels Derived from Biomethane from Dairy and Swine Manure from the Low Carbon Fuel Standard Program

Dear Ms. Lazenby and Mr. Newell,

Thank you for the petition for rulemaking,[1] submitted by Vermont Law School's Environmental Justice Clinic and Public Justice on behalf of the Association of Irritated Residents (AIR), Leadership Counsel for Justice & Accountability, Food & Water Watch, and Animal Legal Defense Fund, on October 27, 2021, to the California Air Resources Board (CARB).[2] CARB initially acknowledged receipt of the petition on November 8, 2021.[3] We appreciate that petitioners agreed to toll the deadline for response to the petition to January 28, 2022, while we took opportunities to discuss the petition with petitioners to better understand the concerns as well as the availability of supporting documentation.[4]

In your petition, you requested that CARB amend the Low Carbon Fuel Standard (LCFS) regulations found at Title 17, California Code of Regulations (CCR), sections 95480 through 95503. The LCFS regulations are authorized by the Global Warming Solutions Act of 2006

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[1] Submitted pursuant to Government Code, § 11340.6.
[2] The petition is available from CARB upon request.
[3] *See* letter from Mr. Matthew Botill, Chief, Industrial Strategies Division, CARB, to Ms. Ruthie Lazenby and Mr. Brent Newell, counsel for petitioners, attached as Exhibit A.
[4] *See* tolling agreement executed on December 6, 2021, attached as Exhibit B.

(Stats. 2006, Ch. 488, commonly referred to as AB 32.[5]) Specifically, the petition requests that CARB exclude all fuels derived from biomethane from dairy and swine manure from the LCFS, or, in the alternative, to reform the LCFS treatment of those fuels to account for additional greenhouse gas (GHG) emissions. The sections of the regulation that the petition requests that CARB amend are title 17, CCR, sections 95488.3 and 95488.9(f).

I want to take this opportunity to again thank the petitioners for taking the time to meet twice with me and other CARB senior management (on December 14, 2021, and also earlier this month on January 13, 2022). I also appreciate you, as a result of those meetings, sharing additional information for our consideration. I found the discussions productive and hope that they will continue through our public processes. I welcome continued engagement on the concerns raised in the petition as we consider the scope of potential amendments which will be discussed with all interested stakeholders as part of a public process we will initiate by first quarter of 2023. In the meantime, we welcome petitioners' input as we review and compile related materials.

CARB and petitioners share a commitment to ensure that CARB programs such as the LCFS continue to reduce air pollution disparities experienced by impacted communities, and that any adjustments to the regulation are carefully evaluated and done so through an open public process. Since 2019, LCFS staff have carefully reviewed comments received from various stakeholders (including the petitioners) in opposition to as well as support of the certification of animal manure biomethane pathways under the current LCFS regulation, and appreciate petitioners' contributions to strengthening that process.[6]

CARB further agrees it is important, as petitioners urge, to "ensure the LCFS provides environmental benefits and does not degrade water quality and interfere with efforts to improve air quality in the San Joaquin Valley."[7] CARB is committed as an organization to continue to use its authority (including the regulations it develops and implements such as the LCFS) to take action to protect the state's most impacted communities while reducing both GHG and other project-related criteria pollutants and toxics air contaminants. We invite ongoing dialogue with the petitioners as well as other stakeholders regarding information and data to ensure that the programs CARB develops and implements are delivering the intended benefits throughout the state and in communities.

As noted, we are committed to engaging with petitioners on their concerns, and committed to ensuring our programs focus on environmental justice and environmental integrity. However, the petition's specific requests for a near-term rulemaking are premature. I am therefore denying your petition in part and granting it in part for the reasons that follow.

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[5] *See, e.g.*, Health and Safety Code, sections 38560 and 38560.5.

[6] *See, e.g.*, June 26, 2020 *Comment Letter Re: Tier 2 Pathway Application: Application No. B0098; Calgren Dairy Fuels plus Circle A, Robert Vander Eyk, Legacy Ranch, Cornerstone, Sousa and Sousa, and Vander Poel Dairies*; and *CARB staff's public response*.

[7] Petition for Rulemaking to Exclude All Fuels Derived from Biomethane from Dairy and Swine Manure from the Low Carbon Fuel Standard Program, page 5, October 27, 2021.

**Relationship Between Ongoing AB 32 Scoping Plan Update and Potential Future LCFS Amendments**

As petitioners are aware, CARB is coordinating an ongoing public process to develop an update of California's statewide strategy to achieve its climate change emissions reduction targets. This statewide strategy, known as the "Scoping Plan," is due to be considered by our Board in 2022.[8] The Scoping Plan is the statewide climate change strategy "for achieving the maximum technologically feasible and cost-effective reductions of greenhouse gas emissions" focusing on evaluating the integration of incentives, programs, and regulations to achieve the state's climate targets.[9] CARB has convened the AB 32 Environmental Justice Advisory Committee to consult and advise on the development of the 2022 Scoping Plan update. As a part of their advisory role, the Environmental Justice Advisory Committee will be conducting community engagement.

The first Scoping Plan was adopted by the Board in 2008, and the most recent update was adopted in late 2017. In June 2021, CARB began the process for the next update to the Scoping Plan for Board consideration in late 2022. Materials related to the ongoing public process, including workshop notices, relevant documents, and public feedback received, are available on our website.[10] As part of the 2022 Scoping Plan update, staff will consider legislative statutory direction, the Governor's Executive Orders, the latest science, and recommendations from the AB 32 Environmental Justice Advisory Committee and all other stakeholders on how to transition away from combustion of fossil fuels in all sectors of the economy. The LCFS has been included in past AB 32 climate change scoping plans as part of the mix of policies designed to drive emissions reductions from the transportation sector. That sector continues to be our largest source of greenhouse gases and harmful local air pollution.

We expect the 2022 Scoping Plan update to identify potential changes necessary to deploy clean fuels and technologies across the economy in order to achieve the state's climate targets. This may ultimately require changes to existing programs, such as the LCFS, or the identification of new programs. But the general direction of such revised or new programs will be informed by recommendations included in the final 2022 Scoping Plan update to ensure California has a holistic, fully-integrated, economy-wide state strategy for meeting its GHG reduction targets.

Past experience with our Scoping Plans is illustrative: The 2017 Scoping Plan update provided recommendations to strengthen LCFS statewide carbon intensity benchmarks in order to help the state achieve our 2030 GHG emissions reduction target of 40 percent below 1990 emissions levels. Following those recommendations, CARB staff proposed LCFS amendments in 2018, which significantly strengthened the program's regulatory targets –

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[8] AB 32 directs CARB to develop, and update at least once every five years, the overarching climate change strategy known by the statutory term "scoping plan." *See* Health and Safety Code, § 38561.

[9] *Id.*

[10] *https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/scoping-plan-meetings-workshops*

from a 10 percent average reduction in statewide transportation fuel lifecycle carbon intensity (CI) by 2020, to a 20 percent CI reduction by 2030. Those LCFS amendments grew out of an extensive informal public stakeholder feedback process launched in 2016,[11] and were formally proposed and eventually adopted in 2018.[12] As required by law, CARB in amending these regulations carried out an environmental analysis pursuant to the California Environmental Quality Act, as well as an economic impact analysis required for major regulations.[13] By the time CARB submitted the final Board approved regulatory package to the Office of Administrative Law, interested stakeholders had provided input on the proposed concepts and amendments through more than two dozen public workshops or working meetings. The proposed amendments were introduced for public and Board member discussion at two Board hearings, and CARB staff responded to hundreds of public comments submitted.

Therefore, it is premature to consider amending the LCFS regulation until the Scoping Plan update process has informed how the state's portfolio approach to climate mitigation may be best structured to deliver cost-effective, technologically feasible, and direct emissions reductions across various sources. CARB staff outlined the anticipated relationship between the 2022 Scoping Plan update and potential future LCFS amendments during the December 7, 2021, LCFS workshop. Specifically, because the 2022 Scoping Plan update will evaluate how California can achieve carbon neutrality by mid-century, including the types and role of low carbon fuels needed in the future, final Board member and public input on that update is likely to inform any eventual staff recommendations on potential amendments to the LCFS. Thus, our staff do not plan to formally propose regulatory changes to the LCFS until after the 2022 Scoping Plan update has been considered by the Board and after informal pre-rulemaking workshops on potential LCFS amendments. However, both the public meetings on the 2022 Scoping Plan update, and on concepts for potential changes to the LCFS as recently occurred, provide an opportunity for CARB staff and petitioners, in open public processes, to discuss the most beneficial role for biomethane in displacing fossil energy, and options to achieve the state's methane reduction targets for 2030. The public meetings of the Environmental Justice Advisory Committee, as well as the recommendations the committee will develop through that process, will provide an additional opportunity for conversation.

We recognize that consideration of LCFS amendments may be necessary to reflect direction from the Scoping Plan update and incorporate changes in conditions and policies that have occurred since the last major LCFS amendments in 2018. Therefore, similar to the public process on the 2017 Scoping Plan update and the 2018 LCFS amendments, CARB staff plan,

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[11] *See* LCFS public working meetings archive materials available here: *https://ww2.arb.ca.gov/resources/documents/lcfs-meetings-workshops-archive#2016*

[12] *See* 2018 LCFS amendments rulemaking materials available here: *https://ww2.arb.ca.gov/rulemaking/2018/low-carbon-fuel-standard-and-alternative-diesel-fuels-regulation-2018*

[13] A standardized regulatory impact analysis is required of any regulatory action "that will have an economic impact on California business enterprises and individuals in an amount exceeding fifty million dollars ($50,000,000), as estimated by the agency." (Govt. Code Section 11342.548.)

throughout 2022, to host informal public workshops and meetings to discuss and consider potential changes to the LCFS program. Petitioners did participate in the initial LCFS public workshop on potential future changes to the LCFS program hosted by CARB staff on December 7, 2021, and submitted one[14] of more than 100 feedback letters received and currently under consideration following that workshop.[15] LCFS staff are currently evaluating that wide ranging public feedback, and working to schedule additional public meetings to continue that discussion.

**Considering Senate Bill (SB) 1383 and the Need for Methane Reductions**

SB 1383 (Stats. 2016, Ch. 395) codified the state's methane reduction milestones, which include the target of reducing statewide livestock manure methane emissions 40 percent below 2013 levels by 2030.[16] Methane is among the high global-warming potential gases with short atmospheric lifetimes we group under state law as "short-lived climate pollutants." In 2017, following a requirement in SB 1383, CARB approved a Short-Lived Climate Pollutant (or SLCP) Reduction Strategy,[17] which was designed as California's comprehensive plan for reducing SLCPs, including methane from dairies and other sources, and discussed the LCFS as one potential regulatory tool for promoting progress toward achieving SLCP reduction goals. In addition to directing CARB to potentially develop methane reduction regulations to achieve those targets, the same section of SB 1383 also directs CARB to "ensure" LCFS crediting for methane reductions.[18] The current LCFS provisions specifically authorizing the generation of LCFS credits for volumes of biomethane supplied as transportation fuel associated with captured methane from agricultural manure are responsive to that SB 1383 statutory direction. Beyond the petition's recommended exclusion of those fuels, to the extent that the petition recommends reform of those provisions to more effectively maximize benefits, and avoid potential harms, we welcome and appreciate petitioners ongoing engagement, and look forward to working with you in the consideration of any subsequent amendments to the LCFS.

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[14] Following the submittal of the petition, in addition to petitioners' January 7, 2022, comment following the December 7, 2021, workshop, petitioners submitted comments on December 14, 20, and 21, 2021, and January 24, 2022, regarding CARB certification of LCFS Tier 2 pathways posted for public comment. Those comments have been or will be addressed separately from this petition response as appropriate.

[15] December 7, 2021, LCFS public workshop materials available here: *https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/lcfs-meetings-and-workshops*; public feedback received on the workshop, including letter from petitioners, available here: *https://www.arb.ca.gov/lispub/comm2/bccommlog.php?listname=lcfs-wkshp-dec21-ws*

[16] *Health & Safety Code, § 39730.7.*

[17] The 2017 SLCP Reduction Strategy and supporting documents, including the associated environmental analysis, are available here: *https://ww2.arb.ca.gov/resources/documents/slcp-strategy-final*

[18] Specifically, *Health & Safety Code, § 39730.7*(e) directs that CARB "shall ensure that projects developed before the implementation of [methane reduction] regulations [not yet developed or adopted now] receive [LCFS] credit for at least 10 years."

As supported by California's 2017 Scoping Plan, SB 1383, the 2018 LCFS rulemaking process, including its associated environmental analysis,[19] the current LCFS crediting regime for biomethane derived from animal manure is delivering the significant benefits it was designed to achieve. Specifically, the current LCFS crediting incentive for manure methane capture for transportation fuel use appears to be spurring the development of new digester projects. CARB staff estimates that those projects will significantly reduce methane emissions associated with the animal agriculture sector in California and beyond. Since the 2018 LCFS amendments came into effect, the number of operational digesters capturing methane from animal manure lagoons in California has nearly quadrupled, from approximately 20, to approximately 77 today.[20] CARB staff estimate that these new digesters, in addition to providing local odor and other air quality benefits,[21] will reduce methane emissions by approximately 75 percent[22] during the lifetimes of these projects. The current LCFS regulatory scheme in effect has supported replacement of diesel heavy duty vehicles with natural gas vehicles, which reduces GHG emissions and decreases criteria air pollutant emissions from transportation. Volumes of animal waste-derived biomethane reported as transportation fuel to the LCFS grew from less than 1.5 million therms, in 2018, to more than 20 million therms in 2020 (the latest full year for which reported volumes is available). Accordingly, potential future improvements to that part of the LCFS will be best addressed in the context of a broader effort to strengthen the regulation as informed by the state's updated overall climate change strategy. We recognize the concerns expressed in your petition about facility consolidation issues, and potential associated environmental impacts, and look forward to reviewing additional data and continuing discussion throughout the workshop and regulatory processes.

**Determination and Conclusion**

Therefore, after careful consideration of your petition, the relevant law, and the current context of ongoing development of the next AB 32 climate change Scoping Plan and anticipated subsequent regulatory activity, I have reached a decision on your petition, pursuant to Government Code section 11340.7.[23] The Code provides that CARB "may grant

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[19] *Final Environmental Analysis for Amendments to the Low Carbon Fuel Standard and the Alternative Diesel Fuels Regulation*, September 17, 2018.

[20] U.S. Environmental Protection Agency, Livestock Anaerobic Digester Database, available here: *https://www.epa.gov/agstar/livestock-anaerobic-digester-database*

[21] See, for example, non-GHG air quality benefit information reported associated with digester projects supported by the Dairy Digester Research and Development Program (DDRDP) administered by the California Department of Food and Agriculture, available on the *California Climate Investments Project Map*.

[22] According to *California's Greenhouse Gas Inventory*, methane emissions from an anaerobic lagoon is estimated at 8.3 tons CO2e per dairy cow per year, whereas methane emissions from an anaerobic digester is estimated at 2.06 tons CO2e per dairy cow per year.

[23] The Board may delegate any duty it deems appropriate to its Executive Officer (Health and Safety Code section 39515(a)). The Board is conclusively presumed to have delegated any of its powers to the Executive Officer unless it has expressly reserved that power to itself (Health and Safety Code section 39516). The Board has not reserved the power to act on rulemaking petitions and it is, therefore, appropriate for me to act on this petition pursuant to my delegated authority.

or deny the petition in part, and may grant any other relief or take any other action it may determine to be warranted by the petition."[24] I am denying your petition in part, and granting other relief in part.[25] Specifically, I am:

(1) Denying your petition in part by declining to amend the LCFS Regulation at this time in the manners suggested.

(2) Granting other relief by affirming that CARB will continue to engage with petitioners on the programmatic and environmental justice and environmental integrity concerns raised in the petition through the ongoing AB 32 Climate Change Scoping Plan update process and upcoming informal workshops on LCFS throughout 2022, both of which will inform any future LCFS amendments. The proposed amendments will be fully vetted in a public process when we launch the formal rulemaking process in early 2023. Throughout this process CARB will continue to focus on improving air quality and health in the state's most impacted communities, ensure progress is made in achieving state and federal air quality standards, and reduce GHG emissions from all sources. CARB is committed to continue to encourage the reduction of emissions from dairy and swine farms.

The record upon which this decision is based includes the petition and its exhibits, this letter, the materials referenced herein, and its attachments.

In accordance with Government Code section 11340.7, subdivision (d), a copy of this letter is being transmitted to the Office of Administrative Law for publication in the California Regulatory Notice Register. The agency contact person in this matter is Gabriel Monroe, Senior Attorney, available at (916) 324-2132 or Gabriel.Monroe@arb.ca.gov. Interested parties may obtain a copy of the petition upon request to Chris Hopkins, available at (279) 208-7347 or Chris.Hopkins@arb.ca.gov. Upon request, physical copies would be obtained from 1001 I Street, Sacramento, California, 95814.

Sincerely,

Richard W. Corey
Executive Officer
California Air Resources Board

cc: (via email only)

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[24] Govt. Code, § 11340.7(b).

[25] Government Code 11340.7 provides that an agency addressing a petition shall "identify the agency, the party submitting the petition, the provisions of the California Code of Regulations requested to be affected, reference to authority to take the action requested, the reasons supporting the agency determination, an agency contact person, and the right of interested persons to obtain a copy of the petition from the agency." This response fulfills those requirements.

cc: Phoebe Seaton, Leadership Counsel for Justice & Accountability
Tom Frantz, Association of Irritated Residents
Tarah Heinzen, Food & Water Watch
Tyler Lobdell, Food & Water Watch
Cristina Stella, Animal Legal Defense Fund
Christine Ball-Blakely, Animal Legal Defense Fund
Liane M. Randolph, CARB Chair
Honorable Board Members
Rajinder Sahota, CARB Deputy Executive Officer
Chanell Fletcher, CARB Deputy Executive Officer
Ellen M. Peter, CARB Chief Counsel

*Attach. 5*

Sent via email

January 26, 2022

Tyler Lobdell, Staff Attorney
Food & Water Watch
*tlobdell@fwwatch.org*

Phoebe Seaton
Leadership Counsel for Justice & Accountability
*pseaton@leadershipcounsel.org*

Tom Frantz
Association of Irritated Residents
*tom.frantz49@gmail.com*

Christine Ball-Blakely
Animal Legal Defense Fund
*cblakely@aldf.org*

Brent Newell
Public Justice
*bnewell@publicjustice.net*

Re: Requests to Deny or Delay Consideration of Low Carbon Fuel Standard (LCFS) Pathway Certifications

Dear Mr. Lobdell, Ms. Seaton, Mr. Frantz, Ms. Ball-Blakely, and Mr. Newell,

Thank you for the comment letters[1] you submitted in December 2021 and January 2022 requesting that the California Air Resources Board (CARB) deny certification of fuel pathway applications under the Low Carbon Fuel Standard (LCFS) regulation.[2]

Your comment letters reference and attach your "Petition for Rulemaking to Exclude All Fuels Derived from Biomethane from Dairy and Swine Manure from the Low Carbon Fuel Standard Program" (Petition), which you all first submitted to CARB on October 27, 2021. We appreciate that petitioners agreed to toll the deadline for CARB's response to the

[1] Specifically, this letter is responsive to the similar comment letters petitioners submitted on LCFS Tier 2 pathway application numbers *B0220*, *B0207*, *B0218,* and *BO280,* as well as petitioners' *January 7, 2022 LCFS workshop feedback letter*. All LCFS Tier 2 pathway public postings, including pathway application information, public comments, and responses from LCFS pathway certification applicants are available *here*.

[2] The Low Carbon Fuel Standard regulation appears at sections 95480 to 95503 of title 17, California Code of Regulations (CCR). For concision, most citations to sections of the LCFS regulation in this letter refer specifically to the section numbers within this range, omitting broader reference to title 17, CCR, where these sections are published.

Petition to January 28, 2022, while we took opportunities to discuss the petition with petitioners to better understand the concerns as well as the availability of supporting documentation. I write to respond briefly to petitioners' pathway comment letters with contextual clarification that I hope might be helpful. This response letter addresses only the petitioners' letters regarding CARB certification of LCFS Tier 2 pathways, and not petitioners' petition for rulemaking, which we have responded to according to the applicable process.

The Petition requests CARB begin a rulemaking process to amend the LCFS regulation. Consistent with the California Administrative Procedure Act, the Petition is not a proper legal mechanism to stop implementing the current version of the LCFS regulation. The current LCFS regulations were adopted through the robust public rulemaking process required by law, and the law requires a similar process for any amendments to ensure all members of the public have an opportunity to engage with CARB prior to any adoption. Accordingly, under current law,[3] CARB must continue routine implementation of the aspects of the LCFS regulation that petitioners asked CARB to amend.

Nevertheless, following the initial October 2021 submission of the Petition, you have requested several times, both verbally in meetings with CARB staff and management and in writing in these public comments on fuel pathway certifications, that CARB agree to cease animal manure biomethane fuel pathway certifications until the Petition's requested amendments are finalized. These pathway certifications are routine implementation of aspects of the current LCFS regulation that the petitioners also request that CARB consider initiating a rulemaking process to amend. While we appreciate petitioners' engagement on both the Petition itself and on ongoing LCFS implementation, petitioners' supplemental request is essentially a request for CARB to grant their Petition in effect while it is still under consideration, which would bypass the legally required open public regulatory amendment process that the Petition requests be initiated.

Thank you again for your comments and ongoing interest in this aspect of the LCFS. We look forward to continuing to work with petitioners to improve the LCFS in the future.

Sincerely,

Gabriel Monroe, Senior Attorney
Legal Office, California Air Resources Board

cc: (via email only)

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[3] *Government Code § 11340.5*(a) outlines this elemental principal of administrative law: "No state agency shall issue, utilize, enforce, or attempt to enforce any guideline, criterion, bulletin, manual, instruction, order, standard of general application, or other rule, which is a regulation as defined in Section 11342.600, unless the guideline, criterion, bulletin, manual, instruction, order, standard of general application, or other rule has been adopted as a regulation and filed with the Secretary of State pursuant to this chapter."

Liane M. Randolph, CARB Chair
Richard W. Corey, CARB Executive Officer
Rajinder Sahota, CARB Deputy Executive Officer
Ellen M. Peter, CARB Chief Counsel

*Attach. 6*

Union of Concerned Scientists

To: Cheryl Laskowski

From: Jeremy Martin

Date: January 6, 2022

Subject: Manure biomethane analysis

As we mentioned in our 2021 feedback on the Scoping Plan, we are becoming increasingly concerned that the subsidies for manure-based biomethane arising from the LCFS are excessive and likely subsiding the largest confined animal feeding operation (CAFO) dairies, contributing to industry consolidation and putting dairies that use other manure methane strategies at a competitive disadvantage. We urge CARB to revise the lifecycle accounting or otherwise adjust the program to avoid these bad outcomes and ensure that the LCFS is an effective tool for transportation decarbonization without contributing to problems in other sectors of the economy.

We recognize that the capture and productive use of waste biomethane generated by anaerobic digestion (AD) from manure lagoons is a useful mechanism to mitigate methane pollution and can also replace a small amount of fossil methane use in energy and industrial applications. Over the last several years, we have heard conflicting arguments about whether the support from the LCFS was necessary to offset the costs of implementing AD or a huge windfall that was distorting the economics of dairies with harmful consequences. An analysis by Professor Aaron Smith at UC Davis suggested that the subsidy associated with LCFS credits for dairy biomethane was an order of magnitude larger than the cost to run and maintain a digester, and indeed that this value per cow is half as large as the value of the milk[1]. If this is true, it raises methodological and policy questions about the treatment of the manure biomethane under the LCFS.

To get a better handle on the issue, we commissioned Professor Kevin Fingerman and Amin Younes of Humboldt State University and the Schatz Energy Research Center to do some preliminary analysis of the issue, which we attach here. Their findings confirm what Professor's Smith's earlier work suggested, that the value of LCFS credits for a large, confined animal feeding operation (CAFO) dairy vastly exceed the cost of recovering the biomethane. This new analysis is not exhaustive, as it does not conduct a full market analysis of how much of the subsidy value of the LCFS is captured by the biomethane producer, versus what is captured by the biomethane user or other parties to the transaction. However, we believe the analysis suggests a high risk of adverse outcomes that could undermine the goals of the LCFS and broader California policy and warrant further scrutiny at the soonest possible opportunity.

Methodologically, the extremely large negative carbon intensity (CI) values for manure biomethane are the result of several assumptions and judgements made by CARB in the life-cycle analysis that bear reconsideration. In particular, CARB should revisit the assumption that the methane from manure lagoons is purely a waste product with no value that would be emitted into the atmosphere absent the LCFS support for use as a transportation fuel. In light of the large subsidies derived from the LCFS, nearly as large as the value of the milk produced at a large dairy, it is naïve to assume the policy will have no

[1] Aaron Smith. 2021. "What's Worth More: A Cow's Milk or its Poop?" asmith.ucdavis.edu/news/cow-power-rising

impact on the economics of the dairy industry going forward. There are any number of alternative lifecycle treatments that may be appropriate in the development of the CI score, for example treating biomethane as a coproduct rather than a waste. However, it might also be appropriate to address this concern through other means, such as guardrails within the LCFS policy to avoid negative spillover effects in agriculture. For example, it may be appropriate to set a floor of zero on the CI scores for fuels absent compelling documentation of permanent carbon sequestration. Avoided methane emissions could potentially still be sold on carbon offset markets, but their inclusion in the valuable LCFS program is distorting both the market for feedstocks and the market for carbon mitigation. Because the LCFS places an especially high effective carbon price on emissions associated with transportation fuels, it creates an incentive for only and specifically any emission avoidance that can be diverted to fuels – whether or not that's the lowest cost abatement and whether or not fuel is the most efficient pathway for that feedstock.

Aside from methodological concerns, we question whether the current LCFS approach to manure methane is good policy. The LCFS is structured to require producers of polluting transportation fuels to bear the costs of mitigating transportation fuel pollution. However, in the case of the manure biomethane, the majority of the climate pollution at stake is methane from manure, and the fossil methane displacement in the transportation fuel market is a relatively small contribution. Thus, in this instance the largest polluter is the one receiving a large subsidy.

The lifecycle basis of the LCFS is supposed to ensure that support for low carbon fuels is based on a comprehensive assessment of their climate benefits. However, in this instance, this structure is functioning as poorly designed offset program with transportation fuel users paying an extremely high price for manure methane mitigation. This is not good transportation fuel policy or good agricultural methane mitigation policy.

From a transportation policy perspective, a vehicle operating on manure biomethane with a CI score of negative several hundred g CO2e/MJ appears by the logic of the current accounting to fully offset the CO2 emissions from several internal engine vehicles running on petroleum fuels. But is a fleet of three diesel trucks and one CNG truck powered with manure biomethane really equivalent to a fleet of four electric trucks powered with solar energy? The extravagant credits awarded to manure biomethane for methane destruction by the current lifecycle analysis come at the expense of support for other low carbon fuels and divert the focus of the LCFS to purposes outside of transportation. The LCFS should work in concert with other policies to minimize the use of combustion fuels in transportation, while also minimizing the supply chain emissions from all fuels. By awarding the most favorable CI score to a combustion technology, the manure biomethane pathway sends a confusing and contradictory policy signal.

From a methane mitigation perspective, there is a reasonable case for public support for strategies that reduce methane pollution, including overcoming the cost barriers to AD. However, this support should be in proportion to the relevant cost barriers and these costs should ultimately be internalized within the food supply chain. While the low rate of AD adoption in the early years of the LCFS policy may have initially justified an assumption of unmanaged methane pollution in the counterfactual scenario, this treatment is not justified indefinitely. AD operators will quickly earn more in credits than they spent on AD installation, especially given additional grants available for these projects. Maintaining indefinitely a counterfactual scenario that assumes no methane control has the effect of paying AD operators their costs many times over to continue to operate equipment that is already paid for. Reducing the level of support for manure methane by revising the counterfactual assumption would still provide a reasonable level of

support for AD based on avoided CO2 emissions without a subsidy so large that it risks distorting agricultural markets.

We do not believe it is wise to make the generation of waste methane a substantial ongoing source of profit for CAFO dairies. First, the main climate benefit of AD is reduced agricultural methane pollution, with displaced fossil methane a secondary benefit. But the LCFS incentive puts other methane mitigation strategies at a disadvantage if they do not simultaneously generate transportation fuel. Some of these other strategies, such as alternative manure management, have other significant co-benefits outside the transportation sector. But dairies using alternative manure management strategies could be priced out of the milk market because competitors receive large subsidies for methane destruction associated with transportation fuel production that are not available to diaries adopting methane avoidance strategies that do not result in fuel production. Also, the analysis below suggests that even among facilities with AD systems, smaller facilities may be at a significant disadvantage compared to the largest CAFOs. The largest CAFOs are associated with many ecological and environmental justice problems, and subsidizing their operations is likely to exacerbate these harms and contribute to further industry consolidation with adverse consequences for overall GHG emissions from California's natural and working lands.

It is important to ensure that policies influencing the food system support just and equitable outcomes, including reductions of both global and local pollution, and that transportation fuel policies do not create distortionary subsidies with negative unintended consequences in the food system. We recognize that this is a complicated issue that deserves careful consideration and that the analysis included here is preliminary and incomplete. We urge you to reconsider in the next rulemaking how best to structure the LCFS manure biomethane pathways to ensure they support agricultural methane reductions in an effective and equitable manner without contributing to harmful outcomes outside the transportation sector.

Regards,

Jeremy Martin

Director of Fuels Policy, Senior Scientist
Clean Transportation Program
Union of Concerned Scientists

*Attach. 7*

# Quantification of Dairy Farm Subsidies Under California's Low Carbon Fuel Standard

*Version 1.2, September 2021*

**Prepared by:**

Amin Younes and Kevin Fingerman, PhD

**Prepared For:**

Union of Concerned Scientists, Washington DC

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**Contact**: Kevin Fingerman

kevin.fingerman@humboldt.edu

(707) 826-4148

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## 1. INTRODUCTION AND PURPOSE

This report documents a study of the subsidies available to dairy farms from selling low-carbon manure-based bioelectricity under California's Low Carbon Fuel Standard (LCFS). It investigates the potential for this revenue stream to distort dairy market economics in a way that may favor larger cattle-raising operations. Farms are assumed to build covered manure lagoon anaerobic digesters and to generate electricity onsite from the resulting methane (in the form of biogas, a substance about half as methane rich as natural gas), although farms could, and some do, instead upgrade this biogas to renewable natural gas for pipeline injection (see Appendix A).

California's Low Carbon Fuel Standard is a key piece of climate policy aimed at decarbonization of the transportation sector by enabling low-carbon petroleum alternatives [1]. Under the LCFS, a generator of low-CI (carbon intensity) electricity can supply it to the California grid and use a book-and-claim system to generate LCFS credits or allow a third party to generate credits on their behalf [2, Sec. 95488.8(i)], [3], [4]. This electricity must be used as a transport fuel within three calendar quarters of being supplied to the grid, but need not be physically traceable between source and end-use [2, Sec. 95488.8(i)(A)]. This third party may, for example, contract with electric vehicle (EV) fleets to provide electricity needed for charging and use the revenue generated from credits for offsetting electricity costs, purchasing electric vehicles, and "improving dairy economics" [3, p. 3]. The generator must also submit a Tier 2 fuel pathway application including a life-cycle assessment (LCA) showing how much carbon is emitted in the use case relative to a base case for that resource (i.e., manure that is anaerobically decomposing in lagoons). This process allows dairies to generate revenue from the LCFS, creating a potentially valuable subsidy to these farms.

There are currently 42 Tier 2 dairy pathways approved under the LCFS, of which ten deliver electricity and 26 produce compressed natural gas (CNG) which is piped to usage locations within California (the remaining six pathways produce gaseous or liquid hydrogen). Because, as shown in Appendix A, the electricity pathways have the potential for higher profit margins, we focus on these pathways, which currently have certified carbon intensities between -109 $gCO_2e/MJ$ and -762 $gCO_2e/MJ$ [5], though a similar potential exists for CNG used in trucks. The specific details of all certified LCFS pathways are confidential, but negative emissions associated with electricity or natural gas derived from manure is generally attributable to capture and combustion of methane from manure lagoons, which is therefore credited with the avoided open release of that methane [6].

It is worth taking a moment to discuss the negative emissions associated with destruction of methane more broadly. At present, manure is responsible for ¼ of methane emissions in California [7] and methane is responsible for 9% of California's global warming from greenhouse gases (taking into account relative global warming potentials) [8]. The alleged negative emissions in these pathways are due to significant release of methane during storage of manure in lagoons or ponds where it anaerobically decomposes [9]. Methane ($CH_4$) has a high global warming potential — 25 times higher than carbon dioxide ($CO_2$) over a 100-year timeframe [10] — so simply capturing and burning methane (i.e., flaring) is an effective way to reduce greenhouse gas emissions relative to its free release. So too are alternative manure management methods such as spreading manure on fields where it *aerobically* decomposes and releases a significantly smaller amount of methane. It is likely that there is some correlation between the size of a dairy operation and the probability that the manure produced is stored in ponds rather than naturally dispersed across rangeland, however, no data was identified by the

authors supporting or refuting this claim. There does not appear to be a significant correlation between dairy size and probability of confinement, with 80% to 85% of animals on farms larger than 19 head confined, regardless of farm size (farms smaller than 19 cows were assumed not to confine animals in the study) [11].

In 2017, California was home to some 1,700 dairies with an average size of 1,100 cows per dairy. While the total number of dairy cows in the state rose between 1997 and 2017, the number of farms decreased by 40%, with the average number of animals per dairy doubling, as shown in Figure 1. This consolidation trend well predates the generation of LCFS credits from manure, but the significant value of LCFS credits combined with the economies of scale present in biogas generation and combustion [12] could serve to further distort the market economics in further favor of larger cattle-raising operations.

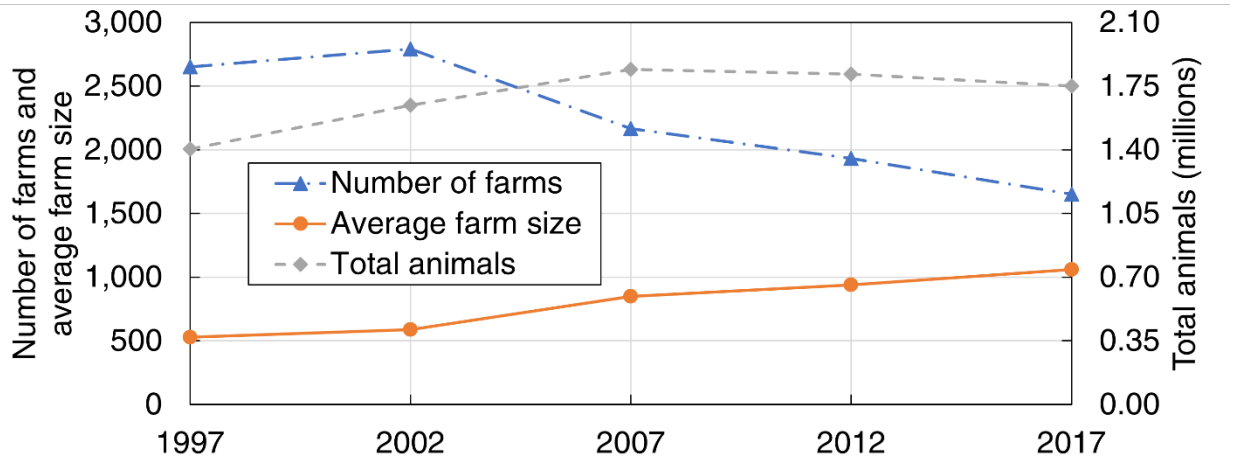


Figure 1. Change in dairy farm quantity and size over two decades [13].

We evaluated the economics of energy generation on dairy farms from the scale of a single cow to 15,000 cows to determine how the profit derived from LCFS credits varies with changing production costs associated with economies of scale. We compared the profit available to the dairy farm from sale of manure-based electricity under the LCFS to the profit derived from the dairy itself and assessed the lifecycle emissions that could be attributed to the manure-based transport fuel using value-based coproduct allocation and revenue-based coproduct allocation.

## 2. METHODS

We began by assessing the value derived from a unit of bioelectricity under the LCFS at several levels of certified CI. Next, we calculated the cost of production and resulting profit as a function of farm size. We then compared these to the dairy's milk production revenue and profit. Finally, we evaluated the impact to the certified CI that would result from attributing some of the dairy production emissions to the energy product via two methods of coproduct allocation.[2]

[2] In life cycle carbon accounting, when more than one product is created from a single feedstock, some of the emissions associated with the feedstock must be attributed to each product. This can be done by any number of factors, including their relative masses, energy contents, or market values, and is called coproduct allocation. Coproduct allocation is generally not performed when one of the "products" is considered to be a waste, which is how manure is treated at present. We investigate the result if the

## 2.1. Bioelectricity Revenue

The revenue bioelectricity can receive from the LCFS depends on two factors: The value of credits ($/MT), and the emissions displaced by the low-carbon fuel (MT/MJ).

Average credit price rose from $160 in 2018, to $192 in 2019, to $199 in 2020. In the first few months of 2021 (Jan-May), prices have varied between $190 and $198 per credit [14]. We use a credit value of $195/MT, which is the weighted average price in 2021 to date and quite close to recent monthly and annual average prices.

The displaced emissions are calculated from three factors: The carbon intensity (CI) of the bioelectricity ($gCO_2e/MJ$), the CI of the referent, the 2021 gasoline benchmark, and the energy economy ratio (EER) of the vehicle drivetrain relative to a gasoline vehicle.[3] Displaced emissions were calculated as follows (adapted from [2, Sec. 95486.1]):

$$D = EER \cdot CI_{Referent} - CI_{Bioelectricity}$$

Where:

- EER = 3.4 for light-duty electric vehicle use [2, Sec. 95486.1]. Heavy-duty electric vehicles have higher EER, up to 5.0, and would thus displace more carbon per unit of bioelectricity, but claiming use in these vehicles is likely to be competitive, and presents no outsized opportunity to manure-based bioelectricity, so we use the EER of the far more common light-duty electric vehicles.
- $CI_{Referent}$ = 91 $gCO_2e/MJ$ [2, Sec. 95484], the 2021 gasoline benchmark.
- We consider three values of $CI_{Bioelectricity}$, as described below.

First, we evaluated LCFS revenue for dairies with a certified CI equal to the average[4] of currently approved manure-based bioelectricity pathways: -461 $gCO_2e/MJ$ [5]. Second, we used the largest magnitude (i.e., most negative) value of currently approved manure-based bioelectricity pathways [5], which is -762 $gCO_2e/MJ$. This value is substantially lower than the average value; however, since life-

status of manure as a waste were changed, and we use two methods: The relative revenue associated with manure-based electricity versus dairy, and the relative profits of the two.

[3] The energy economy ratio reflects the fact that different types of vehicles consume their fuels in different ways and at significantly different efficiencies. In a gasoline or CNG vehicle the fuel is combusted, which is a relatively inefficient process compared to conversion of electricity to mechanical motion in a battery electric vehicle (BEV). As a result, a BEV can travel 3.4 times as many miles compared to a gasoline vehicle per unit of energy consumed. By applying an EER to the carbon intensity score, LCFS comes closer to crediting carbon savings per mile travelled rather than simply per unit of energy delivered.

[4] This number is the simple average among the approved pathways. Using the most recent report [15] of credits and generation from non-grid-average and non-zero-CI electricity, which appears to align with the dairy manure pathways plus a single organic waste pathway among approved LCFS pathways [5], and assuming an EER of 3.4 and 2020 reference CI for gasoline yields a weighted average CI of -487, modestly less (5%) than the simple average.

cycle analysis details are fully redacted, it is uncertain where this variability comes from. Finally, we used 0 $gCO_2e$/MJ, a notional alternative. These resulted in the following three estimates for displaced emissions, *D,* and LCFS credit revenue (per unit of electricity produced), provided in Table 1. For context, the present federal production tax credit available to electricity generated from wind power is $25/MWh, or $0.007/MJ, nearly an order of magnitude less than the subsidy available to zero-CI bioelectricity [16] (though it should be noted that the former is not assumed to be a transport fuel).

Table 1. The displaced emissions per MJ and resulting value derived from credit sales under the LCFS in three emissions scenarios with recent credit pricing of $195/MT.

| Estimate | CI ($gCO_2e$/MJ) | *D* ($gCO_2e$/MJ) | Revenue ($/MJ) |
|---|---|---|---|
| Highest CI (for reference) | -109 | 418 | $0.082 |
| Average CI | -461 | 770 | $0.150 |
| Most-negative CI | -762 | 1,071 | $0.209 |
| Zero CI (notional) | 0 | 309 | $0.060 |

The above CIs are "adjusted" per California Air Resources Board (CARB) guidance in order "to reasonably limit the LCFS incentive for low-efficiency pathways relative to higher efficiency ones" [17, p. 3]. Without this adjustment, lower efficiency pathways would produce less electricity, but with a lower (i.e., more negative) CI because the total avoided methane emissions remain constant. Therefore, CARB requires biogas to electricity pathways to discount calculated carbon intensities by the engine efficiency relative to a benchmark of 50% ("a reasonable efficiency benchmark based on the average efficiency of NG-derived electricity at California power plants and best available technologies for electricity production"5) [17, pp. 3–4]. The net effect of this CI adjustment is that less efficient pathways produce less electricity at the same CI as more efficient pathways and are thus incentivized to use higher efficiency generators to generate more credits. Therefore, we modeled CI as independent of engine efficiency in the below analysis.

## 2.2. Bioelectricity Production Cost

We built cost and biogas productivity estimates for farms up to 15,000 cows assuming they build covered lagoon digesters and onsite generators. These facilities show significant economy of scale, enabling much higher profits for larger operations. In principle, these same profits are available to groups of smaller operations which aggregate their manure, although aggregation and transport costs would need to be added in this case. We then calculated total annual costs by annualizing digester and engine capital costs and adding this to the annual operational expenses for engines [19] and digesters [12], respectively. From the annual costs, we subtracted the revenue from electricity sales, assuming electricity is sold at $79 /MWh,6 to determine the annual net cost of building and running the anaerobic

5 The 2019 weighted average thermal efficiency of the California natural gas fleet was 44.2%, largely driven by the efficiency of combined-cycle natural gas plants, averaging 46.6%. Internal combustion engines, such as those that would be used in onsite generation, have a notably lower efficiency, falling into a category ("miscellaneous") with a 2019 average thermal efficiency of 36.6% [18].

6 We used the generation-weighted average power price for the 51 California power plants in the 2019 EIA Power Plant Operations dataset [20] which report using at least 50% qualifying biofuels as feedstock.

digester and onsite electricity generation operation. We then calculated the net electricity production cost (before LCFS credit revenue) per MJ of electricity, by dividing this total cost by the annual electricity production for each farm size. Additional details are provided in Appendix B.

## 3. RESULTS

Based on the assumptions of this model, farms with 94 or more cows could economically build and operate anaerobic digesters with onsite electricity generation, assuming they achieve the most-negative CI currently recorded within the CARB database [5]. With the more moderate assumption of the average CI within the database, farms would have to be modestly larger, 150 cows, before building a digester would be profitable. In the case of zero-CI manure-based electricity, farms of 580 cows or more could viably build and operate digesters with onsite generation.

For extremely large farms, above 14,000 head of cattle, the net-cost of production falls below one cent per MJ as depicted in Figure 2. Over this range, profits are nearly equal to the value of the LCFS credits, since the net-cost of production is insignificant by comparison. Fifteen-thousand-cow farms would generate a profit of $0.05, $0.14, or $0.20 per MJ produced in the zero-CI, average-CI, and most-negative-CI cases, respectively.

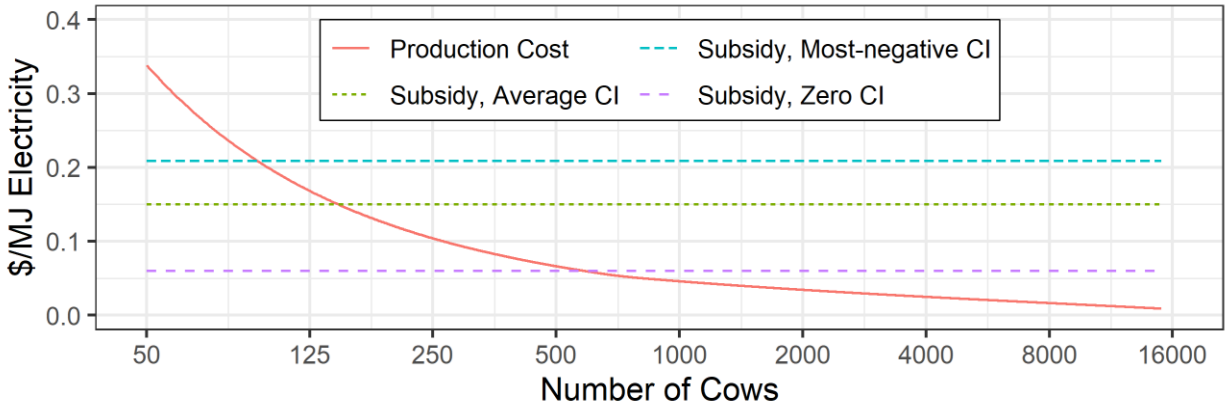


Figure 2. Net production cost (total cost minus electricity revenue) and LCFS credit revenues (i.e., subsidy) by farm size. Note that the x-axis is logarithmic.

There are two important sources of potential error to consider in this analysis: First, smaller operations may have additional unaccounted for costs of manure aggregation, especially if these operations do not currently confine their cattle or aggregate their manure in lagoons (in fact, farms which do not aggregate manure in lagoons would not be able to receive LCFS credits, as discussed earlier). Second, our engine model is built from data for systems 100-kW and larger, and we do not extrapolate outside this range. This results in farms under 700 head of cattle having an oversized generation unit, which

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This yielded a wholesale price of bioelectricity of $78.59/MWh (SD: $34.24). This is a relatively high price for wholesale power, but it is reflective of current market conditions. In part, these high prices may reflect the value of bundled Renewable Energy Credits (RECs) generated under CA's Renewable Portfolio Standard as well as other price supports such as Feed-in Tariffs or Production Tax Credits that are available in some jurisdictions.

could lead to an overestimate of their costs. Smaller engines have been tested [21], [22]; however, they may not be grid compatible due to instabilities [23].

### 3.1. Subsidy Value Per Gallon of Milk Produced

To add additional context to these results, we brought milk production into the picture by calculating the electricity profit (i.e., LCFS subsidy - production cost in Figure 2) per gallon of milk. We assumed that each dairy cow produces 2,720 gallons (23,500 lbs.) of milk per year [24].

The profit derived from LCFS credits reaches $0.14 and $0.39, and $0.55 per gallon of milk for the largest studied farm size (15,000 cows), across the three CI cases (0, -461, -762 $gCO_2e/MJ$), as depicted in Figure 3. A 2,000-cow dairy would derive somewhat lower subsidies, and a 100-cow dairy little to no profit, as shown in Table 2.

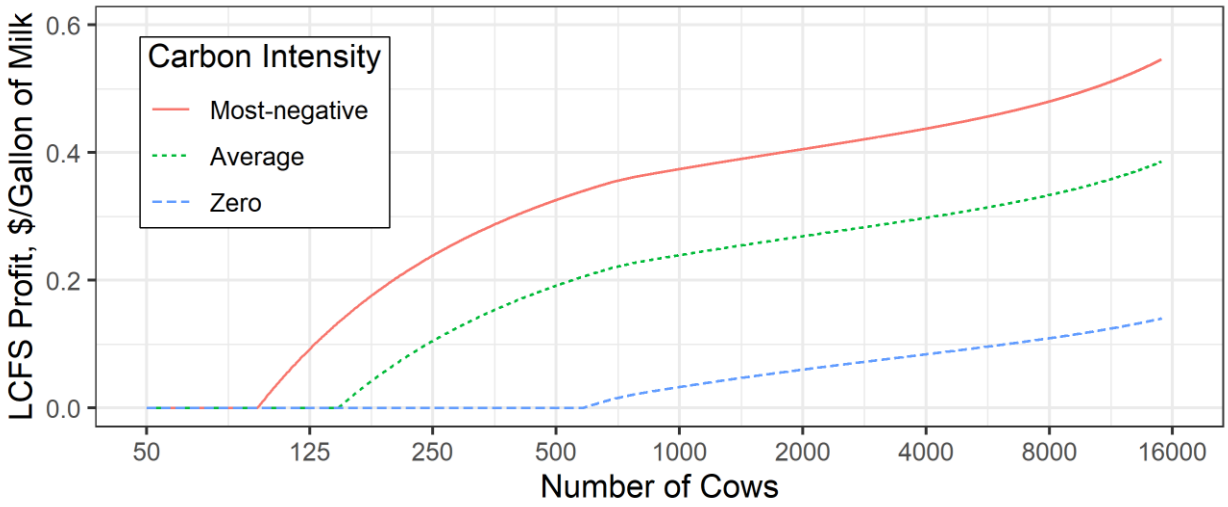


Figure 3. LCFS profit to dairies per gallon of milk under three different CI conditions. Note that the x-axis is logarithmic. The point of departure from $0/gallon indicates the farm size at which electricity generation becomes profitable at a given CI.

Table 2. LCFS credit profit per gallon of milk across farm sizes and conditions of bioelectricity CI.

| | LCF Profit, $/Gallon of Milk | | |
|---|---|---|---|
| Number of Cows | Most-negative CI (-762 gCO2e/MJ) | Average CI (-461 gCO2e/MJ) | Zero CI |
| 100 | $0.02 | $0.00 | $0.00 |
| 500 | $0.33 | $0.19 | $0.00 |
| 1,000 | $0.37 | $0.24 | $0.03 |
| 2,000 | $0.41 | $0.27 | $0.06 |
| 10,000 | $0.50 | $0.35 | $0.12 |
| 15,000 | $0.55 | $0.39 | $0.14 |

We can compare the profit generated under the LCFS to the profit from milk sales. To do so, we assumed the profit from the milk to be $4.30/cwt,[7] an estimated profit margin of 25% [25] times the wholesale price of $17.20/cwt.[8] [27], [28] This is equivalent to $1.48 wholesale per gallon, or $0.37 of profit per gallon. The results of this comparison are depicted in Figure 4, which shows the profit derived from the LCFS as a fraction of total profit (LCFS profit + dairy sales profit). In the case where the CI of manure-based bioelectricity is assumed to be zero, the profit which dairies accrue from the LCFS only exceeds 25% of their total profit for large farms—11,000 head and larger. Conversely, in the other two cases, farms over 280 head derive over 25% their profit from LCFS credits.

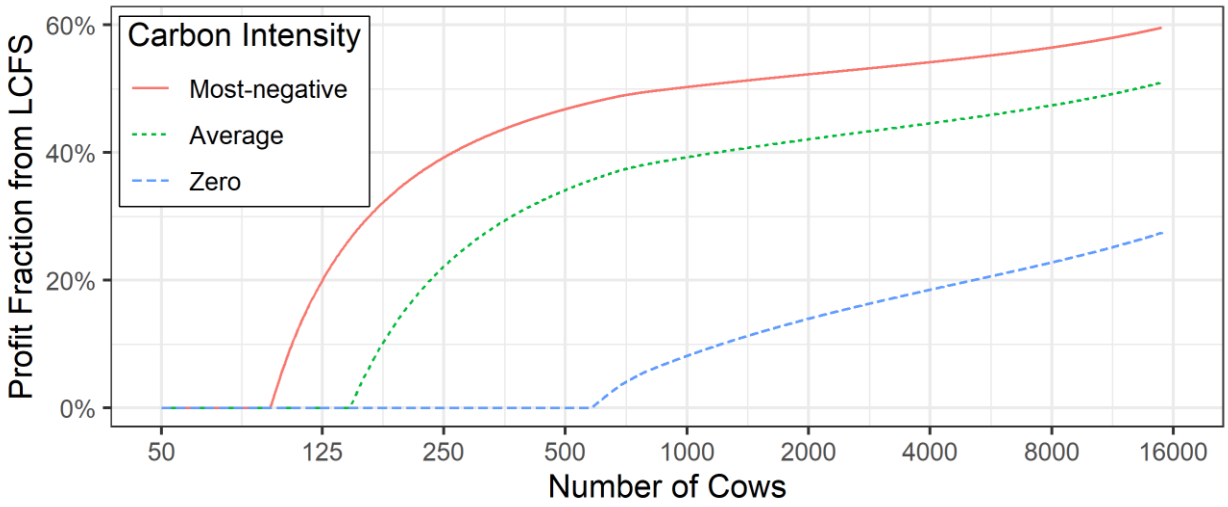


Figure 4. Fraction of profit attributable to LCFS credits as a function of dairy size and the CI of manure-based bioelectricity. Note that the x-axis is logarithmic. The point of departure from 0% indicates the farm size at which electricity generation becomes profitable at an assumed CI.

If, instead of considering the estimated profit fraction from LCFS credit revenue, we observe the calculated fraction of income from electricity (inclusive of electricity sales and LCFS credit sales) compared to the income from milk (i.e., $1.48/gallon), the result is far less dependent upon the scale of the facility,[9] but remains significantly dependent on the certified CI of the electricity. For the average CI case, the revenue fraction from electricity sales ranges from 21% to 24% of the total revenue, and for the most-negative CI case it varies from 26% to 30%. In both cases, smaller farms derive slightly less of their revenue from electricity.

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[7] Wholesale milk prices use the units of hundredweight, which are abbreviated as 'cwt' and equal to 100 pounds.

[8] Based on historic data [26] we assume that 30% of milk is class I, 40% is class III, and the remainder is split evenly between class II and class IV. The most recent prices for class I-IV respectively are: $18.29/cwt [27] $15.56/cwt, $17.67/cwt, and $15.42/cwt [28]. This leads to a weighted-average price of $17.20/cwt.

[9] Since the economy of scale of electricity production is no longer a factor, the only impact is the ratio of milk sales to electricity sales which decreases slightly at larger scale due to the higher efficiency engines used in our model.

### 3.2. Coproduct Allocation

Manure is, at present, considered to be a waste product. Therefore, none of the emissions from milk production are allocated to manure or manure-based bioelectricity production. However, as was shown above, a significant fraction of the revenue of a dairy farm with anaerobic digesters and a significant fraction of the profit from medium-to-large dairies with anaerobic digesters could come from manure that has been concentrated into anaerobic lagoons such that methane is created. The principles of lifecycle assessment suggest that some of the emissions associated with raising dairy cattle should therefore be attributed to this "valuable" coproduct.

Thoma et al. [29] estimate a life-cycle GHG emission of 2.05 kg-$CO_2$e per kg of milk consumed. Downscaling this to account for the 30% lost before consumption and the 24% of emissions from manure management — which will be largely eliminated via the biogas-to-electricity pathway — results in an estimate of 1.09 kg$CO_2$e per kg of milk produced.

Dividing the emissions associated with milk production by the quantity of electricity produced by the same farm allows comparison between the scale of methane emissions avoided by capturing and combusting biogas and those stemming from dairy production. As depicted in Figure 5, the emissions from cattle raising (excluding those associated with manure) are significantly larger than those avoided by capturing and combusting biogas (and linearly decrease as farm size increases due entirely to the higher efficiency of larger engines in our model). The scale of these emissions is 2-2.5 times the magnitude of displaced emissions with the most-negative CI and 3.5-4 times the magnitude of those using average CI, meaning that attribution of a portion of these emissions to biogas-based electricity will significantly impact its CI.

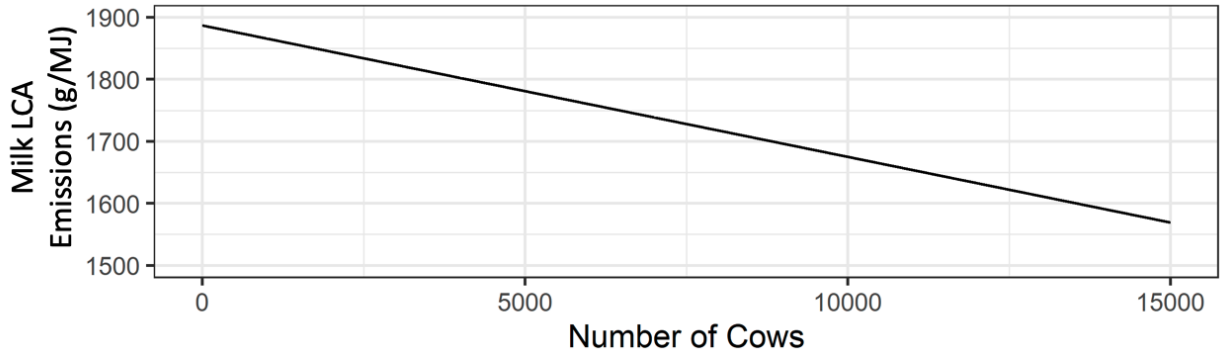


Figure 5. Variation in Milk LCA emissions per MJ of electricity with farm size.

To explore the effect of this allocation on pathway CIs, we attributed a portion of the emissions from dairy production to electricity based upon either the relative revenue or the relative profit. This caused the CI of the electricity to increase (i.e., move towards zero), resulting in lower displaced emissions and lower LCFS revenue. Because the revenue or profit from the electricity would then be lower, thereby changing the relative fractions of profit or revenue, we iterated the CI calculation until it converged to a stable result. This result is summarized in Table 3 for both revenue-based allocation and profit-based allocation methods, and graphically in Figure 6 for profit-based allocation (revenue-based allocation is not shown graphically because the variation is small across notional farm sizes).

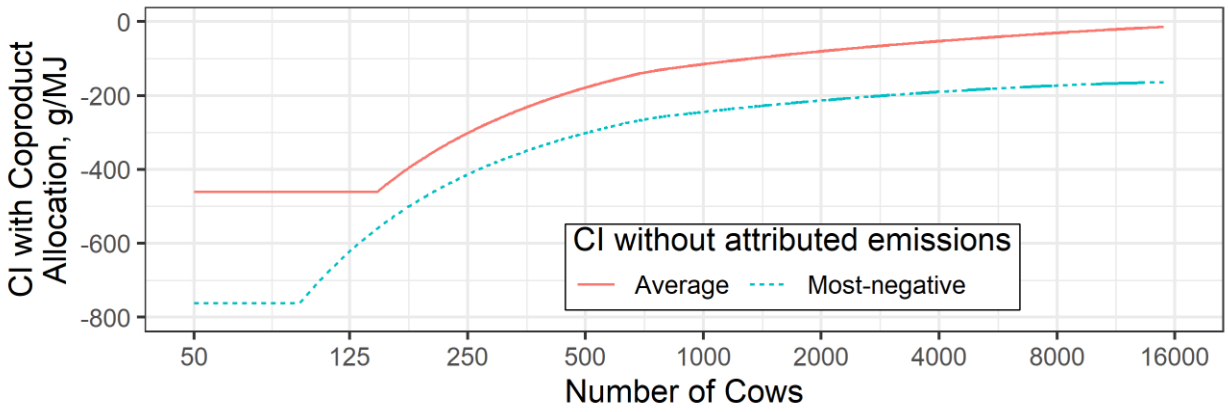


Figure 6. Updated CIs using coproduct allocation based upon relative profit.

Table 3. Updated CIs using coproduct allocation based upon relative profit and from relative revenue comparison.

| Number of Cows | Using Profit-Based Allocation[10] | | Using Revenue-Based Allocation[10] | |
|---|---|---|---|---|
| | Average CI (-461 $gCO_2e/MJ$) | Most negative CI (-762 $gCO_2e/MJ$) | Average CI (-461 $gCO_2e/MJ$) | Most negative CI (-762 $gCO_2e/MJ$) |
| 100 | -461 | -724 | -175 | -393 |
| 500 | -178 | -301 | -175 | -393 |
| 1,000 | -115 | -244 | -175 | -393 |
| 2,000 | -80 | -213 | -176 | -393 |
| 10,000 | -24 | -169 | -179 | -399 |
| 15,000 | -14 | -164 | -181 | -403 |

For small farms, little to no profit is generated from the LCFS, and emissions would be attributed entirely to milk production; however, for larger farm sizes, profit margins on electricity sales quickly outpace profit margins on wholesale dairy, and more emissions are therefore attributable to bioelectricity, bringing the CIs of dairy-derived electricity towards zero. Revenue allocation leads to similar CIs across farm sizes, with the increased ratio of electrical output to milk output (due to increased engine efficiency) leading to slightly lower CIs for larger farms because the milk LCA emissions are spread across more MJ of electricity.

After performing the coproduct allocation, we revisit the enabled LCFS credit profit per gallon of dairy as a function of the original CI and allocation method in Figure 7. LCFS profit generally falls between the

10 Because the certified CI is representative of a physical phenomenon, namely avoided emissions due to combustion of biogas from manure via the bioelectricity pathway, the new CI is dependent upon the original CI. Lower certified CIs lead to more profit or revenue being attributed to electricity, and thus more of the dairy-related emissions being allocated to it, but not enough to wipe out the lower initial CI entirely.

average CI without allocation and zero-CI values, both shown previously in Figure 3. One advantage of profit-based coproduct allocation becomes apparent with this visualization: It leads to the flattest profit for farms greater than 500 head, indicating that this method is the best choice to reduce the market distortion favoring larger dairies currently caused by the LCFS. More broadly, any of the studied alternatives (i.e., zero CI, revenue-based coproduct allocation, or profit-based coproduct allocation) would reduce the tremendous imbalance in profits available to larger farms.

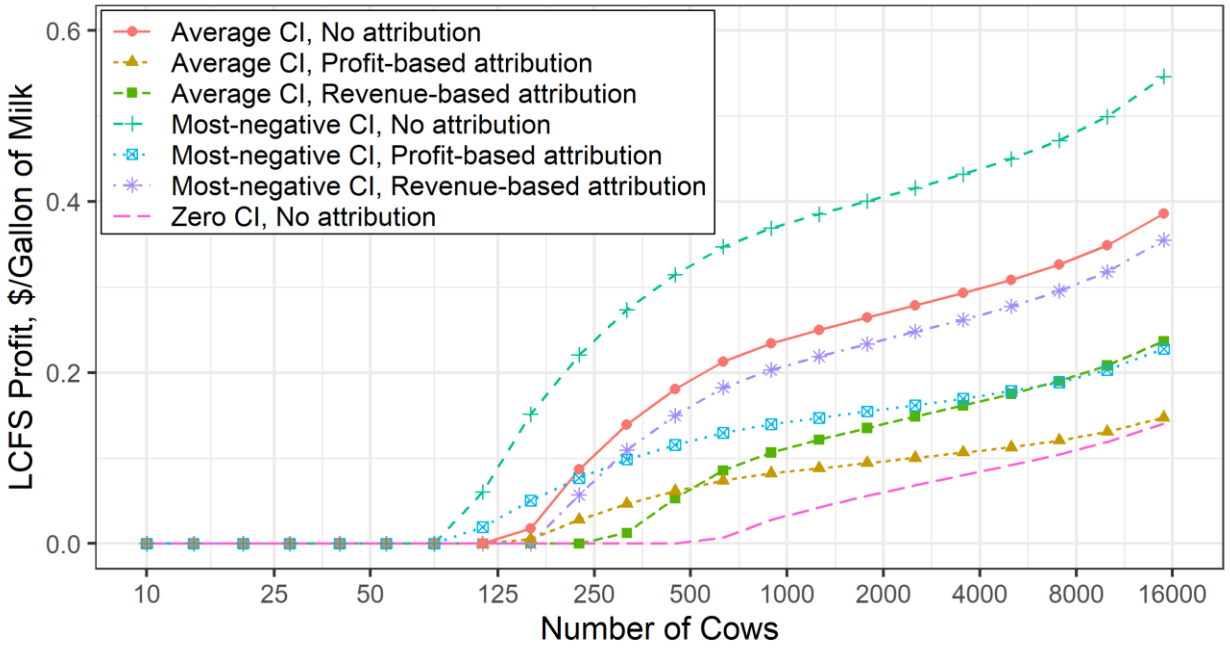


Figure 7. LCFS profit to dairies per gallon of milk under seven different CI conditions. The first half of each legend entry indicates the original CI, and the second half indicates which, if any, method was used to update the CI. Note that the x-axis is logarithmic. The point of departure from $0/gallon indicates the farm size at which electricity generation becomes profitable at a given CI.

## 4. Discussion

For farms above 1,000 head, attributing milk LCA emissions via revenue or value results in significant increases to pathway CIs, by 300 to 600 $gCO_2e/MJ$, depending upon farm size and whether profit or revenue is used in allocation. This is not enough to bring calculated CIs above zero, though they approach zero for large farms using profit-based allocation. Thus, implementing coproduct allocation would still allow dairies to generate significant revenue and profit under the LCFS, but at a reduced level compared to today. Using either a revenue- or a value-based coproduct allocation approach appears to be viable, though the former has the advantage of requiring much less knowledge of farm-specific economic factors while the latter is better at removing the market distortion which presently supports large operations (though it by no means eliminates it). This market distortion leads to two probable outcomes: First, dairies are incentivized to consolidate in order to take advantage of the economies of scale. Second, dairies are incentivized to purchase more cows, independent of consolidation. The resulting trend is expected to be one of an increased number of animals across the state *and* a greater size of individual herds, both of which were already happening before creation of the LCFS, as shown in Figure 1. If profit-based coproduct allocation is used, it is also tremendously sensitive to dairy and

bioelectricity economics and therefore requires a deep look into the technical and accounting factors of these operations.

There is also a third, and very important, outcome created by the LCFS, and that is an incentive towards worse manure handling practices as a baseline. A farm which at present allows its herd to range free and deposit manure without aggregation does not have methane emissions from manure management to mitigate, and thus cannot generate the significant profits identified herein. That farm is being penalized for its lower-impact practices and is incentivized to confine its cattle and aggregate their manure into a methane-emitting pond, which enables it to then receive LCFS credits in exchange for capture and combustion of this methane. Moreover, insofar as smaller farms may be less likely to manage their manure in lagoons, this factor exacerbates the market distortion created by LCFS preferencing larger cattle farming operations.

### 4.1. Comparison to Existing Literature

Aaron Smith [30] performed a comparison of dairy revenue and energy revenue for a 2,000-cow dairy, with similar costs and revenue to those identified in our study. Notably, Smith assumes a pipeline injected compressed natural gas (CNG) pathway for the fuel, whereas we assume a cheaper electricity pathway (though we also provide some of our own analysis for CNG pathways in Appendix A), leading to distinct, but similar results. As Smith says, "[e]qual numbers of California digesters are employed to produce CNG for transportation and to generate electricity."

Smith uses a cost of $636 per cow-year[11] and a CNG revenue of $1,935 per cow-year. In our model, a 2,000-cow dairy would have a capital payment of $234/cow-year[12], and an operational expense of $123. However, since Smith's analysis entails the much more expensive process of upgrading to CNG for pipeline injection, we also looked at the underlying data used [31], which apply a capital cost of $2.9 million for the digester and an operational cost of $174,000. These estimates are slightly below our estimates of $3.3 million in capital expense and $186,000 in annual operational costs for a 2,000-cow dairy.

In comparison to our estimates of CNG cost, our total cost per cow-year is $882, with $302 due to operational expenses. The former is quite a bit higher than Smith's estimate of $636 while the latter is quite close to his estimate of $294.

We estimated an LCFS credit value of $951/cow-year and $1,320/cow-year in our average and most-negative CI cases for electricity, respectively, less than Smith's estimate of $1,935. More comparable are our estimates for CNG, which are also much closer to Smith's, at $1,400 and $2,190 per cow per year in the average and most-negative cases, respectively.

In summary, while Smith does not account for capex cost in his analysis, and assumes a more expensive pathway than we do, these two assumptions approximately cancel out, leading to a cost of $294/cow-year, 82% of our estimate of $357/cow-year. LCFS credit revenues per cow, on the other hand, are much

[11] $294 from operations and $342 from capital, which Smith eliminates because these are often grant funded. Smith also uses a higher CRF of 0.142 compared to the 0.117 which we used.

[12] $284 with a CRF of 0.142.

higher in Smith's analysis, 50% to 100% larger than ours due to the low conversion efficiency of electricity production.

## 5. Conclusions & Policy Recommendations

This model provides only a second-order estimate of the costs, revenues, profits, and emissions from dairies, all of which depend on case-specific factors which we have not characterized, including: varying labor costs, feed choices, animal breed, confinement, the availability of grants for digester capital costs, and much more.

As it stands, our analysis indicates that the LCFS is offering a significant competitive advantage to large-scale dairy operations over smaller-scale operations, and that profits are available only to farms with poor (i.e., methane generating) manure handling practices. We estimate that the value of subsidy available to a 10,000-cow farm range from $0.35 to $0.50 per gallon of milk, which is 1.5 to 1.8 times that available to a 500-head farm assuming the same certified CIs for both facilities. Furthermore, our economic analysis indicates that a small, 100-cow, farm would derive little to no value from LCFS, regardless of avoided methane emissions when producing bioelectricity, even when confining their cattle and aggregating manure into methane-generating ponds. This creates clear market distortions in favor of large, confined operations, which could exacerbate the already-present trend of market consolidation. Furthermore, this study illustrates that the negative emissions associated with use of anaerobic manure digestion are at least in part an artifact of accounting choices that increase the revenue particularly to large dairy operations. These include the policy of considering manure to be a true waste from an LCA standpoint even where it accounts for a significant portion of total revenue, and the base-case assumption of uncontrolled methane release. We recommend one of three possible approaches to alleviate the above concerns:

1. Carbon intensity for CNG and electricity derived from anaerobic digestion of cow manure could be limited to zero. This would reduce subsides to many farms from as high as $0.57/gallon to $0.16/gallon of milk. Per our model, farms larger than 580 head would still be incentivized to produce electricity, and grants could be used to assist smaller farms with manure management practices (whether through capture and destruction of methane or via elimination of the anaerobic decomposition which creates methane in the first place) as well as to account for differences between this model and the reality on the ground.
2. Farms could be required to flare rather than vent biogas generated by manure as a baseline. This would have a similar impact to the option above, since it would mean the carbon intensity of generated electricity would be close to zero rather than significantly negative.
3. LCFS pathways could use coproduct allocation to account for the lifecycle emissions of dairy production in the CIs calculated for manure-based bioelectricity. We calculate that this would lead to a lower limit of CI values for farms above 500-head of cattle of -400 $gCO_2e/MJ$ compared to present day values as low as -762 $gCO_2e/MJ$. This could lead to a stable condition in which large profits from bioelectricity lead to higher CIs of manure-based bioelectricity and vice-versa, stabilizing the generation of credits, but this would require a more detailed study to fully assess. Using either a revenue- or a value-based coproduct allocation approach appears to be viable, though the former has the advantage of requiring much less knowledge of farm-specific economic factors, while the latter is better at removing the market distortions which presently support large operations.

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## APPENDIX

### Appendix A Comparison Between Compressed Natural Gas and Electricity Generation

Several factors affect the relative economics of electricity and compressed natural gas (CNG) pathways from dairy-manure. The first are the certified CIs in the LCFS, which are smaller in magnitude among present CNG pathways: While approved electricity pathways have an average value of -461 $gCO_2e/MJ$ and a lowest value of -762 $gCO_2e/MJ$, CNG pathways have an average value of -309 $gCO_2e/MJ$ and a lowest value of -533 $gCO_2e/MJ$ [5]. Second, compressed natural gas vehicles have an EER of 0.9 or 1, relative to EERs between 2.6 and 5 for electric vehicles. Third, the costs associated with biogas upgrading into natural gas and pipeline injection[13] differ from the costs of onsite production. The first two of these factors are captured in the subsidy levels shown in Figure A-1 while the third factor is captured in the production cost curves.

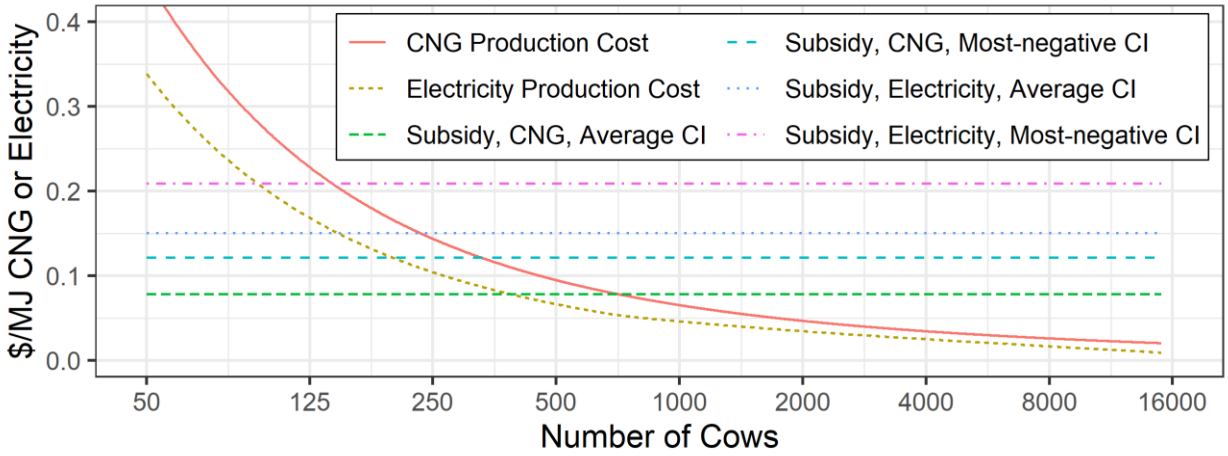


Figure A-1. Net production cost (total cost minus revenue from energy sales) and LCFS credit revenues (i.e., subsidy) by farm size. Note that the x-axis is logarithmic. CNG refers to pipeline injected compressed natural gas.

Significantly, the production cost per unit is higher for CNG while the revenues under the LCFS would be lower. On the other hand, due to the inefficiencies of combustion engines, many more units of energy could be sold in the CNG case — 2.7 times as many for a representative 2,000 cow dairy — raising the potential for higher total profits, though lower profit margins, for CNG. It is important to keep in mind that this lower profit margin is reflective only of the CNG generation process and not of the dairy operation as a whole—it is possible that, due to the higher total revenues from CNG, the dairy operation's profit margins are improved relative to the electricity operation.

These higher total profits are shown to actualize in Table A-1, which reproduces the result of Table 2 for the average and most-negative cases alongside the equivalent values for two CNG pathways. LCFS profit per gallon of milk is generally lower for CNG pathways than for electricity pathways except for relatively

[13] Natural gas upgrading and pipeline costs from Parker et al. [12] assuming an average interconnection distance of 2 miles, approximately the average value in Jaffe et al. [32]

large farms (i.e., over 1,000-head) with the most-negative certified CIs. Here, the CNG pathway could enable up to 30% increased total profit (or profit per gallon of milk, as shown) from fuel production compared to the electricity pathway. While the higher revenues do not significantly alter the picture, the increase in relative profit between medium and large farms (e.g., 1,000 and 10,000 head) is noteworthy. CNG pathways under the LCFS appear to magnify the identified market distortion (see Section 4) in further favor of large operations. However, this effect is mitigated somewhat by the fact that it only affects the exceptionally negative CI case, and not average or subaverage CIs.

Table A-1. LCFS credit profit per gallon of milk across farm sizes, certified CI, and fuel type.

| | LCFS Profit, $/Gallon of Milk - Electricity | | LCFS Profit, $/Gallon of Milk - CNG | |
|---|---|---|---|---|
| Number of Cows | Most-negative CI (-762 gCO2e/MJ) | Average CI (-461 gCO2e/MJ) | Most-negative CI (-533 gCO2e/MJ) | Average CI (-309 gCO2e/MJ) |
| 100 | $0.02 | $0.00 | $0.00 | $0.00 |
| 500 | $0.33 | $0.19 | $0.18 | $0.00 |
| 1,000 | $0.37 | $0.24 | $0.37 | $0.08 |
| 2,000 | $0.41 | $0.27 | $0.50 | $0.21 |
| 10,000 | $0.50 | $0.35 | $0.65 | $0.36 |
| 15,000 | $0.55 | $0.39 | $0.67 | $0.38 |

## Appendix B Electricity Generation Model Details

We built cost and productivity estimates for farms from a single cow up to 15,000 cows. We then calculated the resulting biogas production for each farm size using the biogas production and methane concentration [33] of each farm and heating value of methane of 1,012 BTU/scf.

Digester capital and annual costs were calculated from Parker et al. [12], assuming that each farm purchases its own stirred tank digester [12].

To assess conversion from biogas to electricity, we created an economic model based on Jaramillo & Matthews' [19] generator data. Their paper provides point estimates of heat rate, operational expenses, and annual expenses for five scales each of reciprocating engine and gas turbine. Because a more efficient engine will generate more revenue under the LCFS, we applied only the more efficient (though also more expensive) reciprocating engines in our model.

The 15,000-cow farm produces 64% as much biogas as the largest engines in Jaramillo & Matthews can handle, but the smallest farms extrapolate capital and annual costs below that of their smallest engines. We therefore limited our linear model, capping values which extrapolated outside the range provided (i.e., heat rate, total annual cost and total capital cost were limited to their lowest reported values). We used a capacity factor of 93% [34] to determine necessary engine size, which resulted in the linear models summarized in Table B-1 and Figure B-1 after converting to 2021 dollars.

Table B-1. Linear model created from reciprocating engine data [19].

| Parameter | Unit | Equation (flow_rate in mmbtu/hr) | Minimum Value |
|---|---|---|---|
| Capital cost | $2021 | $172,710*flow_rate-$19,852 | $236,643 |
| Annual cost | $2021 | $14,192*flow_rate-$469 | $23,414 |
| Heat rate | mmbtu/MWh | 0.0572*flow_rate + 11.0 | 8.758 |

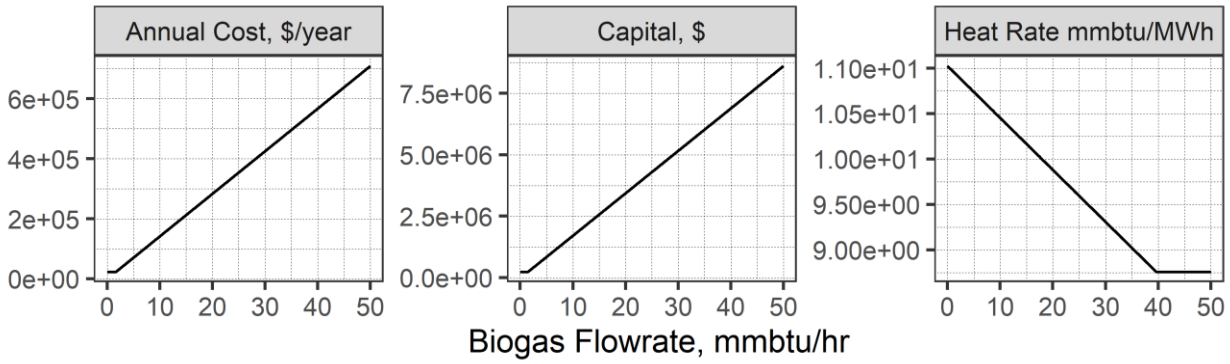


Figure B-1. Linear model created from reciprocating engine data [19].

We then calculated total annual costs by annualizing digester and engine capital costs using a capital recovery factor of 0.117, consistent with 15-year financing at an 8% interest rate, and adding this to the

annual expenses in Jaramillo & Matthews [19] and Parker et al. [12] for engines and digesters, respectively. From the annual costs, we subtracted the revenue from electricity sales, assuming electricity is sold at $79 /MWh[14], to determine the annual net cost of building and running the AD and onsite combustion operation.

We then calculated the net electricity production cost (before LCFS credits) per MJ of electricity, by dividing this total cost by the annual electricity production for each farm size.

[14] We used the generation-weighted average power price for the 51 California power plants in the 2019 EIA Power Plant Operations dataset [20] which report using at least 50% qualifying biofuels as feedstock. This yielded a wholesale price of bioelectricity of $78.59/MWh (SD: $34.24). This is a relatively high price for wholesale power, but it is reflective of current market conditions. In part, these high prices may reflect the value of bundled Renewable Energy Credits (RECs) generated under CA's Renewable Portfolio Standard as well as other price supports such as Feed-in Tariffs or Production Tax Credits that are available in some jurisdictions.

*Attach. 8*

SCIENCE POLICY

# $PM_{2.5}$ polluters disproportionately and systemically affect people of color in the United States

**Christopher W. Tessum[1]*, David A. Paolella[2†], Sarah E. Chambliss[3], Joshua S. Apte[4,5], Jason D. Hill[6], Julian D. Marshall[2]**

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**Racial-ethnic minorities in the United States are exposed to disproportionately high levels of ambient fine particulate air pollution ($PM_{2.5}$), the largest environmental cause of human mortality. However, it is unknown which emission sources drive this disparity and whether differences exist by emission sector, geography, or demographics. Quantifying the $PM_{2.5}$ exposure caused by each emitter type, we show that nearly all major emission categories—consistently across states, urban and rural areas, income levels, and exposure levels—contribute to the systemic $PM_{2.5}$ exposure disparity experienced by people of color. We identify the most inequitable emission source types by state and city, thereby highlighting potential opportunities for addressing this persistent environmental inequity.**

## INTRODUCTION

Ambient fine particulate matter air pollution ($PM_{2.5}$) is responsible for 85,000 to 200,000 excess deaths per year in the United States (*1*, *2*), with health effects observed even at concentrations below the current national standard of 12 μg $m^{-3}$ (*3*–*5*). Racial-ethnic and socioeconomic disparities in air pollution exposure in the United States are well documented (*6*–*10*) and have persisted despite overall decreases in $PM_{2.5}$ pollution (*11*–*13*).

Most evidence of exposure disparity relies on measured or empirically modeled ambient concentrations or on assessment of proximity to industrial or roadway emission sources (*6*, *10*, *12*–*20*). From the existing evidence, however, it is not possible to determine the relative contributions of different source types to racial-ethnic disparity in exposure to $PM_{2.5}$. Here, we model anthropogenic sources of $PM_{2.5}$ exposure resolved by race and ethnicity and show that nearly all major emission source sectors disproportionately affect people of color (POC).

We estimate exposure impacts for each emission source type on five racial-ethnic groups based on the U.S. Census: White (62% of the population), Black (12%), Hispanic (17%), Asian (5%), and POC (38%; see Materials and Methods for details). As a proxy for exposure to $PM_{2.5}$, we calculate population-weighted average ambient $PM_{2.5}$ concentrations for each race-ethnicity based on census-designated residential location.

We examine exposure disparity—the population-weighted concentration difference between each racial-ethnic group and the population average—in relative (percent) and absolute (μg $m^{-3}$) terms. Sources with the highest relative disparity may yield the largest disparity mitigation per unit mass of emission reduction, whereas sources with the highest absolute disparity may have the greatest potential for overall disparity reduction.

[1]Department of Civil and Environmental Engineering, University of Illinois at Urbana-Champaign, Urbana, IL 61801, USA. [2]Department of Civil and Environmental Engineering, University of Washington, Seattle, WA 98195, USA. [3]Department of Civil, Architectural and Environmental Engineering, University of Texas at Austin, Austin, TX 78712, USA. [4]Department of Civil and Environmental Engineering, University of California, Berkeley, Berkeley, CA 94720, USA. [5]School of Public Health, University of California, Berkeley, Berkeley, CA 94720, USA. [6]Department of Bioproducts and Biosystems Engineering, University of Minnesota, St. Paul, MN 55108, USA.
*Corresponding author. Email: ctessum@illinois.edu
†Present address: Clean Energy Transition Institute, Seattle, WA 98105, USA.

## RESULTS

Results indicate that emission sources that disproportionately expose POC are pervasive throughout society. Estimated year 2014 total population average $PM_{2.5}$ exposure from all domestic anthropogenic sources is 6.5 μg $m^{-3}$ in the contiguous United States; exposures are higher than average for POC, Blacks, Hispanics, and Asians (7.4, 7.9, 7.2, and 7.7 μg $m^{-3}$, respectively; Fig. 1, B to E) and lower than average for Whites (5.9 μg $m^{-3}$; Fig. 1A). Whites are exposed to lower-than-average concentrations from emission source types causing 60% of overall exposure (Fig. 1A), with an overall relative exposure disparity of −8% (−0.55 μg $m^{-3}$ absolute disparity) compared with the population average. Conversely, POC experience greater-than-average exposures from source types, causing 75% of overall exposure (Fig. 1B); their overall exposure disparity is 14% (0.90 μg $m^{-3}$). Blacks are exposed to greater-than-average concentrations from source types contributing 78% of exposure (Fig. 1C), with an overall exposure disparity of 21% (1.36 μg $m^{-3}$). Hispanics and Asians are disparately exposed to $PM_{2.5}$ from 87 and 73% of sources, respectively, and experience 11% (0.72 μg $m^{-3}$) and 18% (1.20 μg $m^{-3}$) overall exposure disparities, respectively (Fig. 1, D and E).

Grouping the source types (Fig. 1, A to E) into 14 source sectors (Fig. 1, F to J) reveals that source types that disproportionately expose POC, Blacks, Hispanics, and Asians to higher-than-average concentrations are dominant in most sectors. Whites are exposed to lower-than-average concentrations from most emission sectors (Fig. 1F). Blacks are exposed to higher-than-average concentrations from all sectors (Fig. 1H).

Of the emission source sectors that cause the largest absolute disparities, four out of the top six source sectors are the same for POC, Blacks, Hispanics, and Asians: industry, light-duty gasoline vehicles, construction, and heavy-duty diesel vehicles (Fig. 1, G to J). Residential gas combustion and commercial cooking are among the largest sources of relative disparities for all four groups (e.g., 41 and 35%, respectively for POC; Fig. 1, G to J). The only sectors that affect Whites substantially more than average are coal electric generation and agriculture (8 and 4% relative disparity, respectively; Fig. 1F). Consistent with previous findings (*11*, *21*), we find that POC, Hispanics, and Asians are exposed to less $PM_{2.5}$ from coal electric generators than average (−13%, −38%, and −18%, respectively), and Blacks are exposed to 18% more than average (Fig. 1H).

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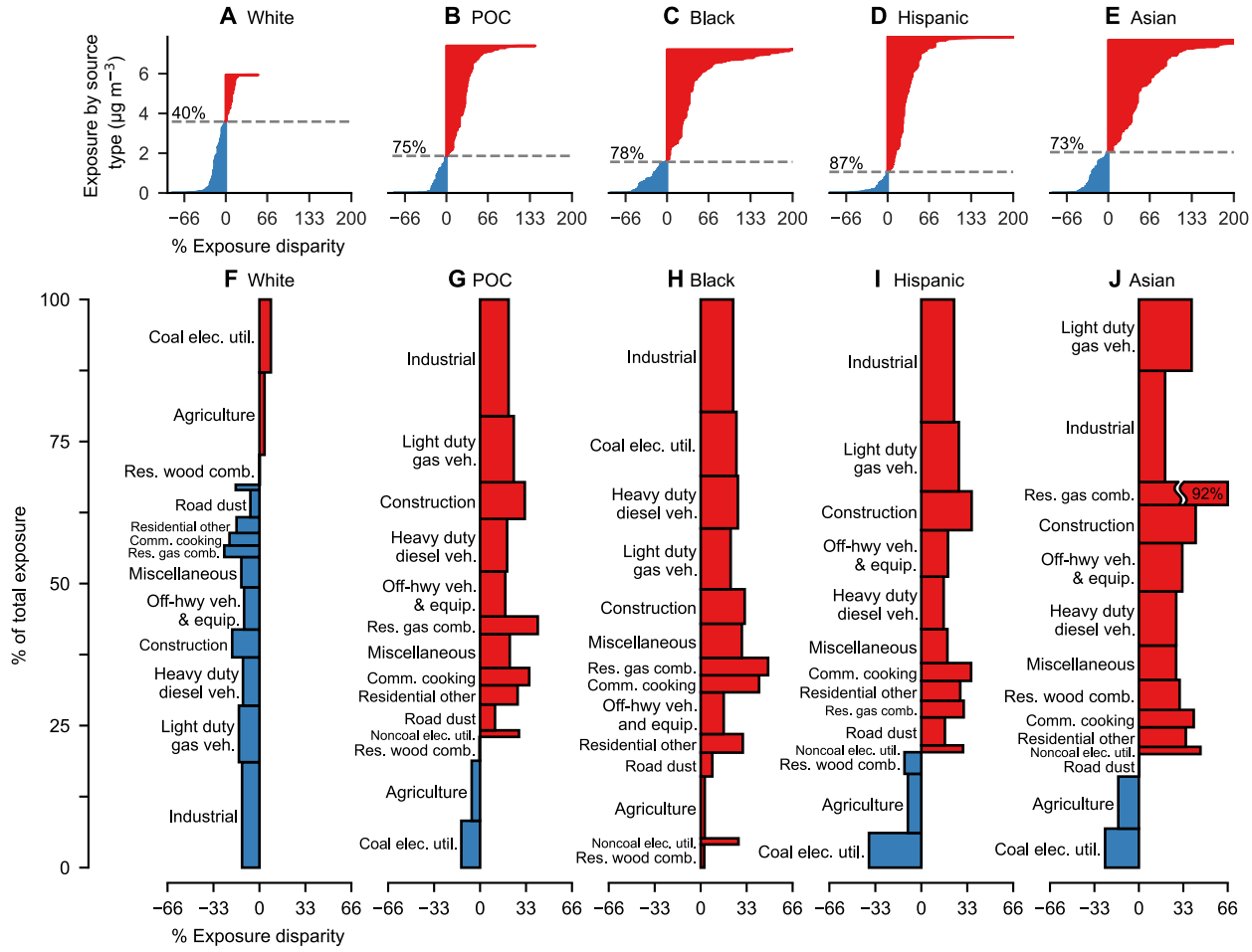


**Fig. 1. Source contributions to racial-ethnic disparity in $PM_{2.5}$ exposure.** (**A** to **E**) Individual source type ($n = 5434$ source types) contributions to exposure (*y* axis) and % exposure disparity (*x* axis, truncated at 200%, positive values are shaded red, negative values are shaded blue), with dashed lines denoting percent exposure caused by sources with positive exposure disparity. (**F** to **J**) Sources in (A) to (E) grouped into source sectors ($n = 14$ groups) and ranked vertically according to absolute exposure disparity, proportional to the area of each rectangle. As shown in (B), POC experience greater-than-average exposures from source types causing 75% of overall exposure. Source: data file S1, which also includes results for individual states and urban areas.

Nationally, racial-ethnic exposure disparities are not caused by a small number of emission sources; instead, most source types and sectors result in higher-than-average exposures for POC and lower-than-average exposures for Whites (Fig. 1). By examining the percent of exposures caused by these disproportionately exposing emission source types for each group [for example, 40% for Whites (Fig. 1A) and 75% for POC (Fig. 1B) nationally], we find that this is also largely true within individual U.S. states, within individual urban and rural areas, across incomes, and across exposure levels (Figs. 2 and 3).

In 45 of the 48 states studied, disproportionately exposing sources cause the majority of POC exposure (Fig. 2A). In the (population-weighted) average state, 78% of exposure is caused by sources that disproportionately expose POC (White: 29%; Black: 77%; Hispanic: 73%; and Asian: 75%; Figs. 2A and 3, C to E; these average-state disparities differ from the national average disparities above because national averages include disparities occurring among states in addition to within states).

We observe the same effect within urban areas (Fig. 2B), with 73% of exposure in the (population-weighted) average urban area caused by sources that disproportionately expose POC (White: 31%; Black: 71%; Hispanic: 71%; and Asian: 56%; Figs. 2B and 3, H to J). There is a notable exception: Asians are less exposed than average in many urban areas in California with large Asian populations (data file S1; for example, Los Angeles, San Francisco, and San Jose). In the (population-weighted) average urban area outside California, 67% of Asian exposure is caused by source types that disproportionately expose Asians, compared with 56% when including California. Disparities also consistently occur in rural areas (defined here as the complement of urban areas), where a large proportion of exposure is caused by sources that disproportionately expose POC (White: 39%; POC: 62%; Black: 63%; Hispanic: 57%; and Asian: 74%; Figs. 2C and 3, M to O). However, disparities in rural areas are not as pronounced as in urban areas (Fig. 2, B and C).

Last, systemic disparity exists at all income levels. Consistent with a large body of evidence (*12*, *22*), we find that racial disparities are not simply a proxy for economic-based disparities. POC at every income level are disproportionately exposed by the majority of sources, with a population-weighted average across income bins of 76% of exposure caused by source types that disproportionately

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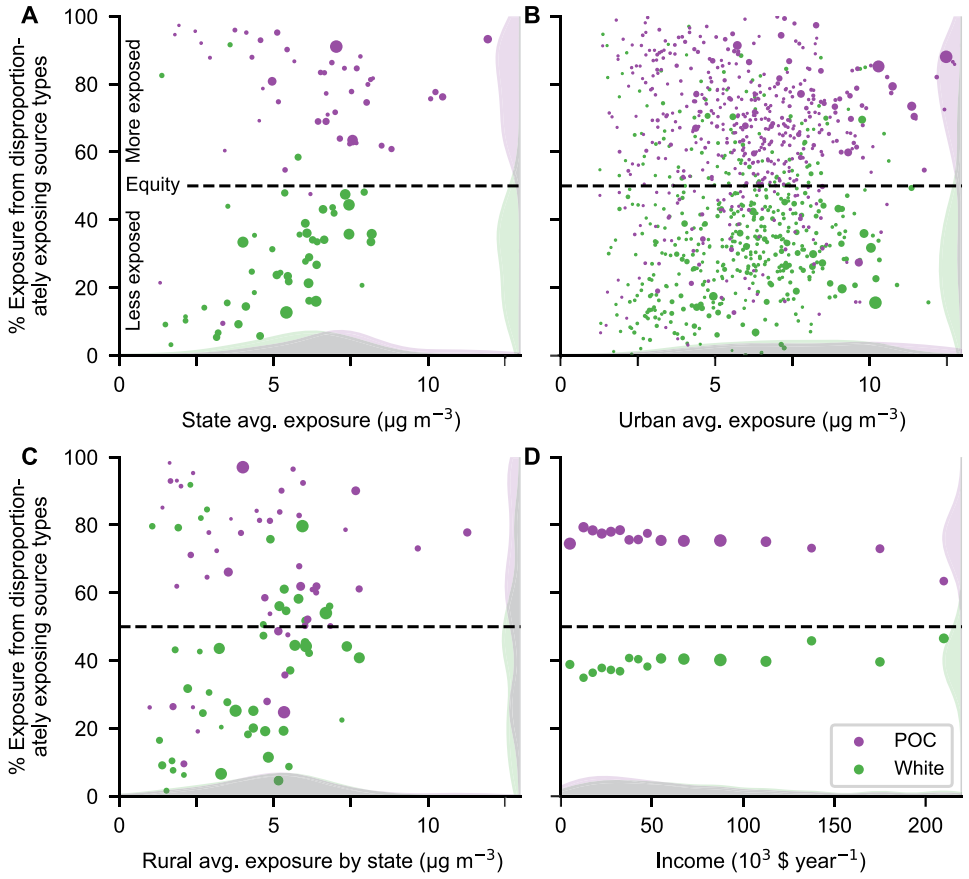


**Fig. 2. Percent of $PM_{2.5}$ exposure caused by emission source types that disproportionately expose people of color (POC) and Whites.** Data shown for (**A**) U.S. states ($n = 48$ states), (**B**) urbanized areas ($n = 481$ areas), (**C**) rural areas in each state ($n = 48$ states), and (**D**) income bins ($n = 16$ bins; last bin is >$200,000). Icon area is proportional to population; shaded areas are kernel density estimates. A *y* axis value of 50% would represent equity for that group (i.e., for the population-average exposure), meaning that half of their exposure comes from source types that disproportionately expose them and the other half is from source types that expose them less than average. Across geographies and levels of exposure (A to C), as well as incomes (D), most emission sources consistently result in higher exposures for POC and lower exposures for Whites. Source: data file S2.

expose POC (Fig. 2D and fig. S1). Exposures vary more by race-ethnicity than by income: The difference in average exposure between POC and Whites is 2.4 times larger than the range in average POC exposure among income levels (data files S1 and S2).

## DISCUSSION

Our results come with caveats. First, we use emission amounts and locations, reduced complexity air quality modeling, and population counts that all contain previously quantified uncertainty (*11*, *23*; Supplementary Text). However, our core findings are consistent across states, urban and rural areas, and concentration levels, rendering it improbable that they are attributable to model or measurement bias. Second, because aggregate results are more robust than results for any single location, we recommend additional analysis incorporating local data and expertise before local actions are taken. Third, our results for states and for urban and rural areas reflect exposure to ambient $PM_{2.5}$, including contributions from emission sources located outside the state, urban area, or rural area. This has implications for local authorities, who may not have jurisdiction over all sources of their exposure. Last, this analysis focuses on outdoor concentrations at locations of residence. Disparities in associated health impacts would also reflect racial-ethnic variability in mobility, microenvironment, outdoor-to-indoor concentration relationships, dose-response, access to health care, and baseline mortality and morbidity rates.

We have shown here that most emission source types—representing ~75% of exposure to $PM_{2.5}$ in the United States—disproportionately affect racial-ethnic minorities. This phenomenon is systemic, holding for nearly all major sectors, as well as across states and urban and rural areas, income levels, and exposure levels. Industry, light-duty gasoline vehicles, construction, and heavy-duty diesel vehicles are often among the largest sources of disparity, but this can vary widely by source type and location. Because of a legacy of racist housing policy (fig. S2; supporting results) and other factors, racial-ethnic exposure disparities have persisted even as overall exposure has decreased (*11*–*13*). Targeting locally important sources for mitigation could be one way to counter this persistence. We hope the information provided here can help guide national, state, and local stakeholders to design policies to efficiently reduce environmental inequity.

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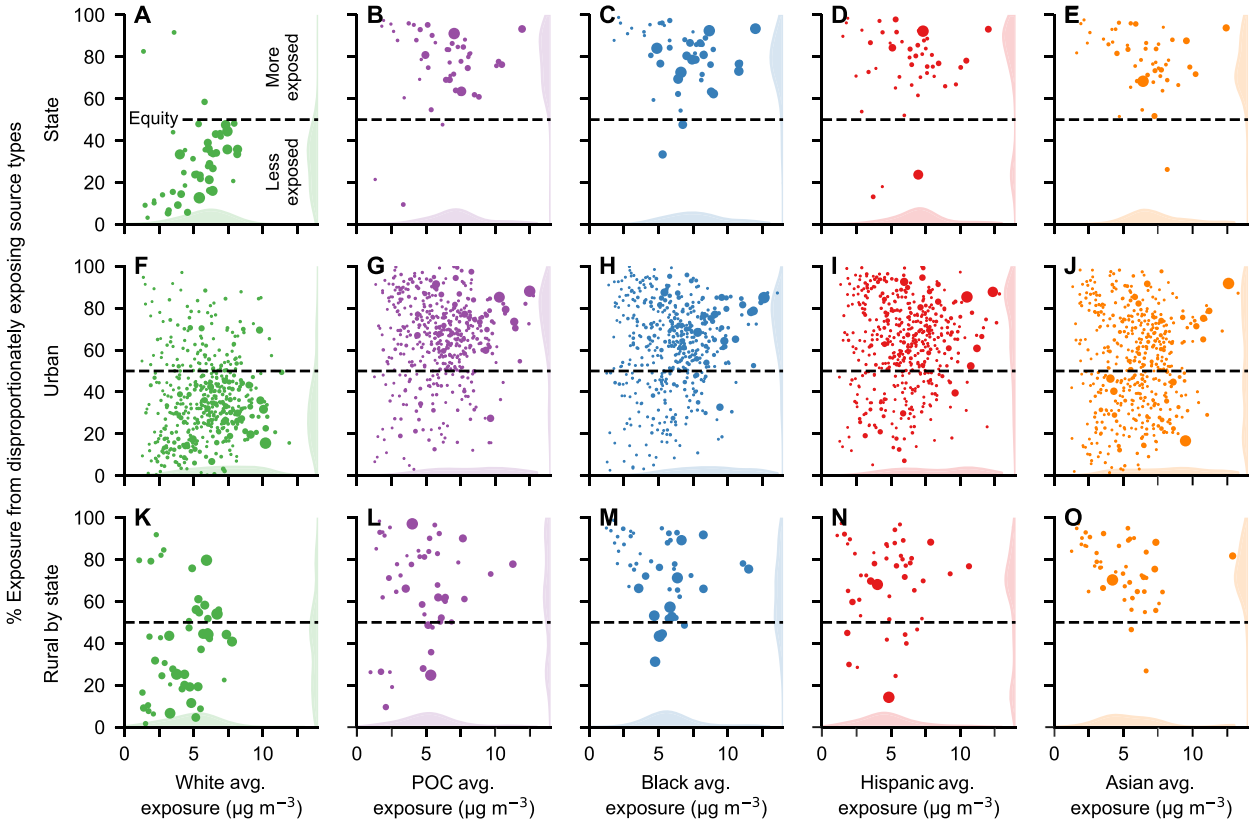


**Fig. 3. Percent of $PM_{2.5}$ exposure caused by emission source types that disproportionately expose each racial-ethnic group by location and race-ethnicity.** Icon area is proportional to population; shaded areas are kernel density estimates. This figure is analogous to Fig. 2 but with results for all five racial-ethnic groups. Source: data file S2.

## MATERIALS AND METHODS

We use a source-receptor matrix (*24*) created using the InMAP (*25*) air quality model to independently estimate concentrations in the contiguous United States resulting from anthropogenic emissions. We consider all 5434 source types [i.e., all U.S. Environmental Protection Agency (EPA) Source Classification Codes (SCCs) with nonzero emissions; we exclude the 8378 SCCs without emissions associated with them] in the 2014 EPA National Emissions Inventory (NEI) v1. County-level emissions are allocated to individual grid cells within the county using spatial surrogates. Emissions processing is described in further detail by Tessum *et al.* (*11*). To focus on impacts from modifiable factors, we do not investigate here emissions from biogenic, wildfire, or international sources. Exposure and health impacts resulting from these additional sources are quantified by Tessum *et al.* (*11*).

We investigate both primary (i.e., directly emitted) and secondary (i.e., formed in the atmosphere from other emissions) $PM_{2.5}$. We model secondary $PM_{2.5}$ formed from volatile organic compounds, oxides of nitrogen and sulfur ($NO_x$ and $SO_x$), and ammonia ($NH_3$). We aggregate the 5434 SCCs (source "types") into 14 source sectors (table S1), each accounting for >1% of total $PM_{2.5}$ exposure. InMAP predicts concentrations at a spatial scale ranging from 48 km in areas with low population density to as fine as 1 km in urban centers; this intraurban spatial scale is necessary to resolve differences in exposure among demographic groups (*26*). The population-weighted average horizontal grid cell edge length is 10.8 km nationwide and 3.4 km in urban areas. Additional grid statistics can be found in table S2.

The source-receptor matrix relates emissions in any one location in a gridded spatial domain to InMAP-computed concentrations in all other locations. These relationships are generated with independent simulations of the air quality model for each of over 50,000 grid cells covering the contiguous United States for both ground-level and elevated sources.

Population-weighted average ambient concentrations, our measure of exposure, are calculated using a conventional approach to weighted averages. Specifically, we first multiply, for each grid cell, the population and the concentration. The sum of those values across all cells in the given spatial domain is then divided by the corresponding population to yield the population-weighted average concentration: $PWA = \Sigma(PC)/\Sigma(P)$. Here, PWA is the population-weighted average, $P$ is the population in a grid cell, $C$ is the concentration in a grid cell, and the summations in the numerator and denominator are across all grid cells in the geography being studied (e.g., in a state, in the contiguous United States).

Population data by race-ethnicity are from the U.S. Census 2012–2016 American Community Survey (ACS) at Census Block Group level of spatial aggregation. We focus on the four largest race-ethnicity groups as determined by self-identification in the Census: Asian, Black or African American, Latino or Hispanic, and White. We aggregate these four population subgroups such that they are mutually exclusive: "Hispanic" including people of all races who

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identify as having Hispanic or Latino origin, and the other three groups (Asian, Black, and White) referring only to non-Latino/non-Hispanic persons. POC are defined herein as everyone except non-Latino/non-Hispanic Whites (i.e., individuals identifying as Hispanic plus non-Hispanic individuals identifying as Black or African American, American Indian or Alaska Native, Asian, Native Hawaiian and other pacific islander, some other race, or two or more races).

The 2012–2016 ACS provides income statistics by Census Tract, with 16 household income categories (lowest: "less than $10,000"; highest: "$200,000 or more"). We use the proportion of households in each income category to estimate population counts at the finest available level of race-ethnicity information: White and POC. Table S3 details the population distribution by income category.

To calculate exposure in individual urban areas, we use year 2018 urbanized area extents as defined by the U.S. Census (www.census.gov/geographies/mapping-files/time-series/geo/carto-boundary-file.html). We define "rural" as everywhere that is not within an urbanized area extent.

To calculate exposure by 1930s-era Home Owners' Loan Corporation (HOLC) grades, we use historical maps digitized by the Mapping Inequality project (*27*). HOLC maps classify urban neighborhoods into four grades: A (green; "best"), B (blue; "still desirable"), C (yellow; "definitely declining"), and D (red; "hazardous"). For results shown in fig. S2, we define "% exposure from disproportionately exposing source types" as the percent of exposure that is caused by source types that expose residents of a given race-ethnicity currently living in an area with the given historical HOLC grade in a given city more than the overall average exposure of all residents of HOLC-graded areas in that city.

## SUPPLEMENTARY MATERIALS

Supplementary material for this article is available at http://advances.sciencemag.org/cgi/content/full/7/18/eabf4491/DC1

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of the authors and do not necessarily reflect those of the Agency. EPA does not endorse any products or commercial services mentioned in this publication. **Author contributions:** Conceived and designed the experiments: C.W.T., D.A.P., J.D.H., and J.D.M. Analyzed the data: C.W.T., D.A.P., and J.D.M. Wrote the paper: C.W.T., D.A.P., S.E.C., J.S.A., J.D.H., and J.D.M. **Competing interests:** The authors declare that they have no competing interests. **Data and materials availability:** All data needed to evaluate the conclusions in the paper are present in the paper and/or the Supplementary Materials. Additional data related to this paper may be requested from the authors.

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# PM polluters disproportionately and systemically affect people of color in the United States

Christopher W. TessumDavid A. PaolellaSarah E. ChamblissJoshua S. ApteJason D. HillJulian D. Marshall

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# Study Finds Exposure to Air Pollution Higher for People of Color Regardless of Region or Income



*Published September 20, 2021*

In the United States, people of color breathe more particulate air pollution on average, a finding that holds across income levels and regions of the US, according to a study by researchers at the EPA-funded Center for Air, Climate, and Energy Solutions. The findings expand a body of evidence showing that African Americans, Hispanics, Asians, and other people of color are disproportionately exposed to a regulated air pollutant called fine particulate matter ($PM_{2.5}$).

The findings, published in April 2021 in *Science Advances*, have serious public health implications–exposure to $PM_{2.5}$ can cause lung and heart problems, especially for those with chronic disease, younger people, older people, and other more vulnerable populations.

The researchers conducted modeling and analyzed EPA data from the National Emissions Inventory for more than 5,000 emission source types for $PM_{2.5}$ such as industry, agriculture, light- and heavy-duty vehicles, construction, residential sources, and road dust to determine which source(s) were causing inequal exposure to $PM_{2.5}$ pollution by race-ethnicity.

They found racial-ethnic disparities for nearly all major emission categories. White people are exposed to lower than average concentrations from emission source types causing 60 percent of overall exposure, whereas people of color experience greater than average exposures from source types causing 75 percent of overall exposure. The disparity generally held across states and urban and rural areas and occurs for people at all income levels.

In other words, the study found that race appears to be an important factor for exposure in nearly all regions.

“Some assume that when there is a systematic racial-ethnic disparity, such as the one we see here, that the underlying cause is a difference in income,” says lead author Christopher Tessum of the University of Illinois. “Because the data shows that the racial disparities hold for all income levels, our study reinforces previous findings that race/ethnicity, independently of income, drives air pollution-exposure disparities.”

Tessum said the results have implications for how regulations might be designed to effectively address environmental injustice for people of color exposed to air pollution from multiple source types.

“We find that nearly all emission sectors cause disproportionate exposures for people of color on average,” said co-author Julian Marshall, a professor of civil and environmental engineering at the University of Washington. The authors noted in the paper that because of a legacy of housing policy and other factors, racial-ethnic exposure disparities continue to persist even with a decrease in the overall exposure.

“The inequities we report are a result of systemic racism: Over time, people of color and pollution have been pushed together, not just in a few cases but for nearly all types of emissions,” said Marshall.

The study results also comes with caveats including uncertainty in the models and in inputs to the models and notes the potential benefit of additional analysis using local data and expertise. In addition, the study focuses on outdoor concentrations at locations of residence; disparities in associated health impacts would also reflect racial-ethnic variability in mobility, microenvironment, outdoor-to-indoor concentration relationships, dose-response, access to health care, and baseline mortality and morbidity rates.

EPA's goal is to provide an environment where all people enjoy the same degree of protection from environmental and health hazards and equal access to the decision-making process to maintain a healthy environment in which to live, learn, and work. To help achieve this, EPA researchers are focused on understanding the air quality concerns in overburdened communities and the health impacts of the residents. They are providing scientific expertise and tools to assist states, tribes, and communities to address environmental justice and equity issues, so that all people can breathe clean air and enjoy improved quality of life.

**This research was funded by an EPA Science to Achieve Results grant:**
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*Attach. 10*

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 0109799999 | 1 | 97 | METRO33660M33660 | Mobile, AL MSA | Mobile County | 61400 | 12900 | 14750 | 16600 | 18400 | 19900 | 21350 | 22850 | 24300 | 5160 | Mobile County | Alabama | 1 |
| AL | 0109999999 | 1 | 99 | NCNTY01099N01099 | Monroe County, AL | Monroe County | 44200 | 11300 | 12900 | 14500 | 16100 | 17400 | 18700 | 20000 | 21300 | 9999 | Monroe County | Alabama | 0 |
| AL | 0110199999 | 1 | 101 | METRO33860M33860 | Montgomery, AL MSA | Montgomery County | 65700 | 13800 | 15800 | 17750 | 19700 | 21300 | 22900 | 24450 | 26050 | 5240 | Montgomery County | Alabama | 1 |
| AL | 0110399999 | 1 | 103 | METRO19460M19460 | Decatur, AL MSA | Morgan County | 63600 | 13400 | 15300 | 17200 | 19100 | 20650 | 22200 | 23700 | 25250 | 2030 | Morgan County | Alabama | 1 |
| AL | 0110599999 | 1 | 105 | NCNTY01105N01105 | Perry County, AL | Perry County | 34700 | 11300 | 12900 | 14500 | 16100 | 17400 | 18700 | 20000 | 21300 | 9999 | Perry County | Alabama | 0 |
| AL | 0110799999 | 1 | 107 | METRO46220N01107 | Pickens County, AL HUD Metro FMR Area | Pickens County | 53900 | 11350 | 12950 | 14550 | 16150 | 17450 | 18750 | 20050 | 21350 | 9999 | Pickens County | Alabama | 1 |
| AL | 0110999999 | 1 | 109 | NCNTY01109N01109 | Pike County, AL | Pike County | 52500 | 11300 | 12900 | 14500 | 16100 | 17400 | 18700 | 20000 | 21300 | 9999 | Pike County | Alabama | 0 |
| AL | 0111199999 | 1 | 111 | NCNTY01111N01111 | Randolph County, AL | Randolph County | 52200 | 11300 | 12900 | 14500 | 16100 | 17400 | 18700 | 20000 | 21300 | 9999 | Randolph County | Alabama | 0 |
| AL | 0111399999 | 1 | 113 | METRO17980M17980 | Columbus, GA-AL MSA | Russell County | 62300 | 13100 | 15000 | 16850 | 18700 | 20200 | 21700 | 23200 | 24700 | 1800 | Russell County | Alabama | 1 |
| AL | 0111599999 | 1 | 115 | METRO13820M13820 | Birmingham-Hoover, AL HUD Metro FMR Area | St. Clair County | 73100 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 1000 | St. Clair County | Alabama | 1 |
| AL | 0111799999 | 1 | 117 | METRO13820M13820 | Birmingham-Hoover, AL HUD Metro FMR Area | Shelby County | 73100 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 1000 | Shelby County | Alabama | 1 |
| AL | 0111999999 | 1 | 119 | NCNTY01119N01119 | Sumter County, AL | Sumter County | 43800 | 11300 | 12900 | 14500 | 16100 | 17400 | 18700 | 20000 | 21300 | 9999 | Sumter County | Alabama | 0 |
| AL | 0112199999 | 1 | 121 | NCNTY01121N01121 | Talladega County, AL | Talladega County | 56700 | 11700 | 13350 | 15000 | 16650 | 18000 | 19350 | 20650 | 22000 | 9999 | Talladega County | Alabama | 0 |
| AL | 0112399999 | 1 | 123 | NCNTY01123N01123 | Tallapoosa County, AL | Tallapoosa County | 56500 | 11900 | 13600 | 15300 | 16950 | 18350 | 19700 | 21050 | 22400 | 9999 | Tallapoosa County | Alabama | 0 |
| AL | 0112599999 | 1 | 125 | METRO46220M46220 | Tuscaloosa, AL HUD Metro FMR Area | Tuscaloosa County | 67800 | 14250 | 16300 | 18350 | 20350 | 22000 | 23650 | 25250 | 26900 | 8600 | Tuscaloosa County | Alabama | 1 |
| AL | 0112799999 | 1 | 127 | METRO13820N01127 | Walker County, AL HUD Metro FMR Area | Walker County | 64100 | 11700 | 13350 | 15000 | 16650 | 18000 | 19350 | 20650 | 22000 | 9999 | Walker County | Alabama | 1 |
| AL | 0112999999 | 1 | 129 | NCNTY01129N01129 | Washington County, AL | Washington County | 49700 | 11300 | 12900 | 14500 | 16100 | 17400 | 18700 | 20000 | 21300 | 9999 | Washington County | Alabama | 0 |
| AL | 0113199999 | 1 | 131 | NCNTY01131N01131 | Wilcox County, AL | Wilcox County | 43400 | 11300 | 12900 | 14500 | 16100 | 17400 | 18700 | 20000 | 21300 | 9999 | Wilcox County | Alabama | 0 |
| AL | 0113399999 | 1 | 133 | NCNTY01133N01133 | Winston County, AL | Winston County | 47300 | 11300 | 12900 | 14500 | 16100 | 17400 | 18700 | 20000 | 21300 | 9999 | Winston County | Alabama | 0 |
| AK | 0201399999 | 2 | 13 | NCNTY02013N02013 | Aleutians East Borough, AK | Aleutians East Borough | 77700 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Aleutians East Borough | Alaska | 0 |
| AK | 0201699999 | 2 | 16 | NCNTY02016N02016 | Aleutians West Census Area, AK | Aleutians West Census Area | 100100 | 21500 | 24600 | 27650 | 30700 | 33200 | 35650 | 38100 | 40550 | 9999 | Aleutians West Census Area | Alaska | 0 |
| AK | 0202099999 | 2 | 20 | METRO11260M11260 | Anchorage, AK HUD Metro FMR Area | Anchorage Municipality | 97300 | 20950 | 23950 | 26950 | 29900 | 32300 | 34700 | 37100 | 39500 | 380 | Anchorage Municipality | Alaska | 1 |
| AK | 0205099999 | 2 | 50 | NCNTY02050N02050 | Bethel Census Area, AK | Bethel Census Area | 56900 | 20650 | 23600 | 26550 | 29500 | 31900 | 34250 | 36600 | 38950 | 9999 | Bethel Census Area | Alaska | 0 |
| AK | 0206099999 | 2 | 60 | NCNTY02060N02060 | Bristol Bay Borough, AK | Bristol Bay Borough | 102500 | 21550 | 24600 | 27700 | 30750 | 33250 | 35700 | 38150 | 40600 | 9999 | Bristol Bay Borough | Alaska | 0 |
| AK | 0206899999 | 2 | 68 | NCNTY02068N02068 | Denali Borough, AK | Denali Borough | 110500 | 23250 | 26550 | 29850 | 33150 | 35850 | 38500 | 41150 | 43800 | 9999 | Denali Borough | Alaska | 0 |
| AK | 0207099999 | 2 | 70 | NCNTY02070N02070 | Dillingham Census Area, AK | Dillingham Census Area | 65000 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Dillingham Census Area | Alaska | 0 |
| AK | 0209099999 | 2 | 90 | METRO21820M21820 | Fairbanks, AK MSA | Fairbanks North Star Borough | 93100 | 19600 | 22400 | 25200 | 27950 | 30200 | 32450 | 34700 | 36900 | 9999 | Fairbanks North Star Borough | Alaska | 1 |
| AK | 0210099999 | 2 | 100 | NCNTY02100N02100 | Haines Borough, AK | Haines Borough | 80000 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Haines Borough | Alaska | 0 |
| AK | 0210599999 | 2 | 105 | NCNTY02105N02105 | Hoonah-Angoon Census Area, AK | Hoonah-Angoon Census Area | 74500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Hoonah-Angoon Census Area | Alaska | 0 |
| AK | 0211099999 | 2 | 110 | NCNTY02110N02110 | Juneau City and Borough, AK | Juneau City and Borough | 117800 | 24750 | 28300 | 31850 | 35350 | 38200 | 41050 | 43850 | 46700 | 9999 | Juneau City and Borough | Alaska | 0 |
| AK | 0212299999 | 2 | 122 | NCNTY02122N02122 | Kenai Peninsula Borough, AK | Kenai Peninsula Borough | 89700 | 18850 | 21550 | 24250 | 26900 | 29100 | 31250 | 33400 | 35550 | 9999 | Kenai Peninsula Borough | Alaska | 0 |
| AK | 0213099999 | 2 | 130 | NCNTY02130N02130 | Ketchikan Gateway Borough, AK | Ketchikan Gateway Borough | 87300 | 18350 | 21000 | 23600 | 26200 | 28300 | 30400 | 32500 | 34600 | 9999 | Ketchikan Gateway Borough | Alaska | 0 |
| AK | 0215099999 | 2 | 150 | NCNTY02150N02150 | Kodiak Island Borough, AK | Kodiak Island Borough | 98400 | 20650 | 23600 | 26550 | 29500 | 31900 | 34250 | 36600 | 38950 | 9999 | Kodiak Island Borough | Alaska | 0 |
| AK | 0215899999 | 2 | 158 | NCNTY02158N02158 | Kusilvak Census Area | Kusilvak Census Area | 38500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Kusilvak Census Area | Alaska | 0 |
| AK | 0216499999 | 2 | 164 | NCNTY02164N02164 | Lake and Peninsula Borough, AK | Lake and Peninsula Borough | 50700 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Lake and Peninsula Borough | Alaska | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AK | 0217099999 | 2 | 170 | METRO11260N02170 | Matanuska-Susitna Borough, AK HUD Metro FMR Area | Matanuska-Susitna Borough | 91400 | 19200 | 21950 | 24700 | 27400 | 29600 | 31800 | 34000 | 36200 | 9999 | Matanuska-Susitna Borough | Alaska | 1 |
| AK | 0218099999 | 2 | 180 | NCNTY02180N02180 | Nome Census Area, AK | Nome Census Area | 55600 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9999 | Nome Census Area | Alaska | 0 |
| AK | 0218599999 | 2 | 185 | NCNTY02185N02185 | North Slope Borough, AK | North Slope Borough | 84900 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | North Slope Borough | Alaska | 0 |
| AK | 0218899999 | 2 | 188 | NCNTY02188N02188 | Northwest Arctic Borough, AK | Northwest Arctic Borough | 62000 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Northwest Arctic Borough | Alaska | 0 |
| AK | 0219599999 | 2 | 195 | NCNTY02195N02195 | Petersburg Borough | Petersburg Borough | 79900 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Petersburg Borough | Alaska | 0 |
| AK | 0219899999 | 2 | 198 | NCNTY02198N02198 | Prince of Wales-Hyder Census Area, AK | Prince of Wales-Hyder Census Area | 67600 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Prince of Wales-Hyder Census Area | Alaska | 0 |
| AK | 0222099999 | 2 | 220 | NCNTY02220N02220 | Sitka City and Borough, AK | Sitka City and Borough | 89100 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Sitka City and Borough | Alaska | 0 |
| AK | 0223099999 | 2 | 230 | NCNTY02230N02230 | Skagway Municipality, AK | Skagway Municipality | 83600 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Skagway Municipality | Alaska | 0 |
| AK | 0224099999 | 2 | 240 | NCNTY02240N02240 | Southeast Fairbanks Census Area, AK | Southeast Fairbanks Census Area | 82700 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Southeast Fairbanks Census Area | Alaska | 0 |
| AK | 0226199999 | 2 | 261 | NCNTY02261N02261 | Valdez-Cordova Census Area, AK | Valdez-Cordova Census Area | 113200 | 23700 | 27100 | 30500 | 33850 | 36600 | 39300 | 42000 | 44700 | 9999 | Valdez-Cordova Census Area | Alaska | 0 |
| AK | 0227599999 | 2 | 275 | NCNTY02275N02275 | Wrangell City and Borough, AK | Wrangell City and Borough | 71400 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Wrangell City and Borough | Alaska | 0 |
| AK | 0228299999 | 2 | 282 | NCNTY02282N02282 | Yakutat City and Borough, AK | Yakutat City and Borough | 90800 | 19100 | 21800 | 24550 | 27250 | 29450 | 31650 | 33800 | 36000 | 9999 | Yakutat City and Borough | Alaska | 0 |
| AK | 0229099999 | 2 | 290 | NCNTY02290N02290 | Yukon-Koyukuk Census Area, AK | Yukon-Koyukuk Census Area | 51400 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Yukon-Koyukuk Census Area | Alaska | 0 |
| AZ | 0400199999 | 4 | 1 | NCNTY04001N04001 | Apache County, AZ | Apache County | 43200 | 10400 | 11850 | 13350 | 14800 | 16000 | 17200 | 18400 | 19550 | 9999 | Apache County | Arizona | 0 |
| AZ | 0400399999 | 4 | 3 | METRO43420M43420 | Sierra Vista-Douglas, AZ MSA | Cochise County | 66300 | 12600 | 14400 | 16200 | 17950 | 19400 | 20850 | 22300 | 23700 | 9999 | Cochise County | Arizona | 1 |
| AZ | 0400599999 | 4 | 5 | METRO22380M22380 | Flagstaff, AZ MSA | Coconino County | 75200 | 15800 | 18050 | 20300 | 22550 | 24400 | 26200 | 28000 | 29800 | 2620 | Coconino County | Arizona | 1 |
| AZ | 0400799999 | 4 | 7 | NCNTY04007N04007 | Gila County, AZ | Gila County | 51800 | 11300 | 12900 | 14500 | 16100 | 17400 | 18700 | 20000 | 21300 | 9999 | Gila County | Arizona | 0 |
| AZ | 0400999999 | 4 | 9 | NCNTY04009N04009 | Graham County, AZ | Graham County | 62400 | 13100 | 15000 | 16850 | 18700 | 20200 | 21700 | 23200 | 24700 | 9999 | Graham County | Arizona | 0 |
| AZ | 0401199999 | 4 | 11 | NCNTY04011N04011 | Greenlee County, AZ | Greenlee County | 64600 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Greenlee County | Arizona | 0 |
| AZ | 0401299999 | 4 | 12 | NCNTY04012N04012 | La Paz County, AZ | La Paz County | 47300 | 10500 | 12000 | 13500 | 15000 | 16200 | 17400 | 18600 | 19800 | 9999 | La Paz County | Arizona | 0 |
| AZ | 0401399999 | 4 | 13 | METRO38060M38060 | Phoenix-Mesa-Scottsdale, AZ MSA | Maricopa County | 77800 | 16350 | 18700 | 21050 | 23350 | 25250 | 27100 | 29000 | 30850 | 6200 | Maricopa County | Arizona | 1 |
| AZ | 0401599999 | 4 | 15 | METRO29420M29420 | Lake Havasu City-Kingman, AZ MSA | Mohave County | 55700 | 11700 | 13400 | 15050 | 16700 | 18050 | 19400 | 20750 | 22050 | 4120 | Mohave County | Arizona | 1 |
| AZ | 0401799999 | 4 | 17 | NCNTY04017N04017 | Navajo County, AZ | Navajo County | 53200 | 11200 | 12800 | 14400 | 15950 | 17250 | 18550 | 19800 | 21100 | 9999 | Navajo County | Arizona | 0 |
| AZ | 0401999999 | 4 | 19 | METRO46060M46060 | Tucson, AZ MSA | Pima County | 68400 | 14350 | 16400 | 18450 | 20500 | 22150 | 23800 | 25450 | 27100 | 8520 | Pima County | Arizona | 1 |
| AZ | 0402199999 | 4 | 21 | METRO38060M38060 | Phoenix-Mesa-Scottsdale, AZ MSA | Pinal County | 77800 | 16350 | 18700 | 21050 | 23350 | 25250 | 27100 | 29000 | 30850 | 6200 | Pinal County | Arizona | 1 |
| AZ | 0402399999 | 4 | 23 | NCNTY04023N04023 | Santa Cruz County, AZ | Santa Cruz County | 46800 | 10400 | 11850 | 13350 | 14800 | 16000 | 17200 | 18400 | 19550 | 9999 | Santa Cruz County | Arizona | 0 |
| AZ | 0402599999 | 4 | 25 | METRO39140M39140 | Prescott, AZ MSA | Yavapai County | 64600 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Yavapai County | Arizona | 1 |
| AZ | 0402799999 | 4 | 27 | METRO49740M49740 | Yuma, AZ MSA | Yuma County | 56500 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9360 | Yuma County | Arizona | 1 |
| AR | 0500199999 | 5 | 1 | NCNTY05001N05001 | Arkansas County, AR | Arkansas County | 51800 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Arkansas County | Arkansas | 0 |
| AR | 0500399999 | 5 | 3 | NCNTY05003N05003 | Ashley County, AR | Ashley County | 50800 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Ashley County | Arkansas | 0 |
| AR | 0500599999 | 5 | 5 | NCNTY05005N05005 | Baxter County, AR | Baxter County | 51400 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Baxter County | Arkansas | 0 |
| AR | 0500799999 | 5 | 7 | METRO22220M22220 | Fayetteville-Springdale-Rogers, AR HUD Metro FMR Area | Benton County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 2580 | Benton County | Arkansas | 1 |
| AR | 0500999999 | 5 | 9 | NCNTY05009N05009 | Boone County, AR | Boone County | 49900 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Boone County | Arkansas | 0 |
| AR | 0501199999 | 5 | 11 | NCNTY05011N05011 | Bradley County, AR | Bradley County | 49800 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Bradley County | Arkansas | 0 |
| AR | 0501399999 | 5 | 13 | NCNTY05013N05013 | Calhoun County, AR | Calhoun County | 50400 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Calhoun County | Arkansas | 0 |
| AR | 0501599999 | 5 | 15 | NCNTY05015N05015 | Carroll County, AR | Carroll County | 54700 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Carroll County | Arkansas | 0 |
| AR | 0501799999 | 5 | 17 | NCNTY05017N05017 | Chicot County, AR | Chicot County | 41500 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Chicot County | Arkansas | 0 |
| AR | 0501999999 | 5 | 19 | NCNTY05019N05019 | Clark County, AR | Clark County | 57700 | 12150 | 13850 | 15600 | 17300 | 18700 | 20100 | 21500 | 22850 | 9999 | Clark County | Arkansas | 0 |
| AR | 0502199999 | 5 | 21 | NCNTY05021N05021 | Clay County, AR | Clay County | 45900 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Clay County | Arkansas | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AR | 0502399999 | 5 | 23 | NCNTY05023N05023 | Cleburne County, AR | Cleburne County | 59700 | 12550 | 14350 | 16150 | 17900 | 19350 | 20800 | 22200 | 23650 | 9999 | Cleburne County | Arkansas | 0 |
| AR | 0502599999 | 5 | 25 | METRO38220M38220 | Pine Bluff, AR MSA | Cleveland County | 52600 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Cleveland County | Arkansas | 1 |
| AR | 0502799999 | 5 | 27 | NCNTY05027N05027 | Columbia County, AR | Columbia County | 52200 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Columbia County | Arkansas | 0 |
| AR | 0502999999 | 5 | 29 | NCNTY05029N05029 | Conway County, AR | Conway County | 54600 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Conway County | Arkansas | 0 |
| AR | 0503199999 | 5 | 31 | METRO27860MM3700 | Jonesboro, AR HUD Metro FMR Area | Craighead County | 65200 | 12450 | 14200 | 16000 | 17750 | 19200 | 20600 | 22050 | 23450 | 3700 | Craighead County | Arkansas | 1 |
| AR | 0503399999 | 5 | 33 | METRO22900M22900 | Fort Smith, AR-OK HUD Metro FMR Area | Crawford County | 54200 | 11400 | 13000 | 14650 | 16250 | 17550 | 18850 | 20150 | 21450 | 2720 | Crawford County | Arkansas | 1 |
| AR | 0503599999 | 5 | 35 | METRO32820M32820 | Memphis, TN-MS-AR HUD Metro FMR Area | Crittenden County | 67900 | 14250 | 16300 | 18350 | 20350 | 22000 | 23650 | 25250 | 26900 | 4920 | Crittenden County | Arkansas | 1 |
| AR | 0503799999 | 5 | 37 | NCNTY05037N05037 | Cross County, AR | Cross County | 54200 | 11400 | 13000 | 14650 | 16250 | 17550 | 18850 | 20150 | 21450 | 9999 | Cross County | Arkansas | 0 |
| AR | 0503999999 | 5 | 39 | NCNTY05039N05039 | Dallas County, AR | Dallas County | 48700 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Dallas County | Arkansas | 0 |
| AR | 0504199999 | 5 | 41 | NCNTY05041N05041 | Desha County, AR | Desha County | 40500 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Desha County | Arkansas | 0 |
| AR | 0504399999 | 5 | 43 | NCNTY05043N05043 | Drew County, AR | Drew County | 53900 | 11350 | 12950 | 14550 | 16150 | 17450 | 18750 | 20050 | 21350 | 9999 | Drew County | Arkansas | 0 |
| AR | 0504599999 | 5 | 45 | METRO30780M30780 | Little Rock-North Little Rock-Conway, AR HUD Metro FMR Area | Faulkner County | 72200 | 15200 | 17350 | 19500 | 21650 | 23400 | 25150 | 26850 | 28600 | 4400 | Faulkner County | Arkansas | 1 |
| AR | 0504799999 | 5 | 47 | NCNTY05047N05047 | Franklin County, AR | Franklin County | 49100 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Franklin County | Arkansas | 0 |
| AR | 0504999999 | 5 | 49 | NCNTY05049N05049 | Fulton County, AR | Fulton County | 45300 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Fulton County | Arkansas | 0 |
| AR | 0505199999 | 5 | 51 | METRO26300M26300 | Hot Springs, AR MSA | Garland County | 63900 | 13150 | 15000 | 16900 | 18750 | 20250 | 21750 | 23250 | 24750 | 9999 | Garland County | Arkansas | 1 |
| AR | 0505399999 | 5 | 53 | METRO30780N05053 | Grant County, AR HUD Metro FMR Area | Grant County | 64700 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Grant County | Arkansas | 1 |
| AR | 0505599999 | 5 | 55 | NCNTY05055N05055 | Greene County, AR | Greene County | 58700 | 12350 | 14100 | 15850 | 17600 | 19050 | 20450 | 21850 | 23250 | 9999 | Greene County | Arkansas | 0 |
| AR | 0505799999 | 5 | 57 | NCNTY05057N05057 | Hempstead County, AR | Hempstead County | 51200 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Hempstead County | Arkansas | 0 |
| AR | 0505999999 | 5 | 59 | NCNTY05059N05059 | Hot Spring County, AR | Hot Spring County | 55300 | 11650 | 13300 | 14950 | 16600 | 17950 | 19300 | 20600 | 21950 | 9999 | Hot Spring County | Arkansas | 0 |
| AR | 0506199999 | 5 | 61 | NCNTY05061N05061 | Howard County, AR | Howard County | 47400 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Howard County | Arkansas | 0 |
| AR | 0506399999 | 5 | 63 | NCNTY05063N05063 | Independence County, AR | Independence County | 54800 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Independence County | Arkansas | 0 |
| AR | 0506599999 | 5 | 65 | NCNTY05065N05065 | Izard County, AR | Izard County | 52000 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Izard County | Arkansas | 0 |
| AR | 0506799999 | 5 | 67 | NCNTY05067N05067 | Jackson County, AR | Jackson County | 44900 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Jackson County | Arkansas | 0 |
| AR | 0506999999 | 5 | 69 | METRO38220M38220 | Pine Bluff, AR MSA | Jefferson County | 52600 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 6240 | Jefferson County | Arkansas | 1 |
| AR | 0507199999 | 5 | 71 | NCNTY05071N05071 | Johnson County, AR | Johnson County | 45600 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Johnson County | Arkansas | 0 |
| AR | 0507399999 | 5 | 73 | NCNTY05073N05073 | Lafayette County, AR | Lafayette County | 46300 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Lafayette County | Arkansas | 0 |
| AR | 0507599999 | 5 | 75 | NCNTY05075N05075 | Lawrence County, AR | Lawrence County | 51400 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Lawrence County | Arkansas | 0 |
| AR | 0507799999 | 5 | 77 | NCNTY05077N05077 | Lee County, AR | Lee County | 41900 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Lee County | Arkansas | 0 |
| AR | 0507999999 | 5 | 79 | METRO38220M38220 | Pine Bluff, AR MSA | Lincoln County | 52600 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Lincoln County | Arkansas | 1 |
| AR | 0508199999 | 5 | 81 | METRO45500N05081 | Little River County, AR HUD Metro FMR Area | Little River County | 54500 | 11450 | 13100 | 14750 | 16350 | 17700 | 19000 | 20300 | 21600 | 9999 | Little River County | Arkansas | 1 |
| AR | 0508399999 | 5 | 83 | NCNTY05083N05083 | Logan County, AR | Logan County | 48900 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Logan County | Arkansas | 0 |
| AR | 0508599999 | 5 | 85 | METRO30780M30780 | Little Rock-North Little Rock-Conway, AR HUD Metro FMR Area | Lonoke County | 72200 | 15200 | 17350 | 19500 | 21650 | 23400 | 25150 | 26850 | 28600 | 4400 | Lonoke County | Arkansas | 1 |
| AR | 0508799999 | 5 | 87 | METRO22220M22220 | Fayetteville-Springdale-Rogers, AR HUD Metro FMR Area | Madison County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Madison County | Arkansas | 1 |
| AR | 0508999999 | 5 | 89 | NCNTY05089N05089 | Marion County, AR | Marion County | 46400 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Marion County | Arkansas | 0 |
| AR | 0509199999 | 5 | 91 | METRO45500M45500 | Texarkana, TX-Texarkana, AR HUD Metro FMR Area | Miller County | 69800 | 13300 | 15200 | 17100 | 19000 | 20550 | 22050 | 23600 | 25100 | 8360 | Miller County | Arkansas | 1 |
| AR | 0509399999 | 5 | 93 | NCNTY05093N05093 | Mississippi County, AR | Mississippi County | 44700 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Mississippi County | Arkansas | 0 |
| AR | 0509599999 | 5 | 95 | NCNTY05095N05095 | Monroe County, AR | Monroe County | 47400 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Monroe County | Arkansas | 0 |
| AR | 0509799999 | 5 | 97 | NCNTY05097N05097 | Montgomery County, AR | Montgomery County | 48900 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Montgomery County | Arkansas | 0 |
| AR | 0509999999 | 5 | 99 | NCNTY05099N05099 | Nevada County, AR | Nevada County | 50500 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Nevada County | Arkansas | 0 |
| AR | 0510199999 | 5 | 101 | NCNTY05101N05101 | Newton County, AR | Newton County | 50200 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Newton County | Arkansas | 0 |
| AR | 0510399999 | 5 | 103 | NCNTY05103N05103 | Ouachita County, AR | Ouachita County | 45400 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Ouachita County | Arkansas | 0 |
| AR | 0510599999 | 5 | 105 | METRO30780M30780 | Little Rock-North Little Rock-Conway, AR HUD Metro FMR Area | Perry County | 72200 | 15200 | 17350 | 19500 | 21650 | 23400 | 25150 | 26850 | 28600 | 9999 | Perry County | Arkansas | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AR | 0510799999 | 5 | 107 | NCNTY05107N05107 | Phillips County, AR | Phillips County | 37100 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Phillips County | Arkansas | 0 |
| AR | 0510999999 | 5 | 109 | NCNTY05109N05109 | Pike County, AR | Pike County | 51800 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Pike County | Arkansas | 0 |
| AR | 0511199999 | 5 | 111 | METRO27860N05111 | Poinsett County, AR HUD Metro FMR Area | Poinsett County | 46600 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Poinsett County | Arkansas | 1 |
| AR | 0511399999 | 5 | 113 | NCNTY05113N05113 | Polk County, AR | Polk County | 42600 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Polk County | Arkansas | 0 |
| AR | 0511599999 | 5 | 115 | NCNTY05115N05115 | Pope County, AR | Pope County | 54100 | 11400 | 13000 | 14650 | 16250 | 17550 | 18850 | 20150 | 21450 | 9999 | Pope County | Arkansas | 0 |
| AR | 0511799999 | 5 | 117 | NCNTY05117N05117 | Prairie County, AR | Prairie County | 51000 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Prairie County | Arkansas | 0 |
| AR | 0511999999 | 5 | 119 | METRO30780M30780 | Little Rock-North Little Rock-Conway, AR HUD Metro FMR Area | Pulaski County | 72200 | 15200 | 17350 | 19500 | 21650 | 23400 | 25150 | 26850 | 28600 | 4400 | Pulaski County | Arkansas | 1 |
| AR | 0512199999 | 5 | 121 | NCNTY05121N05121 | Randolph County, AR | Randolph County | 48400 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Randolph County | Arkansas | 0 |
| AR | 0512399999 | 5 | 123 | NCNTY05123N05123 | St. Francis County, AR | St. Francis County | 43200 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | St. Francis County | Arkansas | 0 |
| AR | 0512599999 | 5 | 125 | METRO30780M30780 | Little Rock-North Little Rock-Conway, AR HUD Metro FMR Area | Saline County | 72200 | 15200 | 17350 | 19500 | 21650 | 23400 | 25150 | 26850 | 28600 | 4400 | Saline County | Arkansas | 1 |
| AR | 0512799999 | 5 | 127 | NCNTY05127N05127 | Scott County, AR | Scott County | 45400 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Scott County | Arkansas | 0 |
| AR | 0512999999 | 5 | 129 | NCNTY05129N05129 | Searcy County, AR | Searcy County | 46900 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Searcy County | Arkansas | 0 |
| AR | 0513199999 | 5 | 131 | METRO22900M22900 | Fort Smith, AR-OK HUD Metro FMR Area | Sebastian County | 54200 | 11400 | 13000 | 14650 | 16250 | 17550 | 18850 | 20150 | 21450 | 2720 | Sebastian County | Arkansas | 1 |
| AR | 0513399999 | 5 | 133 | NCNTY05133N05133 | Sevier County, AR | Sevier County | 56000 | 11800 | 13450 | 15150 | 16800 | 18150 | 19500 | 20850 | 22200 | 9999 | Sevier County | Arkansas | 0 |
| AR | 0513599999 | 5 | 135 | NCNTY05135N05135 | Sharp County, AR | Sharp County | 43200 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Sharp County | Arkansas | 0 |
| AR | 0513799999 | 5 | 137 | NCNTY05137N05137 | Stone County, AR | Stone County | 44300 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Stone County | Arkansas | 0 |
| AR | 0513999999 | 5 | 139 | NCNTY05139N05139 | Union County, AR | Union County | 55100 | 11600 | 13250 | 14900 | 16550 | 17900 | 19200 | 20550 | 21850 | 9999 | Union County | Arkansas | 0 |
| AR | 0514199999 | 5 | 141 | NCNTY05141N05141 | Van Buren County, AR | Van Buren County | 46400 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Van Buren County | Arkansas | 0 |
| AR | 0514399999 | 5 | 143 | METRO22220M22220 | Fayetteville-Springdale-Rogers, AR HUD Metro FMR Area | Washington County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 2580 | Washington County | Arkansas | 1 |
| AR | 0514599999 | 5 | 145 | NCNTY05145N05145 | White County, AR | White County | 57200 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | White County | Arkansas | 0 |
| AR | 0514799999 | 5 | 147 | NCNTY05147N05147 | Woodruff County, AR | Woodruff County | 49400 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Woodruff County | Arkansas | 0 |
| AR | 0514999999 | 5 | 149 | NCNTY05149N05149 | Yell County, AR | Yell County | 48700 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Yell County | Arkansas | 0 |
| CA | 0600199999 | 6 | 1 | METRO41860MM5775 | Oakland-Fremont, CA HUD Metro FMR Area | Alameda County | 119200 | 27450 | 31350 | 35250 | 39150 | 42300 | 45450 | 48550 | 51700 | 5775 | Alameda County | California | 1 |
| CA | 0600399999 | 6 | 3 | NCNTY06003N06003 | Alpine County, CA | Alpine County | 83200 | 17500 | 20000 | 22500 | 24950 | 26950 | 28950 | 30950 | 32950 | 9999 | Alpine County | California | 0 |
| CA | 0600599999 | 6 | 5 | NCNTY06005N06005 | Amador County, CA | Amador County | 78700 | 16550 | 18900 | 21250 | 23600 | 25500 | 27400 | 29300 | 31200 | 9999 | Amador County | California | 0 |
| CA | 0600799999 | 6 | 7 | METRO17020M17020 | Chico, CA MSA | Butte County | 66100 | 14850 | 17000 | 19100 | 21200 | 22900 | 24600 | 26300 | 28000 | 1620 | Butte County | California | 1 |
| CA | 0600999999 | 6 | 9 | NCNTY06009N06009 | Calaveras County, CA | Calaveras County | 80400 | 16900 | 19300 | 21700 | 24100 | 26050 | 28000 | 29900 | 31850 | 9999 | Calaveras County | California | 0 |
| CA | 0601199999 | 6 | 11 | NCNTY06011N06011 | Colusa County, CA | Colusa County | 66400 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Colusa County | California | 0 |
| CA | 0601399999 | 6 | 13 | METRO41860MM5775 | Oakland-Fremont, CA HUD Metro FMR Area | Contra Costa County | 119200 | 27450 | 31350 | 35250 | 39150 | 42300 | 45450 | 48550 | 51700 | 5775 | Contra Costa County | California | 1 |
| CA | 0601599999 | 6 | 15 | NCNTY06015N06015 | Del Norte County, CA | Del Norte County | 57400 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Del Norte County | California | 0 |
| CA | 0601799999 | 6 | 17 | METRO40900M40900 | Sacramento--Roseville--Arden-Arcade, CA HUD Metro FMR Area | El Dorado County | 86300 | 18150 | 20750 | 23350 | 25900 | 28000 | 30050 | 32150 | 34200 | 6920 | El Dorado County | California | 1 |
| CA | 0601999999 | 6 | 19 | METRO23420M23420 | Fresno, CA MSA | Fresno County | 61700 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 2840 | Fresno County | California | 1 |
| CA | 0602199999 | 6 | 21 | NCNTY06021N06021 | Glenn County, CA | Glenn County | 56700 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Glenn County | California | 0 |
| CA | 0602399999 | 6 | 23 | NCNTY06023N06023 | Humboldt County, CA | Humboldt County | 72000 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Humboldt County | California | 0 |
| CA | 0602599999 | 6 | 25 | METRO20940M20940 | El Centro, CA MSA | Imperial County | 55600 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Imperial County | California | 1 |
| CA | 0602799999 | 6 | 27 | NCNTY06027N06027 | Inyo County, CA | Inyo County | 75100 | 15800 | 18050 | 20300 | 22550 | 24400 | 26200 | 28000 | 29800 | 9999 | Inyo County | California | 0 |
| CA | 0602999999 | 6 | 29 | METRO12540M12540 | Bakersfield, CA MSA | Kern County | 56600 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 680 | Kern County | California | 1 |
| CA | 0603199999 | 6 | 31 | METRO25260M25260 | Hanford-Corcoran, CA MSA | Kings County | 62200 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Kings County | California | 1 |
| CA | 0603399999 | 6 | 33 | NCNTY06033N06033 | Lake County, CA | Lake County | 65800 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Lake County | California | 0 |
| CA | 0603599999 | 6 | 35 | NCNTY06035N06035 | Lassen County, CA | Lassen County | 70400 | 14850 | 17000 | 19100 | 21200 | 22900 | 24600 | 26300 | 28000 | 9999 | Lassen County | California | 0 |
| CA | 0603799999 | 6 | 37 | METRO31080MM4480 | Los Angeles-Long Beach-Glendale, CA HUD Metro FMR Area | Los Angeles County | 77300 | 23700 | 27050 | 30450 | 33800 | 36550 | 39250 | 41950 | 44650 | 4480 | Los Angeles County | California | 1 |
| CA | 0603999999 | 6 | 39 | METRO31460M31460 | Madera, CA MSA | Madera County | 59400 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 2840 | Madera County | California | 1 |
| CA | 0604199999 | 6 | 41 | METRO41860MM7360 | San Francisco, CA HUD Metro FMR Area | Marin County | 143100 | 36550 | 41800 | 47000 | 52200 | 56400 | 60600 | 64750 | 68950 | 7360 | Marin County | California | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CA | 0604399999 | 6 | 43 | NCNTY06043N06043 | Mariposa County, CA | Mariposa County | 66900 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Mariposa County | California | 0 |
| CA | 0604599999 | 6 | 45 | NCNTY06045N06045 | Mendocino County, CA | Mendocino County | 70700 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Mendocino County | California | 0 |
| CA | 0604799999 | 6 | 47 | METRO32900M32900 | Merced, CA MSA | Merced County | 52300 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 4940 | Merced County | California | 1 |
| CA | 0604999999 | 6 | 49 | NCNTY06049N06049 | Modoc County, CA | Modoc County | 54200 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Modoc County | California | 0 |
| CA | 0605199999 | 6 | 51 | NCNTY06051N06051 | Mono County, CA | Mono County | 80900 | 17000 | 19400 | 21850 | 24250 | 26200 | 28150 | 30100 | 32050 | 9999 | Mono County | California | 0 |
| CA | 0605399999 | 6 | 53 | METRO41500M41500 | Salinas, CA MSA | Monterey County | 81600 | 20350 | 23250 | 26150 | 29050 | 31400 | 33700 | 36050 | 38350 | 7120 | Monterey County | California | 1 |
| CA | 0605599999 | 6 | 55 | METRO34900M34900 | Napa, CA MSA | Napa County | 109200 | 22750 | 26000 | 29250 | 32500 | 35100 | 37700 | 40300 | 42900 | 8720 | Napa County | California | 1 |
| CA | 0605799999 | 6 | 57 | NCNTY06057N06057 | Nevada County, CA | Nevada County | 92400 | 18100 | 20650 | 23250 | 25800 | 27900 | 29950 | 32000 | 34100 | 9999 | Nevada County | California | 0 |
| CA | 0605999999 | 6 | 59 | METRO31080MM5945 | Santa Ana-Anaheim-Irvine, CA HUD Metro FMR Area | Orange County | 103000 | 26950 | 30800 | 34650 | 38450 | 41550 | 44650 | 47700 | 50800 | 5945 | Orange County | California | 1 |
| CA | 0606199999 | 6 | 61 | METRO40900M40900 | Sacramento--Roseville--Arden-Arcade, CA HUD Metro FMR Area | Placer County | 86300 | 18150 | 20750 | 23350 | 25900 | 28000 | 30050 | 32150 | 34200 | 6920 | Placer County | California | 1 |
| CA | 0606399999 | 6 | 63 | NCNTY06063N06063 | Plumas County, CA | Plumas County | 72200 | 15200 | 17350 | 19500 | 21650 | 23400 | 25150 | 26850 | 28600 | 9999 | Plumas County | California | 0 |
| CA | 0606599999 | 6 | 65 | METRO40140M40140 | Riverside-San Bernardino-Ontario, CA MSA | Riverside County | 75300 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 6780 | Riverside County | California | 1 |
| CA | 0606799999 | 6 | 67 | METRO40900M40900 | Sacramento--Roseville--Arden-Arcade, CA HUD Metro FMR Area | Sacramento County | 86300 | 18150 | 20750 | 23350 | 25900 | 28000 | 30050 | 32150 | 34200 | 6920 | Sacramento County | California | 1 |
| CA | 0606999999 | 6 | 69 | METRO41940N06069 | San Benito County, CA HUD Metro FMR Area | San Benito County | 89700 | 20950 | 23950 | 26950 | 29900 | 32300 | 34700 | 37100 | 39500 | 9999 | San Benito County | California | 1 |
| CA | 0607199999 | 6 | 71 | METRO40140M40140 | Riverside-San Bernardino-Ontario, CA MSA | San Bernardino County | 75300 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 6780 | San Bernardino County | California | 1 |
| CA | 0607399999 | 6 | 73 | METRO41740M41740 | San Diego-Carlsbad, CA MSA | San Diego County | 92700 | 24300 | 27750 | 31200 | 34650 | 37450 | 40200 | 43000 | 45750 | 7320 | San Diego County | California | 1 |
| CA | 0607599999 | 6 | 75 | METRO41860MM7360 | San Francisco, CA HUD Metro FMR Area | San Francisco County | 143100 | 36550 | 41800 | 47000 | 52200 | 56400 | 60600 | 64750 | 68950 | 7360 | San Francisco County | California | 1 |
| CA | 0607799999 | 6 | 77 | METRO44700M44700 | Stockton-Lodi, CA MSA | San Joaquin County | 75000 | 15750 | 18000 | 20250 | 22500 | 24300 | 26100 | 27900 | 29700 | 8120 | San Joaquin County | California | 1 |
| CA | 0607999999 | 6 | 79 | METRO42020M42020 | San Luis Obispo-Paso Robles-Arroyo Grande, CA MSA | San Luis Obispo County | 97300 | 20400 | 23300 | 26200 | 29100 | 31450 | 33800 | 36100 | 38450 | 7460 | San Luis Obispo County | California | 1 |
| CA | 0608199999 | 6 | 81 | METRO41860MM7360 | San Francisco, CA HUD Metro FMR Area | San Mateo County | 143100 | 36550 | 41800 | 47000 | 52200 | 56400 | 60600 | 64750 | 68950 | 7360 | San Mateo County | California | 1 |
| CA | 0608399999 | 6 | 83 | METRO42200M42200 | Santa Maria-Santa Barbara, CA MSA | Santa Barbara County | 87800 | 25000 | 28600 | 32150 | 35700 | 38600 | 41450 | 44300 | 47150 | 7480 | Santa Barbara County | California | 1 |
| CA | 0608599999 | 6 | 85 | METRO41940M41940 | San Jose-Sunnyvale-Santa Clara, CA HUD Metro FMR Area | Santa Clara County | 141600 | 33150 | 37900 | 42650 | 47350 | 51150 | 54950 | 58750 | 62550 | 7400 | Santa Clara County | California | 1 |
| CA | 0608799999 | 6 | 87 | METRO42100M42100 | Santa Cruz-Watsonville, CA MSA | Santa Cruz County | 110000 | 27800 | 31800 | 35750 | 39700 | 42900 | 46100 | 49250 | 52450 | 7485 | Santa Cruz County | California | 1 |
| CA | 0608999999 | 6 | 89 | METRO39820M39820 | Redding, CA MSA | Shasta County | 68500 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 6690 | Shasta County | California | 1 |
| CA | 0609199999 | 6 | 91 | NCNTY06091N06091 | Sierra County, CA | Sierra County | 80500 | 16950 | 19350 | 21750 | 24150 | 26100 | 28050 | 29950 | 31900 | 9999 | Sierra County | California | 0 |
| CA | 0609399999 | 6 | 93 | NCNTY06093N06093 | Siskiyou County, CA | Siskiyou County | 54400 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Siskiyou County | California | 0 |
| CA | 0609599999 | 6 | 95 | METRO46700M46700 | Vallejo-Fairfield, CA MSA | Solano County | 95400 | 19450 | 22200 | 25000 | 27750 | 30000 | 32200 | 34450 | 36650 | 8720 | Solano County | California | 1 |
| CA | 0609799999 | 6 | 97 | METRO42220M42220 | Santa Rosa, CA MSA | Sonoma County | 102700 | 23900 | 27300 | 30700 | 34100 | 36850 | 39600 | 42300 | 45050 | 7500 | Sonoma County | California | 1 |
| CA | 0609999999 | 6 | 99 | METRO33700M33700 | Modesto, CA MSA | Stanislaus County | 69300 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 5170 | Stanislaus County | California | 1 |
| CA | 0610199999 | 6 | 101 | METRO49700M49700 | Yuba City, CA MSA | Sutter County | 75000 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9340 | Sutter County | California | 1 |
| CA | 0610399999 | 6 | 103 | NCNTY06103N06103 | Tehama County, CA | Tehama County | 55800 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Tehama County | California | 0 |
| CA | 0610599999 | 6 | 105 | NCNTY06105N06105 | Trinity County, CA | Trinity County | 51600 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Trinity County | California | 0 |
| CA | 0610799999 | 6 | 107 | METRO47300M47300 | Visalia-Porterville, CA MSA | Tulare County | 52900 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 8780 | Tulare County | California | 1 |
| CA | 0610999999 | 6 | 109 | NCNTY06109N06109 | Tuolumne County, CA | Tuolumne County | 71600 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Tuolumne County | California | 0 |
| CA | 0611199999 | 6 | 111 | METRO37100M37100 | Oxnard-Thousand Oaks-Ventura, CA MSA | Ventura County | 97800 | 23700 | 27100 | 30500 | 33850 | 36600 | 39300 | 42000 | 44700 | 8735 | Ventura County | California | 1 |
| CA | 0611399999 | 6 | 113 | METRO40900MM9270 | Yolo, CA HUD Metro FMR Area | Yolo County | 92500 | 19450 | 22200 | 25000 | 27750 | 30000 | 32200 | 34450 | 36650 | 9270 | Yolo County | California | 1 |
| CA | 0611599999 | 6 | 115 | METRO49700M49700 | Yuba City, CA MSA | Yuba County | 75000 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9340 | Yuba County | California | 1 |
| CO | 0800199999 | 8 | 1 | METRO19740M19740 | Denver-Aurora-Lakewood, CO MSA | Adams County | 100000 | 21000 | 24000 | 27000 | 30000 | 32400 | 34800 | 37200 | 39600 | 2080 | Adams County | Colorado | 1 |
| CO | 0800399999 | 8 | 3 | NCNTY08003N08003 | Alamosa County, CO | Alamosa County | 49100 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Alamosa County | Colorado | 0 |
| CO | 0800599999 | 8 | 5 | METRO19740M19740 | Denver-Aurora-Lakewood, CO MSA | Arapahoe County | 100000 | 21000 | 24000 | 27000 | 30000 | 32400 | 34800 | 37200 | 39600 | 2080 | Arapahoe County | Colorado | 1 |
| CO | 0800799999 | 8 | 7 | NCNTY08007N08007 | Archuleta County, CO | Archuleta County | 58400 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Archuleta County | Colorado | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO | 0800999999 | 8 | 9 | NCNTY08009N08009 | Baca County, CO | Baca County | 48800 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Baca County | Colorado | 0 |
| CO | 0801199999 | 8 | 11 | NCNTY08011N08011 | Bent County, CO | Bent County | 43400 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Bent County | Colorado | 0 |
| CO | 0801399999 | 8 | 13 | METRO14500M14500 | Boulder, CO MSA | Boulder County | 115100 | 24200 | 27650 | 31100 | 34550 | 37350 | 40100 | 42850 | 45650 | 1125 | Boulder County | Colorado | 1 |
| CO | 0801499999 | 8 | 14 | METRO19740M19740 | Denver-Aurora-Lakewood, CO MSA | Broomfield County | 100000 | 21000 | 24000 | 27000 | 30000 | 32400 | 34800 | 37200 | 39600 | 2080 | Broomfield County | Colorado | 1 |
| CO | 0801599999 | 8 | 15 | NCNTY08015N08015 | Chaffee County, CO | Chaffee County | 71300 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Chaffee County | Colorado | 0 |
| CO | 0801799999 | 8 | 17 | NCNTY08017N08017 | Cheyenne County, CO | Cheyenne County | 72800 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 9999 | Cheyenne County | Colorado | 0 |
| CO | 0801999999 | 8 | 19 | METRO19740M19740 | Denver-Aurora-Lakewood, CO MSA | Clear Creek County | 100000 | 21000 | 24000 | 27000 | 30000 | 32400 | 34800 | 37200 | 39600 | 9999 | Clear Creek County | Colorado | 1 |
| CO | 0802199999 | 8 | 21 | NCNTY08021N08021 | Conejos County, CO | Conejos County | 53200 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Conejos County | Colorado | 0 |
| CO | 0802399999 | 8 | 23 | NCNTY08023N08023 | Costilla County, CO | Costilla County | 36800 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Costilla County | Colorado | 0 |
| CO | 0802599999 | 8 | 25 | NCNTY08025N08025 | Crowley County, CO | Crowley County | 52900 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Crowley County | Colorado | 0 |
| CO | 0802799999 | 8 | 27 | NCNTY08027N08027 | Custer County, CO | Custer County | 57700 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Custer County | Colorado | 0 |
| CO | 0802999999 | 8 | 29 | NCNTY08029N08029 | Delta County, CO | Delta County | 58100 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Delta County | Colorado | 0 |
| CO | 0803199999 | 8 | 31 | METRO19740M19740 | Denver-Aurora-Lakewood, CO MSA | Denver County | 100000 | 21000 | 24000 | 27000 | 30000 | 32400 | 34800 | 37200 | 39600 | 2080 | Denver County | Colorado | 1 |
| CO | 0803399999 | 8 | 33 | NCNTY08033N08033 | Dolores County, CO | Dolores County | 51400 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Dolores County | Colorado | 0 |
| CO | 0803599999 | 8 | 35 | METRO19740M19740 | Denver-Aurora-Lakewood, CO MSA | Douglas County | 100000 | 21000 | 24000 | 27000 | 30000 | 32400 | 34800 | 37200 | 39600 | 2080 | Douglas County | Colorado | 1 |
| CO | 0803799999 | 8 | 37 | NCNTY08037N08037 | Eagle County, CO | Eagle County | 99900 | 21000 | 24000 | 27000 | 29950 | 32350 | 34750 | 37150 | 39550 | 9999 | Eagle County | Colorado | 0 |
| CO | 0803999999 | 8 | 39 | METRO19740M19740 | Denver-Aurora-Lakewood, CO MSA | Elbert County | 100000 | 21000 | 24000 | 27000 | 30000 | 32400 | 34800 | 37200 | 39600 | 9999 | Elbert County | Colorado | 1 |
| CO | 0804199999 | 8 | 41 | METRO17820M17820 | Colorado Springs, CO HUD Metro FMR Area | El Paso County | 81600 | 17150 | 19600 | 22050 | 24500 | 26500 | 28450 | 30400 | 32350 | 1720 | El Paso County | Colorado | 1 |
| CO | 0804399999 | 8 | 43 | NCNTY08043N08043 | Fremont County, CO | Fremont County | 59500 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Fremont County | Colorado | 0 |
| CO | 0804599999 | 8 | 45 | NCNTY08045N08045 | Garfield County, CO | Garfield County | 84500 | 17750 | 20300 | 22850 | 25350 | 27400 | 29450 | 31450 | 33500 | 9999 | Garfield County | Colorado | 0 |
| CO | 0804799999 | 8 | 47 | METRO19740M19740 | Denver-Aurora-Lakewood, CO MSA | Gilpin County | 100000 | 21000 | 24000 | 27000 | 30000 | 32400 | 34800 | 37200 | 39600 | 9999 | Gilpin County | Colorado | 1 |
| CO | 0804999999 | 8 | 49 | NCNTY08049N08049 | Grand County, CO | Grand County | 78800 | 16600 | 18950 | 21300 | 23650 | 25550 | 27450 | 29350 | 31250 | 9999 | Grand County | Colorado | 0 |
| CO | 0805199999 | 8 | 51 | NCNTY08051N08051 | Gunnison County, CO | Gunnison County | 75400 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Gunnison County | Colorado | 0 |
| CO | 0805399999 | 8 | 53 | NCNTY08053N08053 | Hinsdale County, CO | Hinsdale County | 76700 | 16100 | 18400 | 20700 | 23000 | 24850 | 26700 | 28550 | 30400 | 9999 | Hinsdale County | Colorado | 0 |
| CO | 0805599999 | 8 | 55 | NCNTY08055N08055 | Huerfano County, CO | Huerfano County | 52600 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Huerfano County | Colorado | 0 |
| CO | 0805799999 | 8 | 57 | NCNTY08057N08057 | Jackson County, CO | Jackson County | 63900 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Jackson County | Colorado | 0 |
| CO | 0805999999 | 8 | 59 | METRO19740M19740 | Denver-Aurora-Lakewood, CO MSA | Jefferson County | 100000 | 21000 | 24000 | 27000 | 30000 | 32400 | 34800 | 37200 | 39600 | 2080 | Jefferson County | Colorado | 1 |
| CO | 0806199999 | 8 | 61 | NCNTY08061N08061 | Kiowa County, CO | Kiowa County | 53500 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Kiowa County | Colorado | 0 |
| CO | 0806399999 | 8 | 63 | NCNTY08063N08063 | Kit Carson County, CO | Kit Carson County | 60400 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Kit Carson County | Colorado | 0 |
| CO | 0806599999 | 8 | 65 | NCNTY08065N08065 | Lake County, CO | Lake County | 66800 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Lake County | Colorado | 0 |
| CO | 0806799999 | 8 | 67 | NCNTY08067N08067 | La Plata County, CO | La Plata County | 83600 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | La Plata County | Colorado | 0 |
| CO | 0806999999 | 8 | 69 | METRO22660M22660 | Fort Collins, CO MSA | Larimer County | 99400 | 19800 | 22600 | 25450 | 28250 | 30550 | 32800 | 35050 | 37300 | 2670 | Larimer County | Colorado | 1 |
| CO | 0807199999 | 8 | 71 | NCNTY08071N08071 | Las Animas County, CO | Las Animas County | 56200 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Las Animas County | Colorado | 0 |
| CO | 0807399999 | 8 | 73 | NCNTY08073N08073 | Lincoln County, CO | Lincoln County | 64000 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Lincoln County | Colorado | 0 |
| CO | 0807599999 | 8 | 75 | NCNTY08075N08075 | Logan County, CO | Logan County | 60800 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Logan County | Colorado | 0 |
| CO | 0807799999 | 8 | 77 | METRO24300M24300 | Grand Junction, CO MSA | Mesa County | 67700 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 2995 | Mesa County | Colorado | 1 |
| CO | 0807999999 | 8 | 79 | NCNTY08079N08079 | Mineral County, CO | Mineral County | 75500 | 15900 | 18150 | 20400 | 22650 | 24500 | 26300 | 28100 | 29900 | 9999 | Mineral County | Colorado | 0 |
| CO | 0808199999 | 8 | 81 | NCNTY08081N08081 | Moffat County, CO | Moffat County | 72700 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Moffat County | Colorado | 0 |
| CO | 0808399999 | 8 | 83 | NCNTY08083N08083 | Montezuma County, CO | Montezuma County | 59200 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Montezuma County | Colorado | 0 |
| CO | 0808599999 | 8 | 85 | NCNTY08085N08085 | Montrose County, CO | Montrose County | 60900 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Montrose County | Colorado | 0 |
| CO | 0808799999 | 8 | 87 | NCNTY08087N08087 | Morgan County, CO | Morgan County | 61000 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Morgan County | Colorado | 0 |
| CO | 0808999999 | 8 | 89 | NCNTY08089N08089 | Otero County, CO | Otero County | 48400 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Otero County | Colorado | 0 |
| CO | 0809199999 | 8 | 91 | NCNTY08091N08091 | Ouray County, CO | Ouray County | 76300 | 16050 | 18350 | 20650 | 22900 | 24750 | 26600 | 28400 | 30250 | 9999 | Ouray County | Colorado | 0 |
| CO | 0809399999 | 8 | 93 | METRO19740M19740 | Denver-Aurora-Lakewood, CO MSA | Park County | 100000 | 21000 | 24000 | 27000 | 30000 | 32400 | 34800 | 37200 | 39600 | 9999 | Park County | Colorado | 1 |
| CO | 0809599999 | 8 | 95 | NCNTY08095N08095 | Phillips County, CO | Phillips County | 68200 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Phillips County | Colorado | 0 |
| CO | 0809799999 | 8 | 97 | NCNTY08097N08097 | Pitkin County, CO | Pitkin County | 110500 | 23250 | 26550 | 29850 | 33150 | 35850 | 38500 | 41150 | 43800 | 9999 | Pitkin County | Colorado | 0 |
| CO | 0809999999 | 8 | 99 | NCNTY08099N08099 | Prowers County, CO | Prowers County | 53400 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Prowers County | Colorado | 0 |
| CO | 0810199999 | 8 | 101 | METRO39380M39380 | Pueblo, CO MSA | Pueblo County | 61200 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 6560 | Pueblo County | Colorado | 1 |
| CO | 0810399999 | 8 | 103 | NCNTY08103N08103 | Rio Blanco County, CO | Rio Blanco County | 83400 | 17500 | 20000 | 22500 | 25000 | 27000 | 29000 | 31000 | 33000 | 9999 | Rio Blanco County | Colorado | 0 |
| CO | 0810599999 | 8 | 105 | NCNTY08105N08105 | Rio Grande County, CO | Rio Grande County | 55800 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Rio Grande County | Colorado | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO | 0810799999 | 8 | 107 | NCNTY08107N08107 | Routt County, CO | Routt County | 87200 | 18350 | 20950 | 23550 | 26150 | 28250 | 30350 | 32450 | 34550 | 9999 | Routt County | Colorado | 0 |
| CO | 0810999999 | 8 | 109 | NCNTY08109N08109 | Saguache County, CO | Saguache County | 48200 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Saguache County | Colorado | 0 |
| CO | 0811199999 | 8 | 111 | NCNTY08111N08111 | San Juan County, CO | San Juan County | 64600 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | San Juan County | Colorado | 0 |
| CO | 0811399999 | 8 | 113 | NCNTY08113N08113 | San Miguel County, CO | San Miguel County | 81500 | 17150 | 19600 | 22050 | 24450 | 26450 | 28400 | 30350 | 32300 | 9999 | San Miguel County | Colorado | 0 |
| CO | 0811599999 | 8 | 115 | NCNTY08115N08115 | Sedgwick County, CO | Sedgwick County | 63800 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Sedgwick County | Colorado | 0 |
| CO | 0811799999 | 8 | 117 | NCNTY08117N08117 | Summit County, CO | Summit County | 95900 | 20150 | 23000 | 25900 | 28750 | 31050 | 33350 | 35650 | 37950 | 9999 | Summit County | Colorado | 0 |
| CO | 0811999999 | 8 | 119 | METRO17820N08119 | Teller County, CO HUD Metro FMR Area | Teller County | 81800 | 17200 | 19650 | 22100 | 24550 | 26550 | 28500 | 30450 | 32450 | 9999 | Teller County | Colorado | 1 |
| CO | 0812199999 | 8 | 121 | NCNTY08121N08121 | Washington County, CO | Washington County | 64200 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Washington County | Colorado | 0 |
| CO | 0812399999 | 8 | 123 | METRO24540M24540 | Greeley, CO MSA | Weld County | 84300 | 17750 | 20250 | 22800 | 25300 | 27350 | 29350 | 31400 | 33400 | 3060 | Weld County | Colorado | 1 |
| CO | 0812599999 | 8 | 125 | NCNTY08125N08125 | Yuma County, CO | Yuma County | 54100 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Yuma County | Colorado | 0 |
| CT | 0900104720 | 9 | 1 | METRO14860MM1930 | Danbury, CT HUD Metro FMR Area | Fairfield County | 122000 | 25650 | 29300 | 32950 | 36600 | 39550 | 42500 | 45400 | 48350 | 1930 | Bethel town | Connecticut | 1 |
| CT | 0900108070 | 9 | 1 | METRO14860MM1160 | Bridgeport, CT HUD Metro FMR Area | Fairfield County | 98000 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 1160 | Bridgeport town | Connecticut | 1 |
| CT | 0900108980 | 9 | 1 | METRO14860MM1930 | Danbury, CT HUD Metro FMR Area | Fairfield County | 122000 | 25650 | 29300 | 32950 | 36600 | 39550 | 42500 | 45400 | 48350 | 1930 | Brookfield town | Connecticut | 1 |
| CT | 0900118500 | 9 | 1 | METRO14860MM1930 | Danbury, CT HUD Metro FMR Area | Fairfield County | 122000 | 25650 | 29300 | 32950 | 36600 | 39550 | 42500 | 45400 | 48350 | 1930 | Danbury town | Connecticut | 1 |
| CT | 0900118850 | 9 | 1 | METRO14860MM8040 | Stamford-Norwalk, CT HUD Metro FMR Area | Fairfield County | 143400 | 30100 | 34400 | 38700 | 43000 | 46450 | 49900 | 53350 | 56800 | 8040 | Darien town | Connecticut | 1 |
| CT | 0900123890 | 9 | 1 | METRO14860MM1160 | Bridgeport, CT HUD Metro FMR Area | Fairfield County | 98000 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 1160 | Easton town | Connecticut | 1 |
| CT | 0900126620 | 9 | 1 | METRO14860MM1160 | Bridgeport, CT HUD Metro FMR Area | Fairfield County | 98000 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 1160 | Fairfield town | Connecticut | 1 |
| CT | 0900133620 | 9 | 1 | METRO14860MM8040 | Stamford-Norwalk, CT HUD Metro FMR Area | Fairfield County | 143400 | 30100 | 34400 | 38700 | 43000 | 46450 | 49900 | 53350 | 56800 | 8040 | Greenwich town | Connecticut | 1 |
| CT | 0900148620 | 9 | 1 | METRO14860MM1160 | Bridgeport, CT HUD Metro FMR Area | Fairfield County | 98000 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 1160 | Monroe town | Connecticut | 1 |
| CT | 0900150580 | 9 | 1 | METRO14860MM8040 | Stamford-Norwalk, CT HUD Metro FMR Area | Fairfield County | 143400 | 30100 | 34400 | 38700 | 43000 | 46450 | 49900 | 53350 | 56800 | 8040 | New Canaan town | Connecticut | 1 |
| CT | 0900150860 | 9 | 1 | METRO14860MM1930 | Danbury, CT HUD Metro FMR Area | Fairfield County | 122000 | 25650 | 29300 | 32950 | 36600 | 39550 | 42500 | 45400 | 48350 | 1930 | New Fairfield town | Connecticut | 1 |
| CT | 0900152980 | 9 | 1 | METRO14860MM1930 | Danbury, CT HUD Metro FMR Area | Fairfield County | 122000 | 25650 | 29300 | 32950 | 36600 | 39550 | 42500 | 45400 | 48350 | 1930 | Newtown town | Connecticut | 1 |
| CT | 0900156060 | 9 | 1 | METRO14860MM8040 | Stamford-Norwalk, CT HUD Metro FMR Area | Fairfield County | 143400 | 30100 | 34400 | 38700 | 43000 | 46450 | 49900 | 53350 | 56800 | 8040 | Norwalk town | Connecticut | 1 |
| CT | 0900163480 | 9 | 1 | METRO14860MM1930 | Danbury, CT HUD Metro FMR Area | Fairfield County | 122000 | 25650 | 29300 | 32950 | 36600 | 39550 | 42500 | 45400 | 48350 | 1930 | Redding town | Connecticut | 1 |
| CT | 0900163970 | 9 | 1 | METRO14860MM1930 | Danbury, CT HUD Metro FMR Area | Fairfield County | 122000 | 25650 | 29300 | 32950 | 36600 | 39550 | 42500 | 45400 | 48350 | 1930 | Ridgefield town | Connecticut | 1 |
| CT | 0900168170 | 9 | 1 | METRO14860MM1160 | Bridgeport, CT HUD Metro FMR Area | Fairfield County | 98000 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 1160 | Shelton town | Connecticut | 1 |
| CT | 0900168310 | 9 | 1 | METRO14860MM1930 | Danbury, CT HUD Metro FMR Area | Fairfield County | 122000 | 25650 | 29300 | 32950 | 36600 | 39550 | 42500 | 45400 | 48350 | 1930 | Sherman town | Connecticut | 1 |
| CT | 0900173070 | 9 | 1 | METRO14860MM8040 | Stamford-Norwalk, CT HUD Metro FMR Area | Fairfield County | 143400 | 30100 | 34400 | 38700 | 43000 | 46450 | 49900 | 53350 | 56800 | 8040 | Stamford town | Connecticut | 1 |
| CT | 0900174190 | 9 | 1 | METRO14860MM1160 | Bridgeport, CT HUD Metro FMR Area | Fairfield County | 98000 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 1160 | Stratford town | Connecticut | 1 |
| CT | 0900177200 | 9 | 1 | METRO14860MM1160 | Bridgeport, CT HUD Metro FMR Area | Fairfield County | 98000 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 1160 | Trumbull town | Connecticut | 1 |
| CT | 0900183430 | 9 | 1 | METRO14860MM8040 | Stamford-Norwalk, CT HUD Metro FMR Area | Fairfield County | 143400 | 30100 | 34400 | 38700 | 43000 | 46450 | 49900 | 53350 | 56800 | 8040 | Weston town | Connecticut | 1 |
| CT | 0900183500 | 9 | 1 | METRO14860MM8040 | Stamford-Norwalk, CT HUD Metro FMR Area | Fairfield County | 143400 | 30100 | 34400 | 38700 | 43000 | 46450 | 49900 | 53350 | 56800 | 8040 | Westport town | Connecticut | 1 |
| CT | 0900186370 | 9 | 1 | METRO14860MM8040 | Stamford-Norwalk, CT HUD Metro FMR Area | Fairfield County | 143400 | 30100 | 34400 | 38700 | 43000 | 46450 | 49900 | 53350 | 56800 | 8040 | Wilton town | Connecticut | 1 |
| CT | 0900302060 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Avon town | Connecticut | 1 |
| CT | 0900304300 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Berlin town | Connecticut | 1 |
| CT | 0900305910 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Bloomfield town | Connecticut | 1 |
| CT | 0900308490 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Bristol town | Connecticut | 1 |
| CT | 0900310100 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Burlington town | Connecticut | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CT | 0900312270 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Canton town | Connecticut | 1 |
| CT | 0900322070 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | East Granby town | Connecticut | 1 |
| CT | 0900322630 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | East Hartford town | Connecticut | 1 |
| CT | 0900324800 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | East Windsor town | Connecticut | 1 |
| CT | 0900325990 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Enfield town | Connecticut | 1 |
| CT | 0900327600 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Farmington town | Connecticut | 1 |
| CT | 0900331240 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Glastonbury town | Connecticut | 1 |
| CT | 0900332640 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Granby town | Connecticut | 1 |
| CT | 0900337070 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Hartford town | Connecticut | 1 |
| CT | 0900337140 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Hartland town | Connecticut | 1 |
| CT | 0900344700 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Manchester town | Connecticut | 1 |
| CT | 0900345820 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Marlborough town | Connecticut | 1 |
| CT | 0900350440 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | New Britain town | Connecticut | 1 |
| CT | 0900352140 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Newington town | Connecticut | 1 |
| CT | 0900360120 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Plainville town | Connecticut | 1 |
| CT | 0900365370 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Rocky Hill town | Connecticut | 1 |
| CT | 0900368940 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Simsbury town | Connecticut | 1 |
| CT | 0900370550 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Southington town | Connecticut | 1 |
| CT | 0900371390 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | South Windsor town | Connecticut | 1 |
| CT | 0900374540 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Suffield town | Connecticut | 1 |
| CT | 0900382590 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | West Hartford town | Connecticut | 1 |
| CT | 0900384900 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Wethersfield town | Connecticut | 1 |
| CT | 0900387000 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Windsor town | Connecticut | 1 |
| CT | 0900387070 | 9 | 3 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Hartford County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Windsor Locks town | Connecticut | 1 |
| CT | 0900502760 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Barkhamsted town | Connecticut | 0 |
| CT | 0900504930 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 8880 | Bethlehem town | Connecticut | 0 |
| CT | 0900508210 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 1930 | Bridgewater town | Connecticut | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CT | 0900510940 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Canaan town | Connecticut | 0 |
| CT | 0900516050 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Colebrook town | Connecticut | 0 |
| CT | 0900517240 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Cornwall town | Connecticut | 0 |
| CT | 0900532290 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Goshen town | Connecticut | 0 |
| CT | 0900537280 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Harwinton town | Connecticut | 0 |
| CT | 0900540290 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Kent town | Connecticut | 0 |
| CT | 0900543370 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Litchfield town | Connecticut | 0 |
| CT | 0900549460 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Morris town | Connecticut | 0 |
| CT | 0900551350 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | New Hartford town | Connecticut | 0 |
| CT | 0900552630 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 1930 | New Milford town | Connecticut | 0 |
| CT | 0900553470 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Norfolk town | Connecticut | 0 |
| CT | 0900554030 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | North Canaan town | Connecticut | 0 |
| CT | 0900560750 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Plymouth town | Connecticut | 0 |
| CT | 0900565930 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 1930 | Roxbury town | Connecticut | 0 |
| CT | 0900566420 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Salisbury town | Connecticut | 0 |
| CT | 0900567960 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Sharon town | Connecticut | 0 |
| CT | 0900575730 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 8880 | Thomaston town | Connecticut | 0 |
| CT | 0900576570 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Torrington town | Connecticut | 0 |
| CT | 0900579510 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Warren town | Connecticut | 0 |
| CT | 0900579720 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 1930 | Washington town | Connecticut | 0 |
| CT | 0900580490 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 8880 | Watertown town | Connecticut | 0 |
| CT | 0900586440 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Winchester town | Connecticut | 0 |
| CT | 0900587910 | 9 | 5 | NCNTY09005N09005 | Litchfield County, CT | Litchfield County | 102600 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 8880 | Woodbury town | Connecticut | 0 |
| CT | 0900714300 | 9 | 7 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Middlesex County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Chester town | Connecticut | 1 |
| CT | 0900715350 | 9 | 7 | METRO25540MM5480 | Southern Middlesex County, CT HUD Metro FMR Area | Middlesex County | 112000 | 23550 | 26900 | 30250 | 33600 | 36300 | 39000 | 41700 | 44400 | 5480 | Clinton town | Connecticut | 1 |
| CT | 0900718080 | 9 | 7 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Middlesex County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Cromwell town | Connecticut | 1 |
| CT | 0900719130 | 9 | 7 | METRO25540MM5480 | Southern Middlesex County, CT HUD Metro FMR Area | Middlesex County | 112000 | 23550 | 26900 | 30250 | 33600 | 36300 | 39000 | 41700 | 44400 | 9999 | Deep River town | Connecticut | 1 |
| CT | 0900720810 | 9 | 7 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Middlesex County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Durham town | Connecticut | 1 |
| CT | 0900722280 | 9 | 7 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Middlesex County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | East Haddam town | Connecticut | 1 |
| CT | 0900722490 | 9 | 7 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Middlesex County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | East Hampton town | Connecticut | 1 |
| CT | 0900726270 | 9 | 7 | METRO25540MM5480 | Southern Middlesex County, CT HUD Metro FMR Area | Middlesex County | 112000 | 23550 | 26900 | 30250 | 33600 | 36300 | 39000 | 41700 | 44400 | 9999 | Essex town | Connecticut | 1 |
| CT | 0900735230 | 9 | 7 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Middlesex County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Haddam town | Connecticut | 1 |
| CT | 0900740710 | 9 | 7 | METRO25540MM5480 | Southern Middlesex County, CT HUD Metro FMR Area | Middlesex County | 112000 | 23550 | 26900 | 30250 | 33600 | 36300 | 39000 | 41700 | 44400 | 5480 | Killingworth town | Connecticut | 1 |
| CT | 0900747080 | 9 | 7 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Middlesex County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Middlefield town | Connecticut | 1 |
| CT | 0900747360 | 9 | 7 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Middlesex County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Middletown town | Connecticut | 1 |
| CT | 0900757320 | 9 | 7 | METRO25540MM5480 | Southern Middlesex County, CT HUD Metro FMR Area | Middlesex County | 112000 | 23550 | 26900 | 30250 | 33600 | 36300 | 39000 | 41700 | 44400 | 5520 | Old Saybrook town | Connecticut | 1 |
| CT | 0900761800 | 9 | 7 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Middlesex County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Portland town | Connecticut | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CT | 0900781680 | 9 | 7 | METRO25540MM5480 | Southern Middlesex County, CT HUD Metro FMR Area | Middlesex County | 112000 | 23550 | 26900 | 30250 | 33600 | 36300 | 39000 | 41700 | 44400 | 9999 | Westbrook town | Connecticut | 1 |
| CT | 0900901220 | 9 | 9 | METRO35300MM1160 | Milford-Ansonia-Seymour, CT HUD Metro FMR Area | New Haven County | 108200 | 22750 | 26000 | 29250 | 32450 | 35050 | 37650 | 40250 | 42850 | 1160 | Ansonia town | Connecticut | 1 |
| CT | 0900903250 | 9 | 9 | METRO35300MM1160 | Milford-Ansonia-Seymour, CT HUD Metro FMR Area | New Haven County | 108200 | 22750 | 26000 | 29250 | 32450 | 35050 | 37650 | 40250 | 42850 | 1160 | Beacon Falls town | Connecticut | 1 |
| CT | 0900904580 | 9 | 9 | METRO35300MM5480 | New Haven-Meriden, CT HUD Metro FMR Area | New Haven County | 91200 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5480 | Bethany town | Connecticut | 1 |
| CT | 0900907310 | 9 | 9 | METRO35300MM5480 | New Haven-Meriden, CT HUD Metro FMR Area | New Haven County | 91200 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5480 | Branford town | Connecticut | 1 |
| CT | 0900914160 | 9 | 9 | METRO35300MM5480 | New Haven-Meriden, CT HUD Metro FMR Area | New Haven County | 91200 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5480 | Cheshire town | Connecticut | 1 |
| CT | 0900919550 | 9 | 9 | METRO35300MM1160 | Milford-Ansonia-Seymour, CT HUD Metro FMR Area | New Haven County | 108200 | 22750 | 26000 | 29250 | 32450 | 35050 | 37650 | 40250 | 42850 | 1160 | Derby town | Connecticut | 1 |
| CT | 0900922910 | 9 | 9 | METRO35300MM5480 | New Haven-Meriden, CT HUD Metro FMR Area | New Haven County | 91200 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5480 | East Haven town | Connecticut | 1 |
| CT | 0900934950 | 9 | 9 | METRO35300MM5480 | New Haven-Meriden, CT HUD Metro FMR Area | New Haven County | 91200 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5480 | Guilford town | Connecticut | 1 |
| CT | 0900935650 | 9 | 9 | METRO35300MM5480 | New Haven-Meriden, CT HUD Metro FMR Area | New Haven County | 91200 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5480 | Hamden town | Connecticut | 1 |
| CT | 0900944560 | 9 | 9 | METRO35300MM5480 | New Haven-Meriden, CT HUD Metro FMR Area | New Haven County | 91200 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5480 | Madison town | Connecticut | 1 |
| CT | 0900946520 | 9 | 9 | METRO35300MM5480 | New Haven-Meriden, CT HUD Metro FMR Area | New Haven County | 91200 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5480 | Meriden town | Connecticut | 1 |
| CT | 0900946940 | 9 | 9 | METRO35300MM8880 | Waterbury, CT HUD Metro FMR Area | New Haven County | 80300 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 8880 | Middlebury town | Connecticut | 1 |
| CT | 0900947535 | 9 | 9 | METRO35300MM1160 | Milford-Ansonia-Seymour, CT HUD Metro FMR Area | New Haven County | 108200 | 22750 | 26000 | 29250 | 32450 | 35050 | 37650 | 40250 | 42850 | 1160 | Milford town | Connecticut | 1 |
| CT | 0900949950 | 9 | 9 | METRO35300MM8880 | Waterbury, CT HUD Metro FMR Area | New Haven County | 80300 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 8880 | Naugatuck town | Connecticut | 1 |
| CT | 0900952070 | 9 | 9 | METRO35300MM5480 | New Haven-Meriden, CT HUD Metro FMR Area | New Haven County | 91200 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5480 | New Haven town | Connecticut | 1 |
| CT | 0900953890 | 9 | 9 | METRO35300MM5480 | New Haven-Meriden, CT HUD Metro FMR Area | New Haven County | 91200 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5480 | North Branford town | Connecticut | 1 |
| CT | 0900954870 | 9 | 9 | METRO35300MM5480 | New Haven-Meriden, CT HUD Metro FMR Area | New Haven County | 91200 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5480 | North Haven town | Connecticut | 1 |
| CT | 0900957600 | 9 | 9 | METRO35300MM5480 | New Haven-Meriden, CT HUD Metro FMR Area | New Haven County | 91200 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5480 | Orange town | Connecticut | 1 |
| CT | 0900958300 | 9 | 9 | METRO35300MM1160 | Milford-Ansonia-Seymour, CT HUD Metro FMR Area | New Haven County | 108200 | 22750 | 26000 | 29250 | 32450 | 35050 | 37650 | 40250 | 42850 | 1160 | Oxford town | Connecticut | 1 |
| CT | 0900962290 | 9 | 9 | METRO35300MM8880 | Waterbury, CT HUD Metro FMR Area | New Haven County | 80300 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 8880 | Prospect town | Connecticut | 1 |
| CT | 0900967610 | 9 | 9 | METRO35300MM1160 | Milford-Ansonia-Seymour, CT HUD Metro FMR Area | New Haven County | 108200 | 22750 | 26000 | 29250 | 32450 | 35050 | 37650 | 40250 | 42850 | 1160 | Seymour town | Connecticut | 1 |
| CT | 0900969640 | 9 | 9 | METRO35300MM8880 | Waterbury, CT HUD Metro FMR Area | New Haven County | 80300 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 8880 | Southbury town | Connecticut | 1 |
| CT | 0900978740 | 9 | 9 | METRO35300MM5480 | New Haven-Meriden, CT HUD Metro FMR Area | New Haven County | 91200 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5480 | Wallingford town | Connecticut | 1 |
| CT | 0900980070 | 9 | 9 | METRO35300MM8880 | Waterbury, CT HUD Metro FMR Area | New Haven County | 80300 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 8880 | Waterbury town | Connecticut | 1 |
| CT | 0900982870 | 9 | 9 | METRO35300MM5480 | New Haven-Meriden, CT HUD Metro FMR Area | New Haven County | 91200 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5480 | West Haven town | Connecticut | 1 |
| CT | 0900987560 | 9 | 9 | METRO35300MM8880 | Waterbury, CT HUD Metro FMR Area | New Haven County | 80300 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 8880 | Wolcott town | Connecticut | 1 |
| CT | 0900987700 | 9 | 9 | METRO35300MM5480 | New Haven-Meriden, CT HUD Metro FMR Area | New Haven County | 91200 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5480 | Woodbridge town | Connecticut | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CT | 0901106820 | 9 | 11 | METRO35980M35980 | Norwich-New London, CT HUD Metro FMR Area | New London County | 91800 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5520 | Bozrah town | Connecticut | 1 |
| CT | 0901115910 | 9 | 11 | METRO35980MM3280 | Colchester-Lebanon, CT HUD Metro FMR Area | New London County | 115000 | 24150 | 27600 | 31050 | 34500 | 37300 | 40050 | 42800 | 45550 | 3280 | Colchester town | Connecticut | 1 |
| CT | 0901123400 | 9 | 11 | METRO35980M35980 | Norwich-New London, CT HUD Metro FMR Area | New London County | 91800 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5520 | East Lyme town | Connecticut | 1 |
| CT | 0901129910 | 9 | 11 | METRO35980M35980 | Norwich-New London, CT HUD Metro FMR Area | New London County | 91800 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5520 | Franklin town | Connecticut | 1 |
| CT | 0901133900 | 9 | 11 | METRO35980M35980 | Norwich-New London, CT HUD Metro FMR Area | New London County | 91800 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5520 | Griswold town | Connecticut | 1 |
| CT | 0901134250 | 9 | 11 | METRO35980M35980 | Norwich-New London, CT HUD Metro FMR Area | New London County | 91800 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5520 | Groton town | Connecticut | 1 |
| CT | 0901142390 | 9 | 11 | METRO35980MM3280 | Colchester-Lebanon, CT HUD Metro FMR Area | New London County | 115000 | 24150 | 27600 | 31050 | 34500 | 37300 | 40050 | 42800 | 45550 | 3280 | Lebanon town | Connecticut | 1 |
| CT | 0901142600 | 9 | 11 | METRO35980M35980 | Norwich-New London, CT HUD Metro FMR Area | New London County | 91800 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5520 | Ledyard town | Connecticut | 1 |
| CT | 0901143230 | 9 | 11 | METRO35980M35980 | Norwich-New London, CT HUD Metro FMR Area | New London County | 91800 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5520 | Lisbon town | Connecticut | 1 |
| CT | 0901144210 | 9 | 11 | METRO35980M35980 | Norwich-New London, CT HUD Metro FMR Area | New London County | 91800 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Lyme town | Connecticut | 1 |
| CT | 0901148900 | 9 | 11 | METRO35980M35980 | Norwich-New London, CT HUD Metro FMR Area | New London County | 91800 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5520 | Montville town | Connecticut | 1 |
| CT | 0901152350 | 9 | 11 | METRO35980M35980 | Norwich-New London, CT HUD Metro FMR Area | New London County | 91800 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5520 | New London town | Connecticut | 1 |
| CT | 0901155500 | 9 | 11 | METRO35980M35980 | Norwich-New London, CT HUD Metro FMR Area | New London County | 91800 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5520 | North Stonington town | Connecticut | 1 |
| CT | 0901156270 | 9 | 11 | METRO35980M35980 | Norwich-New London, CT HUD Metro FMR Area | New London County | 91800 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5520 | Norwich town | Connecticut | 1 |
| CT | 0901157040 | 9 | 11 | METRO35980M35980 | Norwich-New London, CT HUD Metro FMR Area | New London County | 91800 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5520 | Old Lyme town | Connecticut | 1 |
| CT | 0901162150 | 9 | 11 | METRO35980M35980 | Norwich-New London, CT HUD Metro FMR Area | New London County | 91800 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5520 | Preston town | Connecticut | 1 |
| CT | 0901166210 | 9 | 11 | METRO35980M35980 | Norwich-New London, CT HUD Metro FMR Area | New London County | 91800 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5520 | Salem town | Connecticut | 1 |
| CT | 0901171670 | 9 | 11 | METRO35980M35980 | Norwich-New London, CT HUD Metro FMR Area | New London County | 91800 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5520 | Sprague town | Connecticut | 1 |
| CT | 0901173770 | 9 | 11 | METRO35980M35980 | Norwich-New London, CT HUD Metro FMR Area | New London County | 91800 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5520 | Stonington town | Connecticut | 1 |
| CT | 0901178600 | 9 | 11 | METRO35980M35980 | Norwich-New London, CT HUD Metro FMR Area | New London County | 91800 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Voluntown town | Connecticut | 1 |
| CT | 0901180280 | 9 | 11 | METRO35980M35980 | Norwich-New London, CT HUD Metro FMR Area | New London County | 91800 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5520 | Waterford town | Connecticut | 1 |
| CT | 0901301080 | 9 | 13 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Tolland County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Andover town | Connecticut | 1 |
| CT | 0901306260 | 9 | 13 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Tolland County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Bolton town | Connecticut | 1 |
| CT | 0901316400 | 9 | 13 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Tolland County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Columbia town | Connecticut | 1 |
| CT | 0901317800 | 9 | 13 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Tolland County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Coventry town | Connecticut | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CT | 0901325360 | 9 | 13 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Tolland County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Ellington town | Connecticut | 1 |
| CT | 0901337910 | 9 | 13 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Tolland County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Hebron town | Connecticut | 1 |
| CT | 0901344910 | 9 | 13 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Tolland County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Mansfield town | Connecticut | 1 |
| CT | 0901369220 | 9 | 13 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Tolland County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Somers town | Connecticut | 1 |
| CT | 0901372090 | 9 | 13 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Tolland County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Stafford town | Connecticut | 1 |
| CT | 0901376290 | 9 | 13 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Tolland County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Tolland town | Connecticut | 1 |
| CT | 0901377830 | 9 | 13 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Tolland County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Union town | Connecticut | 1 |
| CT | 0901378250 | 9 | 13 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Tolland County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Vernon town | Connecticut | 1 |
| CT | 0901385950 | 9 | 13 | METRO25540M25540 | Hartford-West Hartford-East Hartford, CT HUD Metro FMR Area | Tolland County | 97400 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Willington town | Connecticut | 1 |
| CT | 0901501430 | 9 | 15 | METRO49340N09015 | Windham County, CT HUD Metro FMR Area | Windham County | 86900 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Ashford town | Connecticut | 1 |
| CT | 0901509190 | 9 | 15 | METRO49340N09015 | Windham County, CT HUD Metro FMR Area | Windham County | 86900 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Brooklyn town | Connecticut | 1 |
| CT | 0901512130 | 9 | 15 | METRO49340N09015 | Windham County, CT HUD Metro FMR Area | Windham County | 86900 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5520 | Canterbury town | Connecticut | 1 |
| CT | 0901513810 | 9 | 15 | METRO49340N09015 | Windham County, CT HUD Metro FMR Area | Windham County | 86900 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Chaplin town | Connecticut | 1 |
| CT | 0901521860 | 9 | 15 | METRO49340N09015 | Windham County, CT HUD Metro FMR Area | Windham County | 86900 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Eastford town | Connecticut | 1 |
| CT | 0901536000 | 9 | 15 | METRO49340N09015 | Windham County, CT HUD Metro FMR Area | Windham County | 86900 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Hampton town | Connecticut | 1 |
| CT | 0901540500 | 9 | 15 | METRO49340N09015 | Windham County, CT HUD Metro FMR Area | Windham County | 86900 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Killingly town | Connecticut | 1 |
| CT | 0901559980 | 9 | 15 | METRO49340N09015 | Windham County, CT HUD Metro FMR Area | Windham County | 86900 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 5520 | Plainfield town | Connecticut | 1 |
| CT | 0901561030 | 9 | 15 | METRO49340N09015 | Windham County, CT HUD Metro FMR Area | Windham County | 86900 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Pomfret town | Connecticut | 1 |
| CT | 0901562710 | 9 | 15 | METRO49340N09015 | Windham County, CT HUD Metro FMR Area | Windham County | 86900 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Putnam town | Connecticut | 1 |
| CT | 0901567400 | 9 | 15 | METRO49340N09015 | Windham County, CT HUD Metro FMR Area | Windham County | 86900 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Scotland town | Connecticut | 1 |
| CT | 0901573420 | 9 | 15 | METRO49340N09015 | Windham County, CT HUD Metro FMR Area | Windham County | 86900 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Sterling town | Connecticut | 1 |
| CT | 0901575870 | 9 | 15 | METRO49340N09015 | Windham County, CT HUD Metro FMR Area | Windham County | 86900 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9240 | Thompson town | Connecticut | 1 |
| CT | 0901586790 | 9 | 15 | METRO49340N09015 | Windham County, CT HUD Metro FMR Area | Windham County | 86900 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 3280 | Windham town | Connecticut | 1 |
| CT | 0901588190 | 9 | 15 | METRO49340N09015 | Windham County, CT HUD Metro FMR Area | Windham County | 86900 | 21600 | 24650 | 27750 | 30800 | 33300 | 35750 | 38200 | 40700 | 9999 | Woodstock town | Connecticut | 1 |
| DE | 1000199999 | 10 | 1 | METRO20100M20100 | Dover, DE MSA | Kent County | 68400 | 14350 | 16400 | 18450 | 20500 | 22150 | 23800 | 25450 | 27100 | 2190 | Kent County | Delaware | 1 |
| DE | 1000399999 | 10 | 3 | METRO37980M37980 | Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA | New Castle County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 9160 | New Castle County | Delaware | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DE | 1000599999 | 10 | 5 | METRO41540N10005 | Sussex County, DE HUD Metro FMR Area | Sussex County | 75900 | 15950 | 18200 | 20500 | 22750 | 24600 | 26400 | 28250 | 30050 | 9999 | Sussex County | Delaware | 1 |
| DC | 1100199999 | 11 | 1 | METRO47900M47900 | Washington-Arlington-Alexandria, DC-VA-MD HUD Metro FMR Area | District of Columbia | 126000 | 26500 | 30250 | 34050 | 37800 | 40850 | 43850 | 46900 | 49900 | 8840 | District of Columbia | District of Columbia | 1 |
| FL | 1200199999 | 12 | 1 | METRO23540M23540 | Gainesville, FL MSA | Alachua County | 69800 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 2900 | Alachua County | Florida | 1 |
| FL | 1200399999 | 12 | 3 | METRO27260N12003 | Baker County, FL HUD Metro FMR Area | Baker County | 71600 | 14950 | 17100 | 19250 | 21350 | 23100 | 24800 | 26500 | 28200 | 9999 | Baker County | Florida | 1 |
| FL | 1200599999 | 12 | 5 | METRO37460M37460 | Panama City-Lynn Haven-Panama City Beach, FL HUD Metro FMR Area | Bay County | 72000 | 14600 | 16650 | 18750 | 20800 | 22500 | 24150 | 25800 | 27500 | 6015 | Bay County | Florida | 1 |
| FL | 1200799999 | 12 | 7 | NCNTY12007N12007 | Bradford County, FL | Bradford County | 59500 | 12500 | 14300 | 16100 | 17850 | 19300 | 20750 | 22150 | 23600 | 9999 | Bradford County | Florida | 0 |
| FL | 1200999999 | 12 | 9 | METRO37340M37340 | Palm Bay-Melbourne-Titusville, FL MSA | Brevard County | 69200 | 14550 | 16600 | 18700 | 20750 | 22450 | 24100 | 25750 | 27400 | 4900 | Brevard County | Florida | 1 |
| FL | 1201199999 | 12 | 11 | METRO33100MM2680 | Fort Lauderdale, FL HUD Metro FMR Area | Broward County | 74800 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 2680 | Broward County | Florida | 1 |
| FL | 1201399999 | 12 | 13 | NCNTY12013N12013 | Calhoun County, FL | Calhoun County | 47900 | 11100 | 12700 | 14300 | 15850 | 17150 | 18400 | 19700 | 20950 | 9999 | Calhoun County | Florida | 0 |
| FL | 1201599999 | 12 | 15 | METRO39460M39460 | Punta Gorda, FL MSA | Charlotte County | 64100 | 13000 | 14850 | 16700 | 18550 | 20050 | 21550 | 23050 | 24500 | 6580 | Charlotte County | Florida | 1 |
| FL | 1201799999 | 12 | 17 | METRO26140M26140 | Homosassa Springs, FL MSA | Citrus County | 55900 | 11750 | 13400 | 15100 | 16750 | 18100 | 19450 | 20800 | 22150 | 9999 | Citrus County | Florida | 1 |
| FL | 1201999999 | 12 | 19 | METRO27260M27260 | Jacksonville, FL HUD Metro FMR Area | Clay County | 75000 | 15750 | 18000 | 20250 | 22500 | 24300 | 26100 | 27900 | 29700 | 3600 | Clay County | Florida | 1 |
| FL | 1202199999 | 12 | 21 | METRO34940M34940 | Naples-Immokalee-Marco Island, FL MSA | Collier County | 82300 | 17300 | 19800 | 22250 | 24700 | 26700 | 28700 | 30650 | 32650 | 5345 | Collier County | Florida | 1 |
| FL | 1202399999 | 12 | 23 | NCNTY12023N12023 | Columbia County, FL | Columbia County | 55200 | 11800 | 13450 | 15150 | 16800 | 18150 | 19500 | 20850 | 22200 | 9999 | Columbia County | Florida | 0 |
| FL | 1202799999 | 12 | 27 | NCNTY12027N12027 | DeSoto County, FL | DeSoto County | 42700 | 11100 | 12700 | 14300 | 15850 | 17150 | 18400 | 19700 | 20950 | 9999 | DeSoto County | Florida | 0 |
| FL | 1202999999 | 12 | 29 | NCNTY12029N12029 | Dixie County, FL | Dixie County | 44600 | 11100 | 12700 | 14300 | 15850 | 17150 | 18400 | 19700 | 20950 | 9999 | Dixie County | Florida | 0 |
| FL | 1203199999 | 12 | 31 | METRO27260M27260 | Jacksonville, FL HUD Metro FMR Area | Duval County | 75000 | 15750 | 18000 | 20250 | 22500 | 24300 | 26100 | 27900 | 29700 | 3600 | Duval County | Florida | 1 |
| FL | 1203399999 | 12 | 33 | METRO37860M37860 | Pensacola-Ferry Pass-Brent, FL MSA | Escambia County | 65900 | 13850 | 15800 | 17800 | 19750 | 21350 | 22950 | 24500 | 26100 | 6080 | Escambia County | Florida | 1 |
| FL | 1203599999 | 12 | 35 | METRO19660M37380 | Palm Coast, FL HUD Metro FMR Area | Flagler County | 65600 | 13800 | 15800 | 17750 | 19700 | 21300 | 22900 | 24450 | 26050 | 2020 | Flagler County | Florida | 1 |
| FL | 1203799999 | 12 | 37 | NCNTY12037N12037 | Franklin County, FL | Franklin County | 55400 | 11650 | 13300 | 14950 | 16600 | 17950 | 19300 | 20600 | 21950 | 9999 | Franklin County | Florida | 0 |
| FL | 1203999999 | 12 | 39 | METRO45220M45220 | Tallahassee, FL HUD Metro FMR Area | Gadsden County | 72700 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 8240 | Gadsden County | Florida | 1 |
| FL | 1204199999 | 12 | 41 | METRO23540M23540 | Gainesville, FL MSA | Gilchrist County | 69800 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Gilchrist County | Florida | 1 |
| FL | 1204399999 | 12 | 43 | NCNTY12043N12043 | Glades County, FL | Glades County | 45900 | 11100 | 12700 | 14300 | 15850 | 17150 | 18400 | 19700 | 20950 | 9999 | Glades County | Florida | 0 |
| FL | 1204599999 | 12 | 45 | METRO37460N12045 | Gulf County, FL HUD Metro FMR Area | Gulf County | 59300 | 12350 | 14100 | 15850 | 17600 | 19050 | 20450 | 21850 | 23250 | 9999 | Gulf County | Florida | 1 |
| FL | 1204799999 | 12 | 47 | NCNTY12047N12047 | Hamilton County, FL | Hamilton County | 44600 | 11100 | 12700 | 14300 | 15850 | 17150 | 18400 | 19700 | 20950 | 9999 | Hamilton County | Florida | 0 |
| FL | 1204999999 | 12 | 49 | NCNTY12049N12049 | Hardee County, FL | Hardee County | 49000 | 11100 | 12700 | 14300 | 15850 | 17150 | 18400 | 19700 | 20950 | 9999 | Hardee County | Florida | 0 |
| FL | 1205199999 | 12 | 51 | NCNTY12051N12051 | Hendry County, FL | Hendry County | 47400 | 11100 | 12700 | 14300 | 15850 | 17150 | 18400 | 19700 | 20950 | 9999 | Hendry County | Florida | 0 |
| FL | 1205399999 | 12 | 53 | METRO45300M45300 | Tampa-St. Petersburg-Clearwater, FL MSA | Hernando County | 69200 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 8280 | Hernando County | Florida | 1 |
| FL | 1205599999 | 12 | 55 | METRO42700M42700 | Sebring, FL MSA | Highlands County | 49600 | 11100 | 12700 | 14300 | 15850 | 17150 | 18400 | 19700 | 20950 | 9999 | Highlands County | Florida | 1 |
| FL | 1205799999 | 12 | 57 | METRO45300M45300 | Tampa-St. Petersburg-Clearwater, FL MSA | Hillsborough County | 69200 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 8280 | Hillsborough County | Florida | 1 |
| FL | 1205999999 | 12 | 59 | NCNTY12059N12059 | Holmes County, FL | Holmes County | 51600 | 11100 | 12700 | 14300 | 15850 | 17150 | 18400 | 19700 | 20950 | 9999 | Holmes County | Florida | 0 |
| FL | 1206199999 | 12 | 61 | METRO42680M42680 | Sebastian-Vero Beach, FL MSA | Indian River County | 69600 | 14650 | 16750 | 18850 | 20900 | 22600 | 24250 | 25950 | 27600 | 9999 | Indian River County | Florida | 1 |
| FL | 1206399999 | 12 | 63 | NCNTY12063N12063 | Jackson County, FL | Jackson County | 51000 | 11100 | 12700 | 14300 | 15850 | 17150 | 18400 | 19700 | 20950 | 9999 | Jackson County | Florida | 0 |
| FL | 1206599999 | 12 | 65 | METRO45220M45220 | Tallahassee, FL HUD Metro FMR Area | Jefferson County | 72700 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Jefferson County | Florida | 1 |
| FL | 1206799999 | 12 | 67 | NCNTY12067N12067 | Lafayette County, FL | Lafayette County | 60100 | 11750 | 13400 | 15100 | 16750 | 18100 | 19450 | 20800 | 22150 | 9999 | Lafayette County | Florida | 0 |
| FL | 1206999999 | 12 | 69 | METRO36740M36740 | Orlando-Kissimmee-Sanford, FL MSA | Lake County | 68100 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 5960 | Lake County | Florida | 1 |
| FL | 1207199999 | 12 | 71 | METRO15980M15980 | Cape Coral-Fort Myers, FL MSA | Lee County | 68700 | 14500 | 16550 | 18600 | 20650 | 22350 | 24000 | 25650 | 27300 | 2700 | Lee County | Florida | 1 |
| FL | 1207399999 | 12 | 73 | METRO45220M45220 | Tallahassee, FL HUD Metro FMR Area | Leon County | 72700 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 8240 | Leon County | Florida | 1 |
| FL | 1207599999 | 12 | 75 | NCNTY12075N12075 | Levy County, FL | Levy County | 47500 | 11100 | 12700 | 14300 | 15850 | 17150 | 18400 | 19700 | 20950 | 9999 | Levy County | Florida | 0 |
| FL | 1207799999 | 12 | 77 | NCNTY12077N12077 | Liberty County, FL | Liberty County | 44500 | 11100 | 12700 | 14300 | 15850 | 17150 | 18400 | 19700 | 20950 | 9999 | Liberty County | Florida | 0 |
| FL | 1207999999 | 12 | 79 | NCNTY12079N12079 | Madison County, FL | Madison County | 44000 | 11100 | 12700 | 14300 | 15850 | 17150 | 18400 | 19700 | 20950 | 9999 | Madison County | Florida | 0 |
| FL | 1208199999 | 12 | 81 | METRO35840M35840 | North Port-Sarasota-Bradenton, FL MSA | Manatee County | 76700 | 16100 | 18400 | 20700 | 22950 | 24800 | 26650 | 28500 | 30300 | 7510 | Manatee County | Florida | 1 |
| FL | 1208399999 | 12 | 83 | METRO36100M36100 | Ocala, FL MSA | Marion County | 55000 | 11550 | 13200 | 14850 | 16500 | 17850 | 19150 | 20500 | 21800 | 5790 | Marion County | Florida | 1 |
| FL | 1208599999 | 12 | 85 | METRO38940M38940 | Port St. Lucie, FL MSA | Martin County | 67500 | 14600 | 16700 | 18800 | 20850 | 22550 | 24200 | 25900 | 27550 | 2710 | Martin County | Florida | 1 |
| FL | 1208699999 | 12 | 86 | METRO33100MM5000 | Miami-Miami Beach-Kendall, FL HUD Metro FMR Area | Miami-Dade County | 59100 | 19200 | 21950 | 24700 | 27400 | 29600 | 31800 | 34000 | 36200 | 5000 | Miami-Dade County | Florida | 1 |
| FL | 1208799999 | 12 | 87 | NCNTY12087N12087 | Monroe County, FL | Monroe County | 81400 | 21150 | 24200 | 27200 | 30200 | 32650 | 35050 | 37450 | 39900 | 9999 | Monroe County | Florida | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FL | 1208999999 | 12 | 89 | METRO27260M27260 | Jacksonville, FL HUD Metro FMR Area | Nassau County | 75000 | 15750 | 18000 | 20250 | 22500 | 24300 | 26100 | 27900 | 29700 | 3600 | Nassau County | Florida | 1 |
| FL | 1209199999 | 12 | 91 | METRO18880M18880 | Crestview-Fort Walton Beach-Destin, FL HUD Metro FMR Area | Okaloosa County | 81600 | 16350 | 18700 | 21050 | 23350 | 25250 | 27100 | 29000 | 30850 | 2750 | Okaloosa County | Florida | 1 |
| FL | 1209399999 | 12 | 93 | NCNTY12093N12093 | Okeechobee County, FL | Okeechobee County | 48500 | 11100 | 12700 | 14300 | 15850 | 17150 | 18400 | 19700 | 20950 | 9999 | Okeechobee County | Florida | 0 |
| FL | 1209599999 | 12 | 95 | METRO36740M36740 | Orlando-Kissimmee-Sanford, FL MSA | Orange County | 68100 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 5960 | Orange County | Florida | 1 |
| FL | 1209799999 | 12 | 97 | METRO36740M36740 | Orlando-Kissimmee-Sanford, FL MSA | Osceola County | 68100 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 5960 | Osceola County | Florida | 1 |
| FL | 1209999999 | 12 | 99 | METRO33100MM8960 | West Palm Beach-Boca Raton, FL HUD Metro FMR Area | Palm Beach County | 79100 | 18450 | 21100 | 23750 | 26350 | 28500 | 30600 | 32700 | 34800 | 8960 | Palm Beach County | Florida | 1 |
| FL | 1210199999 | 12 | 101 | METRO45300M45300 | Tampa-St. Petersburg-Clearwater, FL MSA | Pasco County | 69200 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 8280 | Pasco County | Florida | 1 |
| FL | 1210399999 | 12 | 103 | METRO45300M45300 | Tampa-St. Petersburg-Clearwater, FL MSA | Pinellas County | 69200 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 8280 | Pinellas County | Florida | 1 |
| FL | 1210599999 | 12 | 105 | METRO29460M29460 | Lakeland-Winter Haven, FL MSA | Polk County | 58800 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 3980 | Polk County | Florida | 1 |
| FL | 1210799999 | 12 | 107 | NCNTY12107N12107 | Putnam County, FL | Putnam County | 41600 | 11100 | 12700 | 14300 | 15850 | 17150 | 18400 | 19700 | 20950 | 9999 | Putnam County | Florida | 0 |
| FL | 1210999999 | 12 | 109 | METRO27260M27260 | Jacksonville, FL HUD Metro FMR Area | St. Johns County | 75000 | 15750 | 18000 | 20250 | 22500 | 24300 | 26100 | 27900 | 29700 | 3600 | St. Johns County | Florida | 1 |
| FL | 1211199999 | 12 | 111 | METRO38940M38940 | Port St. Lucie, FL MSA | St. Lucie County | 67500 | 14600 | 16700 | 18800 | 20850 | 22550 | 24200 | 25900 | 27550 | 2710 | St. Lucie County | Florida | 1 |
| FL | 1211399999 | 12 | 113 | METRO37860M37860 | Pensacola-Ferry Pass-Brent, FL MSA | Santa Rosa County | 65900 | 13850 | 15800 | 17800 | 19750 | 21350 | 22950 | 24500 | 26100 | 6080 | Santa Rosa County | Florida | 1 |
| FL | 1211599999 | 12 | 115 | METRO35840M35840 | North Port-Sarasota-Bradenton, FL MSA | Sarasota County | 76700 | 16100 | 18400 | 20700 | 22950 | 24800 | 26650 | 28500 | 30300 | 7510 | Sarasota County | Florida | 1 |
| FL | 1211799999 | 12 | 117 | METRO36740M36740 | Orlando-Kissimmee-Sanford, FL MSA | Seminole County | 68100 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 5960 | Seminole County | Florida | 1 |
| FL | 1211999999 | 12 | 119 | METRO45540M45540 | The Villages, FL MSA | Sumter County | 67500 | 14250 | 16300 | 18350 | 20350 | 22000 | 23650 | 25250 | 26900 | 9999 | Sumter County | Florida | 1 |
| FL | 1212199999 | 12 | 121 | NCNTY12121N12121 | Suwannee County, FL | Suwannee County | 51700 | 11100 | 12700 | 14300 | 15850 | 17150 | 18400 | 19700 | 20950 | 9999 | Suwannee County | Florida | 0 |
| FL | 1212399999 | 12 | 123 | NCNTY12123N12123 | Taylor County, FL | Taylor County | 49100 | 11100 | 12700 | 14300 | 15850 | 17150 | 18400 | 19700 | 20950 | 9999 | Taylor County | Florida | 0 |
| FL | 1212599999 | 12 | 125 | NCNTY12125N12125 | Union County, FL | Union County | 49700 | 11100 | 12700 | 14300 | 15850 | 17150 | 18400 | 19700 | 20950 | 9999 | Union County | Florida | 0 |
| FL | 1212799999 | 12 | 127 | METRO19660M19660 | Deltona-Daytona Beach-Ormond Beach, FL HUD Metro FMR Area | Volusia County | 64900 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 2020 | Volusia County | Florida | 1 |
| FL | 1212999999 | 12 | 129 | METRO45220N12129 | Wakulla County, FL HUD Metro FMR Area | Wakulla County | 70000 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Wakulla County | Florida | 1 |
| FL | 1213199999 | 12 | 131 | METRO18880N12131 | Walton County, FL HUD Metro FMR Area | Walton County | 66300 | 13950 | 15950 | 17950 | 19900 | 21500 | 23100 | 24700 | 26300 | 9999 | Walton County | Florida | 1 |
| FL | 1213399999 | 12 | 133 | NCNTY12133N12133 | Washington County, FL | Washington County | 50700 | 11100 | 12700 | 14300 | 15850 | 17150 | 18400 | 19700 | 20950 | 9999 | Washington County | Florida | 0 |
| GA | 1300199999 | 13 | 1 | NCNTY13001N13001 | Appling County, GA | Appling County | 49600 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Appling County | Georgia | 0 |
| GA | 1300399999 | 13 | 3 | NCNTY13003N13003 | Atkinson County, GA | Atkinson County | 37500 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Atkinson County | Georgia | 0 |
| GA | 1300599999 | 13 | 5 | NCNTY13005N13005 | Bacon County, GA | Bacon County | 49200 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Bacon County | Georgia | 0 |
| GA | 1300799999 | 13 | 7 | METRO10500M10500 | Albany, GA MSA | Baker County | 52300 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Baker County | Georgia | 1 |
| GA | 1300999999 | 13 | 9 | NCNTY13009N13009 | Baldwin County, GA | Baldwin County | 54900 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Baldwin County | Georgia | 0 |
| GA | 1301199999 | 13 | 11 | NCNTY13011N13011 | Banks County, GA | Banks County | 51800 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Banks County | Georgia | 0 |
| GA | 1301399999 | 13 | 13 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | Barrow County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 520 | Barrow County | Georgia | 1 |
| GA | 1301599999 | 13 | 15 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | Bartow County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 520 | Bartow County | Georgia | 1 |
| GA | 1301799999 | 13 | 17 | NCNTY13017N13017 | Ben Hill County, GA | Ben Hill County | 39500 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Ben Hill County | Georgia | 0 |
| GA | 1301999999 | 13 | 19 | NCNTY13019N13019 | Berrien County, GA | Berrien County | 47900 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Berrien County | Georgia | 0 |
| GA | 1302199999 | 13 | 21 | METRO31420M31420 | Macon-Bibb County, GA HUD Metro FMR Area | Bibb County | 59000 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 4680 | Bibb County | Georgia | 1 |
| GA | 1302399999 | 13 | 23 | NCNTY13023N13023 | Bleckley County, GA | Bleckley County | 53400 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Bleckley County | Georgia | 0 |
| GA | 1302599999 | 13 | 25 | METRO15260M15260 | Brunswick, GA MSA | Brantley County | 71200 | 13200 | 15050 | 16950 | 18800 | 20350 | 21850 | 23350 | 24850 | 9999 | Brantley County | Georgia | 1 |
| GA | 1302799999 | 13 | 27 | METRO46660M46660 | Valdosta, GA MSA | Brooks County | 55400 | 11650 | 13300 | 14950 | 16600 | 17950 | 19300 | 20600 | 21950 | 9999 | Brooks County | Georgia | 1 |
| GA | 1302999999 | 13 | 29 | METRO42340M42340 | Savannah, GA MSA | Bryan County | 72000 | 15150 | 17300 | 19450 | 21600 | 23350 | 25100 | 26800 | 28550 | 7520 | Bryan County | Georgia | 1 |
| GA | 1303199999 | 13 | 31 | NCNTY13031N13031 | Bulloch County, GA | Bulloch County | 54900 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Bulloch County | Georgia | 0 |
| GA | 1303399999 | 13 | 33 | METRO12260M12260 | Augusta-Richmond County, GA-SC HUD Metro FMR Area | Burke County | 65900 | 13850 | 15800 | 17800 | 19750 | 21350 | 22950 | 24500 | 26100 | 9999 | Burke County | Georgia | 1 |
| GA | 1303599999 | 13 | 35 | METRO12060N13035 | Butts County, GA HUD Metro FMR Area | Butts County | 51600 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Butts County | Georgia | 1 |
| GA | 1303799999 | 13 | 37 | NCNTY13037N13037 | Calhoun County, GA | Calhoun County | 39600 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Calhoun County | Georgia | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GA | 1303999999 | 13 | 39 | NCNTY13039N13039 | Camden County, GA | Camden County | 63000 | 13250 | 15150 | 17050 | 18900 | 20450 | 21950 | 23450 | 24950 | 9999 | Camden County | Georgia | 0 |
| GA | 1304399999 | 13 | 43 | NCNTY13043N13043 | Candler County, GA | Candler County | 39300 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Candler County | Georgia | 0 |
| GA | 1304599999 | 13 | 45 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | Carroll County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 520 | Carroll County | Georgia | 1 |
| GA | 1304799999 | 13 | 47 | METRO16860M16860 | Chattanooga, TN-GA MSA | Catoosa County | 72600 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 1560 | Catoosa County | Georgia | 1 |
| GA | 1304999999 | 13 | 49 | NCNTY13049N13049 | Charlton County, GA | Charlton County | 57700 | 12150 | 13850 | 15600 | 17300 | 18700 | 20100 | 21500 | 22850 | 9999 | Charlton County | Georgia | 0 |
| GA | 1305199999 | 13 | 51 | METRO42340M42340 | Savannah, GA MSA | Chatham County | 72000 | 15150 | 17300 | 19450 | 21600 | 23350 | 25100 | 26800 | 28550 | 7520 | Chatham County | Georgia | 1 |
| GA | 1305399999 | 13 | 53 | METRO17980M17980 | Columbus, GA-AL MSA | Chattahoochee County | 62300 | 13100 | 15000 | 16850 | 18700 | 20200 | 21700 | 23200 | 24700 | 1800 | Chattahoochee County | Georgia | 1 |
| GA | 1305599999 | 13 | 55 | NCNTY13055N13055 | Chattooga County, GA | Chattooga County | 46800 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Chattooga County | Georgia | 0 |
| GA | 1305799999 | 13 | 57 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | Cherokee County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 520 | Cherokee County | Georgia | 1 |
| GA | 1305999999 | 13 | 59 | METRO12020M12020 | Athens-Clarke County, GA MSA | Clarke County | 65600 | 13800 | 15800 | 17750 | 19700 | 21300 | 22900 | 24450 | 26050 | 500 | Clarke County | Georgia | 1 |
| GA | 1306199999 | 13 | 61 | NCNTY13061N13061 | Clay County, GA | Clay County | 37400 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Clay County | Georgia | 0 |
| GA | 1306399999 | 13 | 63 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | Clayton County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 520 | Clayton County | Georgia | 1 |
| GA | 1306599999 | 13 | 65 | NCNTY13065N13065 | Clinch County, GA | Clinch County | 46300 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Clinch County | Georgia | 0 |
| GA | 1306799999 | 13 | 67 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | Cobb County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 520 | Cobb County | Georgia | 1 |
| GA | 1306999999 | 13 | 69 | NCNTY13069N13069 | Coffee County, GA | Coffee County | 48900 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Coffee County | Georgia | 0 |
| GA | 1307199999 | 13 | 71 | NCNTY13071N13071 | Colquitt County, GA | Colquitt County | 42500 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Colquitt County | Georgia | 0 |
| GA | 1307399999 | 13 | 73 | METRO12260M12260 | Augusta-Richmond County, GA-SC HUD Metro FMR Area | Columbia County | 65900 | 13850 | 15800 | 17800 | 19750 | 21350 | 22950 | 24500 | 26100 | 600 | Columbia County | Georgia | 1 |
| GA | 1307599999 | 13 | 75 | NCNTY13075N13075 | Cook County, GA | Cook County | 44400 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Cook County | Georgia | 0 |
| GA | 1307799999 | 13 | 77 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | Coweta County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 520 | Coweta County | Georgia | 1 |
| GA | 1307999999 | 13 | 79 | METRO31420M31420 | Macon-Bibb County, GA HUD Metro FMR Area | Crawford County | 59000 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Crawford County | Georgia | 1 |
| GA | 1308199999 | 13 | 81 | NCNTY13081N13081 | Crisp County, GA | Crisp County | 41700 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Crisp County | Georgia | 0 |
| GA | 1308399999 | 13 | 83 | METRO16860M16860 | Chattanooga, TN-GA MSA | Dade County | 72600 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 1560 | Dade County | Georgia | 1 |
| GA | 1308599999 | 13 | 85 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | Dawson County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 9999 | Dawson County | Georgia | 1 |
| GA | 1308799999 | 13 | 87 | NCNTY13087N13087 | Decatur County, GA | Decatur County | 50400 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Decatur County | Georgia | 0 |
| GA | 1308999999 | 13 | 89 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | DeKalb County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 520 | DeKalb County | Georgia | 1 |
| GA | 1309199999 | 13 | 91 | NCNTY13091N13091 | Dodge County, GA | Dodge County | 49900 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Dodge County | Georgia | 0 |
| GA | 1309399999 | 13 | 93 | NCNTY13093N13093 | Dooly County, GA | Dooly County | 48800 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Dooly County | Georgia | 0 |
| GA | 1309599999 | 13 | 95 | METRO10500M10500 | Albany, GA MSA | Dougherty County | 52300 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 120 | Dougherty County | Georgia | 1 |
| GA | 1309799999 | 13 | 97 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | Douglas County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 520 | Douglas County | Georgia | 1 |
| GA | 1309999999 | 13 | 99 | NCNTY13099N13099 | Early County, GA | Early County | 42700 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Early County | Georgia | 0 |
| GA | 1310199999 | 13 | 101 | METRO46660M46660 | Valdosta, GA MSA | Echols County | 55400 | 11650 | 13300 | 14950 | 16600 | 17950 | 19300 | 20600 | 21950 | 9999 | Echols County | Georgia | 1 |
| GA | 1310399999 | 13 | 103 | METRO42340M42340 | Savannah, GA MSA | Effingham County | 72000 | 15150 | 17300 | 19450 | 21600 | 23350 | 25100 | 26800 | 28550 | 7520 | Effingham County | Georgia | 1 |
| GA | 1310599999 | 13 | 105 | NCNTY13105N13105 | Elbert County, GA | Elbert County | 47500 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Elbert County | Georgia | 0 |
| GA | 1310799999 | 13 | 107 | NCNTY13107N13107 | Emanuel County, GA | Emanuel County | 43700 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Emanuel County | Georgia | 0 |
| GA | 1310999999 | 13 | 109 | NCNTY13109N13109 | Evans County, GA | Evans County | 52200 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Evans County | Georgia | 0 |
| GA | 1311199999 | 13 | 111 | NCNTY13111N13111 | Fannin County, GA | Fannin County | 59800 | 12150 | 13900 | 15650 | 17350 | 18750 | 20150 | 21550 | 22950 | 9999 | Fannin County | Georgia | 0 |
| GA | 1311399999 | 13 | 113 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | Fayette County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 520 | Fayette County | Georgia | 1 |
| GA | 1311599999 | 13 | 115 | METRO40660M40660 | Rome, GA MSA | Floyd County | 58700 | 12350 | 14100 | 15850 | 17600 | 19050 | 20450 | 21850 | 23250 | 9999 | Floyd County | Georgia | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GA | 1311799999 | 13 | 117 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | Forsyth County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 520 | Forsyth County | Georgia | 1 |
| GA | 1311999999 | 13 | 119 | NCNTY13119N13119 | Franklin County, GA | Franklin County | 52400 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Franklin County | Georgia | 0 |
| GA | 1312199999 | 13 | 121 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | Fulton County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 520 | Fulton County | Georgia | 1 |
| GA | 1312399999 | 13 | 123 | NCNTY13123N13123 | Gilmer County, GA | Gilmer County | 58400 | 12250 | 14000 | 15750 | 17500 | 18900 | 20300 | 21700 | 23100 | 9999 | Gilmer County | Georgia | 0 |
| GA | 1312599999 | 13 | 125 | NCNTY13125N13125 | Glascock County, GA | Glascock County | 64000 | 12550 | 14350 | 16150 | 17900 | 19350 | 20800 | 22200 | 23650 | 9999 | Glascock County | Georgia | 0 |
| GA | 1312799999 | 13 | 127 | METRO15260M15260 | Brunswick, GA MSA | Glynn County | 71200 | 13200 | 15050 | 16950 | 18800 | 20350 | 21850 | 23350 | 24850 | 9999 | Glynn County | Georgia | 1 |
| GA | 1312999999 | 13 | 129 | NCNTY13129N13129 | Gordon County, GA | Gordon County | 50200 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Gordon County | Georgia | 0 |
| GA | 1313199999 | 13 | 131 | NCNTY13131N13131 | Grady County, GA | Grady County | 48400 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Grady County | Georgia | 0 |
| GA | 1313399999 | 13 | 133 | NCNTY13133N13133 | Greene County, GA | Greene County | 63500 | 13150 | 15000 | 16900 | 18750 | 20250 | 21750 | 23250 | 24750 | 9999 | Greene County | Georgia | 0 |
| GA | 1313599999 | 13 | 135 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | Gwinnett County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 520 | Gwinnett County | Georgia | 1 |
| GA | 1313799999 | 13 | 137 | NCNTY13137N13137 | Habersham County, GA | Habersham County | 58000 | 12200 | 13950 | 15700 | 17400 | 18800 | 20200 | 21600 | 23000 | 9999 | Habersham County | Georgia | 0 |
| GA | 1313999999 | 13 | 139 | METRO23580M23580 | Gainesville, GA MSA | Hall County | 75500 | 15200 | 17350 | 19500 | 21650 | 23400 | 25150 | 26850 | 28600 | 9999 | Hall County | Georgia | 1 |
| GA | 1314199999 | 13 | 141 | NCNTY13141N13141 | Hancock County, GA | Hancock County | 35200 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Hancock County | Georgia | 0 |
| GA | 1314399999 | 13 | 143 | METRO12060N13143 | Haralson County, GA HUD Metro FMR Area | Haralson County | 57300 | 12050 | 13800 | 15500 | 17200 | 18600 | 20000 | 21350 | 22750 | 9999 | Haralson County | Georgia | 1 |
| GA | 1314599999 | 13 | 145 | METRO17980M17980 | Columbus, GA-AL MSA | Harris County | 62300 | 13100 | 15000 | 16850 | 18700 | 20200 | 21700 | 23200 | 24700 | 1800 | Harris County | Georgia | 1 |
| GA | 1314799999 | 13 | 147 | NCNTY13147N13147 | Hart County, GA | Hart County | 55300 | 11650 | 13300 | 14950 | 16600 | 17950 | 19300 | 20600 | 21950 | 9999 | Hart County | Georgia | 0 |
| GA | 1314999999 | 13 | 149 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | Heard County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 9999 | Heard County | Georgia | 1 |
| GA | 1315199999 | 13 | 151 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | Henry County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 520 | Henry County | Georgia | 1 |
| GA | 1315399999 | 13 | 153 | METRO47580M47580 | Warner Robins, GA HUD Metro FMR Area | Houston County | 69600 | 14750 | 16850 | 18950 | 21050 | 22750 | 24450 | 26150 | 27800 | 4680 | Houston County | Georgia | 1 |
| GA | 1315599999 | 13 | 155 | NCNTY13155N13155 | Irwin County, GA | Irwin County | 51800 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Irwin County | Georgia | 0 |
| GA | 1315799999 | 13 | 157 | NCNTY13157N13157 | Jackson County, GA | Jackson County | 81000 | 15200 | 17350 | 19500 | 21650 | 23400 | 25150 | 26850 | 28600 | 9999 | Jackson County | Georgia | 0 |
| GA | 1315999999 | 13 | 159 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | Jasper County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 9999 | Jasper County | Georgia | 1 |
| GA | 1316199999 | 13 | 161 | NCNTY13161N13161 | Jeff Davis County, GA | Jeff Davis County | 47300 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Jeff Davis County | Georgia | 0 |
| GA | 1316399999 | 13 | 163 | NCNTY13163N13163 | Jefferson County, GA | Jefferson County | 43900 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Jefferson County | Georgia | 0 |
| GA | 1316599999 | 13 | 165 | NCNTY13165N13165 | Jenkins County, GA | Jenkins County | 41500 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Jenkins County | Georgia | 0 |
| GA | 1316799999 | 13 | 167 | NCNTY13167N13167 | Johnson County, GA | Johnson County | 51100 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Johnson County | Georgia | 0 |
| GA | 1316999999 | 13 | 169 | METRO31420M31420 | Macon-Bibb County, GA HUD Metro FMR Area | Jones County | 59000 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 4680 | Jones County | Georgia | 1 |
| GA | 1317199999 | 13 | 171 | METRO12060N13171 | Lamar County, GA HUD Metro FMR Area | Lamar County | 57300 | 12050 | 13800 | 15500 | 17200 | 18600 | 20000 | 21350 | 22750 | 9999 | Lamar County | Georgia | 1 |
| GA | 1317399999 | 13 | 173 | METRO46660M46660 | Valdosta, GA MSA | Lanier County | 55400 | 11650 | 13300 | 14950 | 16600 | 17950 | 19300 | 20600 | 21950 | 9999 | Lanier County | Georgia | 1 |
| GA | 1317599999 | 13 | 175 | NCNTY13175N13175 | Laurens County, GA | Laurens County | 45700 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Laurens County | Georgia | 0 |
| GA | 1317799999 | 13 | 177 | METRO10500M10500 | Albany, GA MSA | Lee County | 52300 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 120 | Lee County | Georgia | 1 |
| GA | 1317999999 | 13 | 179 | METRO25980M25980 | Hinesville, GA HUD Metro FMR Area | Liberty County | 50200 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Liberty County | Georgia | 1 |
| GA | 1318199999 | 13 | 181 | METRO12260N13181 | Lincoln County, GA HUD Metro FMR Area | Lincoln County | 52000 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Lincoln County | Georgia | 1 |
| GA | 1318399999 | 13 | 183 | METRO25980N13183 | Long County, GA HUD Metro FMR Area | Long County | 59100 | 12450 | 14200 | 16000 | 17750 | 19200 | 20600 | 22050 | 23450 | 9999 | Long County | Georgia | 1 |
| GA | 1318599999 | 13 | 185 | METRO46660M46660 | Valdosta, GA MSA | Lowndes County | 55400 | 11650 | 13300 | 14950 | 16600 | 17950 | 19300 | 20600 | 21950 | 9999 | Lowndes County | Georgia | 1 |
| GA | 1318799999 | 13 | 187 | NCNTY13187N13187 | Lumpkin County, GA | Lumpkin County | 59800 | 12600 | 14400 | 16200 | 17950 | 19400 | 20850 | 22300 | 23700 | 9999 | Lumpkin County | Georgia | 0 |
| GA | 1318999999 | 13 | 189 | METRO12260M12260 | Augusta-Richmond County, GA-SC HUD Metro FMR Area | McDuffie County | 65900 | 13850 | 15800 | 17800 | 19750 | 21350 | 22950 | 24500 | 26100 | 600 | McDuffie County | Georgia | 1 |
| GA | 1319199999 | 13 | 191 | METRO15260M15260 | Brunswick, GA MSA | McIntosh County | 71200 | 13200 | 15050 | 16950 | 18800 | 20350 | 21850 | 23350 | 24850 | 9999 | McIntosh County | Georgia | 1 |
| GA | 1319399999 | 13 | 193 | NCNTY13193N13193 | Macon County, GA | Macon County | 41700 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Macon County | Georgia | 0 |
| GA | 1319599999 | 13 | 195 | METRO12020M12020 | Athens-Clarke County, GA MSA | Madison County | 65600 | 13800 | 15800 | 17750 | 19700 | 21300 | 22900 | 24450 | 26050 | 500 | Madison County | Georgia | 1 |
| GA | 1319799999 | 13 | 197 | METRO17980M17980 | Columbus, GA-AL MSA | Marion County | 62300 | 13100 | 15000 | 16850 | 18700 | 20200 | 21700 | 23200 | 24700 | 9999 | Marion County | Georgia | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GA | 1319999999 | 13 | 199 | METRO12060N13199 | Meriwether County, GA HUD Metro FMR Area | Meriwether County | 51700 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Meriwether County | Georgia | 1 |
| GA | 1320199999 | 13 | 201 | NCNTY13201N13201 | Miller County, GA | Miller County | 49800 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Miller County | Georgia | 0 |
| GA | 1320599999 | 13 | 205 | NCNTY13205N13205 | Mitchell County, GA | Mitchell County | 43300 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Mitchell County | Georgia | 0 |
| GA | 1320799999 | 13 | 207 | METRO31420N13207 | Monroe County, GA HUD Metro FMR Area | Monroe County | 70600 | 14500 | 16550 | 18600 | 20650 | 22350 | 24000 | 25650 | 27300 | 9999 | Monroe County | Georgia | 1 |
| GA | 1320999999 | 13 | 209 | NCNTY13209N13209 | Montgomery County, GA | Montgomery County | 51100 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Montgomery County | Georgia | 0 |
| GA | 1321199999 | 13 | 211 | METRO12060N13211 | Morgan County, GA HUD Metro FMR Area | Morgan County | 68000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Morgan County | Georgia | 1 |
| GA | 1321399999 | 13 | 213 | METRO19140N13213 | Murray County, GA HUD Metro FMR Area | Murray County | 51400 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Murray County | Georgia | 1 |
| GA | 1321599999 | 13 | 215 | METRO17980M17980 | Columbus, GA-AL MSA | Muscogee County | 62300 | 13100 | 15000 | 16850 | 18700 | 20200 | 21700 | 23200 | 24700 | 1800 | Muscogee County | Georgia | 1 |
| GA | 1321799999 | 13 | 217 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | Newton County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 520 | Newton County | Georgia | 1 |
| GA | 1321999999 | 13 | 219 | METRO12020M12020 | Athens-Clarke County, GA MSA | Oconee County | 65600 | 13800 | 15800 | 17750 | 19700 | 21300 | 22900 | 24450 | 26050 | 500 | Oconee County | Georgia | 1 |
| GA | 1322199999 | 13 | 221 | METRO12020M12020 | Athens-Clarke County, GA MSA | Oglethorpe County | 65600 | 13800 | 15800 | 17750 | 19700 | 21300 | 22900 | 24450 | 26050 | 9999 | Oglethorpe County | Georgia | 1 |
| GA | 1322399999 | 13 | 223 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | Paulding County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 520 | Paulding County | Georgia | 1 |
| GA | 1322599999 | 13 | 225 | METRO47580N13225 | Peach County, GA HUD Metro FMR Area | Peach County | 59500 | 12500 | 14300 | 16100 | 17850 | 19300 | 20750 | 22150 | 23600 | 4680 | Peach County | Georgia | 1 |
| GA | 1322799999 | 13 | 227 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | Pickens County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 520 | Pickens County | Georgia | 1 |
| GA | 1322999999 | 13 | 229 | NCNTY13229N13229 | Pierce County, GA | Pierce County | 53500 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Pierce County | Georgia | 0 |
| GA | 1323199999 | 13 | 231 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | Pike County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 9999 | Pike County | Georgia | 1 |
| GA | 1323399999 | 13 | 233 | NCNTY13233N13233 | Polk County, GA | Polk County | 53000 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Polk County | Georgia | 0 |
| GA | 1323599999 | 13 | 235 | METRO47580N13235 | Pulaski County, GA HUD Metro FMR Area | Pulaski County | 52500 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Pulaski County | Georgia | 1 |
| GA | 1323799999 | 13 | 237 | NCNTY13237N13237 | Putnam County, GA | Putnam County | 60900 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Putnam County | Georgia | 0 |
| GA | 1323999999 | 13 | 239 | NCNTY13239N13239 | Quitman County, GA | Quitman County | 39700 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Quitman County | Georgia | 0 |
| GA | 1324199999 | 13 | 241 | NCNTY13241N13241 | Rabun County, GA | Rabun County | 54400 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Rabun County | Georgia | 0 |
| GA | 1324399999 | 13 | 243 | NCNTY13243N13243 | Randolph County, GA | Randolph County | 37900 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Randolph County | Georgia | 0 |
| GA | 1324599999 | 13 | 245 | METRO12260M12260 | Augusta-Richmond County, GA-SC HUD Metro FMR Area | Richmond County | 65900 | 13850 | 15800 | 17800 | 19750 | 21350 | 22950 | 24500 | 26100 | 600 | Richmond County | Georgia | 1 |
| GA | 1324799999 | 13 | 247 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | Rockdale County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 520 | Rockdale County | Georgia | 1 |
| GA | 1324999999 | 13 | 249 | NCNTY13249N13249 | Schley County, GA | Schley County | 48200 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Schley County | Georgia | 0 |
| GA | 1325199999 | 13 | 251 | NCNTY13251N13251 | Screven County, GA | Screven County | 48100 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Screven County | Georgia | 0 |
| GA | 1325399999 | 13 | 253 | NCNTY13253N13253 | Seminole County, GA | Seminole County | 45400 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Seminole County | Georgia | 0 |
| GA | 1325599999 | 13 | 255 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | Spalding County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 520 | Spalding County | Georgia | 1 |
| GA | 1325799999 | 13 | 257 | NCNTY13257N13257 | Stephens County, GA | Stephens County | 57900 | 12150 | 13900 | 15650 | 17350 | 18750 | 20150 | 21550 | 22950 | 9999 | Stephens County | Georgia | 0 |
| GA | 1325999999 | 13 | 259 | NCNTY13259N13259 | Stewart County, GA | Stewart County | 30100 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Stewart County | Georgia | 0 |
| GA | 1326199999 | 13 | 261 | NCNTY13261N13261 | Sumter County, GA | Sumter County | 44200 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Sumter County | Georgia | 0 |
| GA | 1326399999 | 13 | 263 | NCNTY13263N13263 | Talbot County, GA | Talbot County | 49000 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Talbot County | Georgia | 0 |
| GA | 1326599999 | 13 | 265 | NCNTY13265N13265 | Taliaferro County, GA | Taliaferro County | 44000 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Taliaferro County | Georgia | 0 |
| GA | 1326799999 | 13 | 267 | NCNTY13267N13267 | Tattnall County, GA | Tattnall County | 50100 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Tattnall County | Georgia | 0 |
| GA | 1326999999 | 13 | 269 | NCNTY13269N13269 | Taylor County, GA | Taylor County | 37900 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Taylor County | Georgia | 0 |
| GA | 1327199999 | 13 | 271 | NCNTY13271N13271 | Telfair County, GA | Telfair County | 38400 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Telfair County | Georgia | 0 |
| GA | 1327399999 | 13 | 273 | METRO10500M10500 | Albany, GA MSA | Terrell County | 52300 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Terrell County | Georgia | 1 |
| GA | 1327599999 | 13 | 275 | NCNTY13275N13275 | Thomas County, GA | Thomas County | 53900 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Thomas County | Georgia | 0 |
| GA | 1327799999 | 13 | 277 | NCNTY13277N13277 | Tift County, GA | Tift County | 50000 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Tift County | Georgia | 0 |
| GA | 1327999999 | 13 | 279 | NCNTY13279N13279 | Toombs County, GA | Toombs County | 50300 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Toombs County | Georgia | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GA | 1328199999 | 13 | 281 | NCNTY13281N13281 | Towns County, GA | Towns County | 54900 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Towns County | Georgia | 0 |
| GA | 1328399999 | 13 | 283 | NCNTY13283N13283 | Treutlen County, GA | Treutlen County | 55400 | 11800 | 13450 | 15150 | 16800 | 18150 | 19500 | 20850 | 22200 | 9999 | Treutlen County | Georgia | 0 |
| GA | 1328599999 | 13 | 285 | NCNTY13285N13285 | Troup County, GA | Troup County | 60600 | 12450 | 14200 | 16000 | 17750 | 19200 | 20600 | 22050 | 23450 | 9999 | Troup County | Georgia | 0 |
| GA | 1328799999 | 13 | 287 | NCNTY13287N13287 | Turner County, GA | Turner County | 49600 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Turner County | Georgia | 0 |
| GA | 1328999999 | 13 | 289 | METRO31420M31420 | Macon-Bibb County, GA HUD Metro FMR Area | Twiggs County | 59000 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 4680 | Twiggs County | Georgia | 1 |
| GA | 1329199999 | 13 | 291 | NCNTY13291N13291 | Union County, GA | Union County | 59200 | 12450 | 14200 | 16000 | 17750 | 19200 | 20600 | 22050 | 23450 | 9999 | Union County | Georgia | 0 |
| GA | 1329399999 | 13 | 293 | NCNTY13293N13293 | Upson County, GA | Upson County | 50600 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Upson County | Georgia | 0 |
| GA | 1329599999 | 13 | 295 | METRO16860M16860 | Chattanooga, TN-GA MSA | Walker County | 72600 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 1560 | Walker County | Georgia | 1 |
| GA | 1329799999 | 13 | 297 | METRO12060M12060 | Atlanta-Sandy Springs-Roswell, GA HUD Metro FMR Area | Walton County | 82700 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 520 | Walton County | Georgia | 1 |
| GA | 1329999999 | 13 | 299 | NCNTY13299N13299 | Ware County, GA | Ware County | 47700 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Ware County | Georgia | 0 |
| GA | 1330199999 | 13 | 301 | NCNTY13301N13301 | Warren County, GA | Warren County | 48800 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Warren County | Georgia | 0 |
| GA | 1330399999 | 13 | 303 | NCNTY13303N13303 | Washington County, GA | Washington County | 49200 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Washington County | Georgia | 0 |
| GA | 1330599999 | 13 | 305 | NCNTY13305N13305 | Wayne County, GA | Wayne County | 54300 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Wayne County | Georgia | 0 |
| GA | 1330799999 | 13 | 307 | NCNTY13307N13307 | Webster County, GA | Webster County | 53800 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Webster County | Georgia | 0 |
| GA | 1330999999 | 13 | 309 | NCNTY13309N13309 | Wheeler County, GA | Wheeler County | 40700 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Wheeler County | Georgia | 0 |
| GA | 1331199999 | 13 | 311 | NCNTY13311N13311 | White County, GA | White County | 55300 | 11650 | 13300 | 14950 | 16600 | 17950 | 19300 | 20600 | 21950 | 9999 | White County | Georgia | 0 |
| GA | 1331399999 | 13 | 313 | METRO19140M19140 | Dalton, GA HUD Metro FMR Area | Whitfield County | 53100 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Whitfield County | Georgia | 1 |
| GA | 1331599999 | 13 | 315 | NCNTY13315N13315 | Wilcox County, GA | Wilcox County | 49500 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Wilcox County | Georgia | 0 |
| GA | 1331799999 | 13 | 317 | NCNTY13317N13317 | Wilkes County, GA | Wilkes County | 52200 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Wilkes County | Georgia | 0 |
| GA | 1331999999 | 13 | 319 | NCNTY13319N13319 | Wilkinson County, GA | Wilkinson County | 53500 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Wilkinson County | Georgia | 0 |
| GA | 1332199999 | 13 | 321 | METRO10500M10500 | Albany, GA MSA | Worth County | 52300 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Worth County | Georgia | 1 |
| HI | 1500199999 | 15 | 1 | NCNTY15001N15001 | Hawaii County, HI | Hawaii County | 75200 | 17500 | 20000 | 22500 | 25000 | 27000 | 29000 | 31000 | 33000 | 9999 | Hawaii County | Hawaii | 0 |
| HI | 1500399999 | 15 | 3 | METRO46520M46520 | Urban Honolulu, HI MSA | Honolulu County | 101600 | 26450 | 30200 | 34000 | 37750 | 40800 | 43800 | 46850 | 49850 | 3320 | Honolulu County | Hawaii | 1 |
| HI | 1500599999 | 15 | 5 | METRO27980M27980 | Kahului-Wailuku-Lahaina, HI MSA | Kalawao County | 97500 | 21550 | 24600 | 27700 | 30750 | 33250 | 35700 | 38150 | 40600 | 9999 | Kalawao County | Hawaii | 1 |
| HI | 1500799999 | 15 | 7 | NCNTY15007N15007 | Kauai County, HI | Kauai County | 101800 | 20450 | 23350 | 26250 | 29150 | 31500 | 33850 | 36150 | 38500 | 9999 | Kauai County | Hawaii | 0 |
| HI | 1500999999 | 15 | 9 | METRO27980M27980 | Kahului-Wailuku-Lahaina, HI MSA | Maui County | 97500 | 21550 | 24600 | 27700 | 30750 | 33250 | 35700 | 38150 | 40600 | 9999 | Maui County | Hawaii | 1 |
| ID | 1600199999 | 16 | 1 | METRO14260M14260 | Boise City, ID HUD Metro FMR Area | Ada County | 74800 | 15750 | 18000 | 20250 | 22450 | 24250 | 26050 | 27850 | 29650 | 1080 | Ada County | Idaho | 1 |
| ID | 1600399999 | 16 | 3 | NCNTY16003N16003 | Adams County, ID | Adams County | 59300 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Adams County | Idaho | 0 |
| ID | 1600599999 | 16 | 5 | METRO38540M38540 | Pocatello, ID MSA | Bannock County | 66000 | 13900 | 15850 | 17850 | 19800 | 21400 | 23000 | 24600 | 26150 | 6340 | Bannock County | Idaho | 1 |
| ID | 1600799999 | 16 | 7 | NCNTY16007N16007 | Bear Lake County, ID | Bear Lake County | 65700 | 13800 | 15800 | 17750 | 19700 | 21300 | 22900 | 24450 | 26050 | 9999 | Bear Lake County | Idaho | 0 |
| ID | 1600999999 | 16 | 9 | NCNTY16009N16009 | Benewah County, ID | Benewah County | 54900 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Benewah County | Idaho | 0 |
| ID | 1601199999 | 16 | 11 | NCNTY16011N16011 | Bingham County, ID | Bingham County | 64200 | 13500 | 15400 | 17350 | 19250 | 20800 | 22350 | 23900 | 25450 | 9999 | Bingham County | Idaho | 0 |
| ID | 1601399999 | 16 | 13 | NCNTY16013N16013 | Blaine County, ID | Blaine County | 78400 | 16450 | 18800 | 21150 | 23500 | 25400 | 27300 | 29150 | 31050 | 9999 | Blaine County | Idaho | 0 |
| ID | 1601599999 | 16 | 15 | METRO14260M14260 | Boise City, ID HUD Metro FMR Area | Boise County | 74800 | 15750 | 18000 | 20250 | 22450 | 24250 | 26050 | 27850 | 29650 | 9999 | Boise County | Idaho | 1 |
| ID | 1601799999 | 16 | 17 | NCNTY16017N16017 | Bonner County, ID | Bonner County | 61500 | 12950 | 14800 | 16650 | 18450 | 19950 | 21450 | 22900 | 24400 | 9999 | Bonner County | Idaho | 0 |
| ID | 1601999999 | 16 | 19 | METRO26820M26820 | Idaho Falls, ID HUD Metro FMR Area | Bonneville County | 70500 | 14850 | 16950 | 19050 | 21150 | 22850 | 24550 | 26250 | 27950 | 9999 | Bonneville County | Idaho | 1 |
| ID | 1602199999 | 16 | 21 | NCNTY16021N16021 | Boundary County, ID | Boundary County | 63900 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Boundary County | Idaho | 0 |
| ID | 1602399999 | 16 | 23 | METRO26820N16023 | Butte County, ID HUD Metro FMR Area | Butte County | 55200 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Butte County | Idaho | 1 |
| ID | 1602599999 | 16 | 25 | NCNTY16025N16025 | Camas County, ID | Camas County | 57200 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Camas County | Idaho | 0 |
| ID | 1602799999 | 16 | 27 | METRO14260M14260 | Boise City, ID HUD Metro FMR Area | Canyon County | 74800 | 15750 | 18000 | 20250 | 22450 | 24250 | 26050 | 27850 | 29650 | 1080 | Canyon County | Idaho | 1 |
| ID | 1602999999 | 16 | 29 | NCNTY16029N16029 | Caribou County, ID | Caribou County | 70400 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Caribou County | Idaho | 0 |
| ID | 1603199999 | 16 | 31 | NCNTY16031N16031 | Cassia County, ID | Cassia County | 55800 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Cassia County | Idaho | 0 |
| ID | 1603399999 | 16 | 33 | NCNTY16033N16033 | Clark County, ID | Clark County | 60900 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Clark County | Idaho | 0 |
| ID | 1603599999 | 16 | 35 | NCNTY16035N16035 | Clearwater County, ID | Clearwater County | 55600 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Clearwater County | Idaho | 0 |
| ID | 1603799999 | 16 | 37 | NCNTY16037N16037 | Custer County, ID | Custer County | 53900 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Custer County | Idaho | 0 |
| ID | 1603999999 | 16 | 39 | NCNTY16039N16039 | Elmore County, ID | Elmore County | 57000 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Elmore County | Idaho | 0 |
| ID | 1604199999 | 16 | 41 | METRO30860M30860 | Logan, UT-ID MSA | Franklin County | 71000 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Franklin County | Idaho | 1 |
| ID | 1604399999 | 16 | 43 | NCNTY16043N16043 | Fremont County, ID | Fremont County | 63000 | 13250 | 15150 | 17050 | 18900 | 20450 | 21950 | 23450 | 24950 | 9999 | Fremont County | Idaho | 0 |
| ID | 1604599999 | 16 | 45 | METRO14260N16045 | Gem County, ID HUD Metro FMR Area | Gem County | 53200 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Gem County | Idaho | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ID | 1604799999 | 16 | 47 | NCNTY16047N16047 | Gooding County, ID | Gooding County | 55900 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Gooding County | Idaho | 0 |
| ID | 1604999999 | 16 | 49 | NCNTY16049N16049 | Idaho County, ID | Idaho County | 53000 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Idaho County | Idaho | 0 |
| ID | 1605199999 | 16 | 51 | METRO26820M26820 | Idaho Falls, ID HUD Metro FMR Area | Jefferson County | 70500 | 14850 | 16950 | 19050 | 21150 | 22850 | 24550 | 26250 | 27950 | 9999 | Jefferson County | Idaho | 1 |
| ID | 1605399999 | 16 | 53 | NCNTY16053N16053 | Jerome County, ID | Jerome County | 55300 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Jerome County | Idaho | 0 |
| ID | 1605599999 | 16 | 55 | METRO17660M17660 | Coeur d'Alene, ID MSA | Kootenai County | 70400 | 14650 | 16750 | 18850 | 20900 | 22600 | 24250 | 25950 | 27600 | 9999 | Kootenai County | Idaho | 1 |
| ID | 1605799999 | 16 | 57 | NCNTY16057N16057 | Latah County, ID | Latah County | 70600 | 14850 | 17000 | 19100 | 21200 | 22900 | 24600 | 26300 | 28000 | 9999 | Latah County | Idaho | 0 |
| ID | 1605999999 | 16 | 59 | NCNTY16059N16059 | Lemhi County, ID | Lemhi County | 53000 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Lemhi County | Idaho | 0 |
| ID | 1606199999 | 16 | 61 | NCNTY16061N16061 | Lewis County, ID | Lewis County | 54000 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Lewis County | Idaho | 0 |
| ID | 1606399999 | 16 | 63 | NCNTY16063N16063 | Lincoln County, ID | Lincoln County | 58500 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Lincoln County | Idaho | 0 |
| ID | 1606599999 | 16 | 65 | NCNTY16065N16065 | Madison County, ID | Madison County | 38800 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Madison County | Idaho | 0 |
| ID | 1606799999 | 16 | 67 | NCNTY16067N16067 | Minidoka County, ID | Minidoka County | 55100 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Minidoka County | Idaho | 0 |
| ID | 1606999999 | 16 | 69 | METRO30300M30300 | Lewiston, ID-WA MSA | Nez Perce County | 73900 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Nez Perce County | Idaho | 1 |
| ID | 1607199999 | 16 | 71 | NCNTY16071N16071 | Oneida County, ID | Oneida County | 64600 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Oneida County | Idaho | 0 |
| ID | 1607399999 | 16 | 73 | METRO14260M14260 | Boise City, ID HUD Metro FMR Area | Owyhee County | 74800 | 15750 | 18000 | 20250 | 22450 | 24250 | 26050 | 27850 | 29650 | 9999 | Owyhee County | Idaho | 1 |
| ID | 1607599999 | 16 | 75 | NCNTY16075N16075 | Payette County, ID | Payette County | 59300 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Payette County | Idaho | 0 |
| ID | 1607799999 | 16 | 77 | NCNTY16077N16077 | Power County, ID | Power County | 58500 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Power County | Idaho | 0 |
| ID | 1607999999 | 16 | 79 | NCNTY16079N16079 | Shoshone County, ID | Shoshone County | 53600 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Shoshone County | Idaho | 0 |
| ID | 1608199999 | 16 | 81 | NCNTY16081N16081 | Teton County, ID | Teton County | 72800 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 9999 | Teton County | Idaho | 0 |
| ID | 1608399999 | 16 | 83 | NCNTY16083N16083 | Twin Falls County, ID | Twin Falls County | 60700 | 13050 | 14900 | 16750 | 18600 | 20100 | 21600 | 23100 | 24600 | 9999 | Twin Falls County | Idaho | 0 |
| ID | 1608599999 | 16 | 85 | NCNTY16085N16085 | Valley County, ID | Valley County | 67400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Valley County | Idaho | 0 |
| ID | 1608799999 | 16 | 87 | NCNTY16087N16087 | Washington County, ID | Washington County | 50900 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Washington County | Idaho | 0 |
| IL | 1700199999 | 17 | 1 | NCNTY17001N17001 | Adams County, IL | Adams County | 67300 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Adams County | Illinois | 0 |
| IL | 1700399999 | 17 | 3 | METRO16020M16020 | Cape Girardeau, MO-IL MSA | Alexander County | 67000 | 14100 | 16100 | 18100 | 20100 | 21750 | 23350 | 24950 | 26550 | 9999 | Alexander County | Illinois | 1 |
| IL | 1700599999 | 17 | 5 | METRO41180N17005 | Bond County, IL HUD Metro FMR Area | Bond County | 71900 | 15100 | 17250 | 19400 | 21550 | 23300 | 25000 | 26750 | 28450 | 9999 | Bond County | Illinois | 1 |
| IL | 1700799999 | 17 | 7 | METRO40420M40420 | Rockford, IL MSA | Boone County | 69600 | 14650 | 16750 | 18850 | 20900 | 22600 | 24250 | 25950 | 27600 | 6880 | Boone County | Illinois | 1 |
| IL | 1700999999 | 17 | 9 | NCNTY17009N17009 | Brown County, IL | Brown County | 77600 | 16350 | 18650 | 21000 | 23300 | 25200 | 27050 | 28900 | 30800 | 9999 | Brown County | Illinois | 0 |
| IL | 1701199999 | 17 | 11 | NCNTY17011N17011 | Bureau County, IL | Bureau County | 71400 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Bureau County | Illinois | 0 |
| IL | 1701399999 | 17 | 13 | METRO41180M41180 | St. Louis, MO-IL HUD Metro FMR Area | Calhoun County | 82900 | 17400 | 19900 | 22400 | 24850 | 26850 | 28850 | 30850 | 32850 | 9999 | Calhoun County | Illinois | 1 |
| IL | 1701599999 | 17 | 15 | NCNTY17015N17015 | Carroll County, IL | Carroll County | 67800 | 14250 | 16300 | 18350 | 20350 | 22000 | 23650 | 25250 | 26900 | 9999 | Carroll County | Illinois | 0 |
| IL | 1701799999 | 17 | 17 | NCNTY17017N17017 | Cass County, IL | Cass County | 64100 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Cass County | Illinois | 0 |
| IL | 1701999999 | 17 | 19 | METRO16580M16580 | Champaign-Urbana, IL MSA | Champaign County | 83600 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 1400 | Champaign County | Illinois | 1 |
| IL | 1702199999 | 17 | 21 | NCNTY17021N17021 | Christian County, IL | Christian County | 64300 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Christian County | Illinois | 0 |
| IL | 1702399999 | 17 | 23 | NCNTY17023N17023 | Clark County, IL | Clark County | 63700 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Clark County | Illinois | 0 |
| IL | 1702599999 | 17 | 25 | NCNTY17025N17025 | Clay County, IL | Clay County | 64500 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Clay County | Illinois | 0 |
| IL | 1702799999 | 17 | 27 | METRO41180M41180 | St. Louis, MO-IL HUD Metro FMR Area | Clinton County | 82900 | 17400 | 19900 | 22400 | 24850 | 26850 | 28850 | 30850 | 32850 | 7040 | Clinton County | Illinois | 1 |
| IL | 1702999999 | 17 | 29 | NCNTY17029N17029 | Coles County, IL | Coles County | 62800 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Coles County | Illinois | 0 |
| IL | 1703199999 | 17 | 31 | METRO16980M16980 | Chicago-Joliet-Naperville, IL HUD Metro FMR Area | Cook County | 91000 | 19150 | 21850 | 24600 | 27300 | 29500 | 31700 | 33900 | 36050 | 1600 | Cook County | Illinois | 1 |
| IL | 1703399999 | 17 | 33 | NCNTY17033N17033 | Crawford County, IL | Crawford County | 66000 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Crawford County | Illinois | 0 |
| IL | 1703599999 | 17 | 35 | NCNTY17035N17035 | Cumberland County, IL | Cumberland County | 67400 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Cumberland County | Illinois | 0 |
| IL | 1703799999 | 17 | 37 | METRO16980MM2050 | DeKalb County, IL HUD Metro FMR Area | DeKalb County | 83700 | 17550 | 20050 | 22550 | 25050 | 27100 | 29100 | 31100 | 33100 | 2050 | DeKalb County | Illinois | 1 |
| IL | 1703999999 | 17 | 39 | METRO14010N17039 | De Witt County, IL HUD Metro FMR Area | De Witt County | 72600 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | De Witt County | Illinois | 1 |
| IL | 1704199999 | 17 | 41 | NCNTY17041N17041 | Douglas County, IL | Douglas County | 68000 | 14300 | 16350 | 18400 | 20400 | 22050 | 23700 | 25300 | 26950 | 9999 | Douglas County | Illinois | 0 |
| IL | 1704399999 | 17 | 43 | METRO16980M16980 | Chicago-Joliet-Naperville, IL HUD Metro FMR Area | DuPage County | 91000 | 19150 | 21850 | 24600 | 27300 | 29500 | 31700 | 33900 | 36050 | 1600 | DuPage County | Illinois | 1 |
| IL | 1704599999 | 17 | 45 | NCNTY17045N17045 | Edgar County, IL | Edgar County | 63000 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Edgar County | Illinois | 0 |
| IL | 1704799999 | 17 | 47 | NCNTY17047N17047 | Edwards County, IL | Edwards County | 67700 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Edwards County | Illinois | 0 |
| IL | 1704999999 | 17 | 49 | NCNTY17049N17049 | Effingham County, IL | Effingham County | 75200 | 15800 | 18050 | 20300 | 22550 | 24400 | 26200 | 28000 | 29800 | 9999 | Effingham County | Illinois | 0 |
| IL | 1705199999 | 17 | 51 | NCNTY17051N17051 | Fayette County, IL | Fayette County | 57000 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Fayette County | Illinois | 0 |
| IL | 1705399999 | 17 | 53 | METRO16580M16580 | Champaign-Urbana, IL MSA | Ford County | 83600 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Ford County | Illinois | 1 |
| IL | 1705599999 | 17 | 55 | NCNTY17055N17055 | Franklin County, IL | Franklin County | 54200 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Franklin County | Illinois | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IL | 1705799999 | 17 | 57 | NCNTY17057N17057 | Fulton County, IL | Fulton County | 64200 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Fulton County | Illinois | 0 |
| IL | 1705999999 | 17 | 59 | NCNTY17059N17059 | Gallatin County, IL | Gallatin County | 55400 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Gallatin County | Illinois | 0 |
| IL | 1706199999 | 17 | 61 | NCNTY17061N17061 | Greene County, IL | Greene County | 57200 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Greene County | Illinois | 0 |
| IL | 1706399999 | 17 | 63 | METRO16980MM3170 | Grundy County, IL HUD Metro FMR Area | Grundy County | 88900 | 18700 | 21350 | 24000 | 26650 | 28800 | 30950 | 33050 | 35200 | 3170 | Grundy County | Illinois | 1 |
| IL | 1706599999 | 17 | 65 | NCNTY17065N17065 | Hamilton County, IL | Hamilton County | 62800 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Hamilton County | Illinois | 0 |
| IL | 1706799999 | 17 | 67 | NCNTY17067N17067 | Hancock County, IL | Hancock County | 65200 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Hancock County | Illinois | 0 |
| IL | 1706999999 | 17 | 69 | NCNTY17069N17069 | Hardin County, IL | Hardin County | 59100 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Hardin County | Illinois | 0 |
| IL | 1707199999 | 17 | 71 | NCNTY17071N17071 | Henderson County, IL | Henderson County | 58500 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Henderson County | Illinois | 0 |
| IL | 1707399999 | 17 | 73 | METRO19340M19340 | Davenport-Moline-Rock Island, IA-IL MSA | Henry County | 75400 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 1960 | Henry County | Illinois | 1 |
| IL | 1707599999 | 17 | 75 | NCNTY17075N17075 | Iroquois County, IL | Iroquois County | 64900 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Iroquois County | Illinois | 0 |
| IL | 1707799999 | 17 | 77 | METRO16060N17077 | Jackson County, IL HUD Metro FMR Area | Jackson County | 60300 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Jackson County | Illinois | 1 |
| IL | 1707999999 | 17 | 79 | NCNTY17079N17079 | Jasper County, IL | Jasper County | 71800 | 15100 | 17250 | 19400 | 21550 | 23300 | 25000 | 26750 | 28450 | 9999 | Jasper County | Illinois | 0 |
| IL | 1708199999 | 17 | 81 | NCNTY17081N17081 | Jefferson County, IL | Jefferson County | 62500 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Jefferson County | Illinois | 0 |
| IL | 1708399999 | 17 | 83 | METRO41180M41180 | St. Louis, MO-IL HUD Metro FMR Area | Jersey County | 82900 | 17400 | 19900 | 22400 | 24850 | 26850 | 28850 | 30850 | 32850 | 7040 | Jersey County | Illinois | 1 |
| IL | 1708599999 | 17 | 85 | NCNTY17085N17085 | Jo Daviess County, IL | Jo Daviess County | 76200 | 16000 | 18300 | 20600 | 22850 | 24700 | 26550 | 28350 | 30200 | 9999 | Jo Daviess County | Illinois | 0 |
| IL | 1708799999 | 17 | 87 | NCNTY17087N17087 | Johnson County, IL | Johnson County | 61300 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Johnson County | Illinois | 0 |
| IL | 1708999999 | 17 | 89 | METRO16980M16980 | Chicago-Joliet-Naperville, IL HUD Metro FMR Area | Kane County | 91000 | 19150 | 21850 | 24600 | 27300 | 29500 | 31700 | 33900 | 36050 | 1600 | Kane County | Illinois | 1 |
| IL | 1709199999 | 17 | 91 | METRO28100M28100 | Kankakee, IL MSA | Kankakee County | 76500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 3740 | Kankakee County | Illinois | 1 |
| IL | 1709399999 | 17 | 93 | METRO16980MM3780 | Kendall County, IL HUD Metro FMR Area | Kendall County | 107300 | 22550 | 25800 | 29000 | 32200 | 34800 | 37400 | 39950 | 42550 | 3780 | Kendall County | Illinois | 1 |
| IL | 1709599999 | 17 | 95 | NCNTY17095N17095 | Knox County, IL | Knox County | 61300 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Knox County | Illinois | 0 |
| IL | 1709799999 | 17 | 97 | METRO16980M16980 | Chicago-Joliet-Naperville, IL HUD Metro FMR Area | Lake County | 91000 | 19150 | 21850 | 24600 | 27300 | 29500 | 31700 | 33900 | 36050 | 1600 | Lake County | Illinois | 1 |
| IL | 1709999999 | 17 | 99 | NCNTY17099N17099 | La Salle County, IL | La Salle County | 69300 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | La Salle County | Illinois | 0 |
| IL | 1710199999 | 17 | 101 | NCNTY17101N17101 | Lawrence County, IL | Lawrence County | 59200 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Lawrence County | Illinois | 0 |
| IL | 1710399999 | 17 | 103 | NCNTY17103N17103 | Lee County, IL | Lee County | 76000 | 16000 | 18250 | 20550 | 22800 | 24650 | 26450 | 28300 | 30100 | 9999 | Lee County | Illinois | 0 |
| IL | 1710599999 | 17 | 105 | NCNTY17105N17105 | Livingston County, IL | Livingston County | 74200 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Livingston County | Illinois | 0 |
| IL | 1710799999 | 17 | 107 | NCNTY17107N17107 | Logan County, IL | Logan County | 75000 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Logan County | Illinois | 0 |
| IL | 1710999999 | 17 | 109 | NCNTY17109N17109 | McDonough County, IL | McDonough County | 71700 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | McDonough County | Illinois | 0 |
| IL | 1711199999 | 17 | 111 | METRO16980M16980 | Chicago-Joliet-Naperville, IL HUD Metro FMR Area | McHenry County | 91000 | 19150 | 21850 | 24600 | 27300 | 29500 | 31700 | 33900 | 36050 | 1600 | McHenry County | Illinois | 1 |
| IL | 1711399999 | 17 | 113 | METRO14010M14060 | Bloomington, IL HUD Metro FMR Area | McLean County | 98400 | 20050 | 22900 | 25750 | 28600 | 30900 | 33200 | 35500 | 37800 | 1040 | McLean County | Illinois | 1 |
| IL | 1711599999 | 17 | 115 | METRO19500M19500 | Decatur, IL MSA | Macon County | 71300 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 2040 | Macon County | Illinois | 1 |
| IL | 1711799999 | 17 | 117 | METRO41180N17117 | Macoupin County, IL HUD Metro FMR Area | Macoupin County | 68900 | 14500 | 16550 | 18600 | 20650 | 22350 | 24000 | 25650 | 27300 | 9999 | Macoupin County | Illinois | 1 |
| IL | 1711999999 | 17 | 119 | METRO41180M41180 | St. Louis, MO-IL HUD Metro FMR Area | Madison County | 82900 | 17400 | 19900 | 22400 | 24850 | 26850 | 28850 | 30850 | 32850 | 7040 | Madison County | Illinois | 1 |
| IL | 1712199999 | 17 | 121 | NCNTY17121N17121 | Marion County, IL | Marion County | 60000 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Marion County | Illinois | 0 |
| IL | 1712399999 | 17 | 123 | METRO37900M37900 | Peoria, IL MSA | Marshall County | 79600 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 9999 | Marshall County | Illinois | 1 |
| IL | 1712599999 | 17 | 125 | NCNTY17125N17125 | Mason County, IL | Mason County | 59900 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Mason County | Illinois | 0 |
| IL | 1712799999 | 17 | 127 | NCNTY17127N17127 | Massac County, IL | Massac County | 60100 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Massac County | Illinois | 0 |
| IL | 1712999999 | 17 | 129 | METRO44100M44100 | Springfield, IL MSA | Menard County | 85200 | 17300 | 19800 | 22250 | 24700 | 26700 | 28700 | 30650 | 32650 | 7880 | Menard County | Illinois | 1 |
| IL | 1713199999 | 17 | 131 | METRO19340M19340 | Davenport-Moline-Rock Island, IA-IL MSA | Mercer County | 75400 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Mercer County | Illinois | 1 |
| IL | 1713399999 | 17 | 133 | METRO41180M41180 | St. Louis, MO-IL HUD Metro FMR Area | Monroe County | 82900 | 17400 | 19900 | 22400 | 24850 | 26850 | 28850 | 30850 | 32850 | 7040 | Monroe County | Illinois | 1 |
| IL | 1713599999 | 17 | 135 | NCNTY17135N17135 | Montgomery County, IL | Montgomery County | 63500 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Montgomery County | Illinois | 0 |
| IL | 1713799999 | 17 | 137 | NCNTY17137N17137 | Morgan County, IL | Morgan County | 65400 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Morgan County | Illinois | 0 |
| IL | 1713999999 | 17 | 139 | NCNTY17139N17139 | Moultrie County, IL | Moultrie County | 67000 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Moultrie County | Illinois | 0 |
| IL | 1714199999 | 17 | 141 | NCNTY17141N17141 | Ogle County, IL | Ogle County | 75100 | 15800 | 18050 | 20300 | 22550 | 24400 | 26200 | 28000 | 29800 | 6880 | Ogle County | Illinois | 0 |
| IL | 1714399999 | 17 | 143 | METRO37900M37900 | Peoria, IL MSA | Peoria County | 79600 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 6120 | Peoria County | Illinois | 1 |
| IL | 1714599999 | 17 | 145 | NCNTY17145N17145 | Perry County, IL | Perry County | 68200 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Perry County | Illinois | 0 |
| IL | 1714799999 | 17 | 147 | METRO16580M16580 | Champaign-Urbana, IL MSA | Piatt County | 83600 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Piatt County | Illinois | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IL | 1714999999 | 17 | 149 | NCNTY17149N17149 | Pike County, IL | Pike County | 56400 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Pike County | Illinois | 0 |
| IL | 1715199999 | 17 | 151 | NCNTY17151N17151 | Pope County, IL | Pope County | 60800 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Pope County | Illinois | 0 |
| IL | 1715399999 | 17 | 153 | NCNTY17153N17153 | Pulaski County, IL | Pulaski County | 54400 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Pulaski County | Illinois | 0 |
| IL | 1715599999 | 17 | 155 | NCNTY17155N17155 | Putnam County, IL | Putnam County | 84100 | 17700 | 20200 | 22750 | 25250 | 27300 | 29300 | 31350 | 33350 | 9999 | Putnam County | Illinois | 0 |
| IL | 1715799999 | 17 | 157 | NCNTY17157N17157 | Randolph County, IL | Randolph County | 69100 | 14550 | 16600 | 18700 | 20750 | 22450 | 24100 | 25750 | 27400 | 9999 | Randolph County | Illinois | 0 |
| IL | 1715999999 | 17 | 159 | NCNTY17159N17159 | Richland County, IL | Richland County | 62100 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Richland County | Illinois | 0 |
| IL | 1716199999 | 17 | 161 | METRO19340M19340 | Davenport-Moline-Rock Island, IA-IL MSA | Rock Island County | 75400 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 1960 | Rock Island County | Illinois | 1 |
| IL | 1716399999 | 17 | 163 | METRO41180M41180 | St. Louis, MO-IL HUD Metro FMR Area | St. Clair County | 82900 | 17400 | 19900 | 22400 | 24850 | 26850 | 28850 | 30850 | 32850 | 7040 | St. Clair County | Illinois | 1 |
| IL | 1716599999 | 17 | 165 | NCNTY17165N17165 | Saline County, IL | Saline County | 55100 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Saline County | Illinois | 0 |
| IL | 1716799999 | 17 | 167 | METRO44100M44100 | Springfield, IL MSA | Sangamon County | 85200 | 17300 | 19800 | 22250 | 24700 | 26700 | 28700 | 30650 | 32650 | 7880 | Sangamon County | Illinois | 1 |
| IL | 1716999999 | 17 | 169 | NCNTY17169N17169 | Schuyler County, IL | Schuyler County | 63500 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Schuyler County | Illinois | 0 |
| IL | 1717199999 | 17 | 171 | NCNTY17171N17171 | Scott County, IL | Scott County | 68700 | 14450 | 16500 | 18550 | 20600 | 22250 | 23900 | 25550 | 27200 | 9999 | Scott County | Illinois | 0 |
| IL | 1717399999 | 17 | 173 | NCNTY17173N17173 | Shelby County, IL | Shelby County | 63300 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Shelby County | Illinois | 0 |
| IL | 1717599999 | 17 | 175 | METRO37900M37900 | Peoria, IL MSA | Stark County | 79600 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 9999 | Stark County | Illinois | 1 |
| IL | 1717799999 | 17 | 177 | NCNTY17177N17177 | Stephenson County, IL | Stephenson County | 62100 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Stephenson County | Illinois | 0 |
| IL | 1717999999 | 17 | 179 | METRO37900M37900 | Peoria, IL MSA | Tazewell County | 79600 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 6120 | Tazewell County | Illinois | 1 |
| IL | 1718199999 | 17 | 181 | NCNTY17181N17181 | Union County, IL | Union County | 58600 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Union County | Illinois | 0 |
| IL | 1718399999 | 17 | 183 | METRO19180M19180 | Danville, IL MSA | Vermilion County | 55600 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Vermilion County | Illinois | 1 |
| IL | 1718599999 | 17 | 185 | NCNTY17185N17185 | Wabash County, IL | Wabash County | 69000 | 14500 | 16600 | 18650 | 20700 | 22400 | 24050 | 25700 | 27350 | 9999 | Wabash County | Illinois | 0 |
| IL | 1718799999 | 17 | 187 | NCNTY17187N17187 | Warren County, IL | Warren County | 63400 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Warren County | Illinois | 0 |
| IL | 1718999999 | 17 | 189 | NCNTY17189N17189 | Washington County, IL | Washington County | 74300 | 15650 | 17850 | 20100 | 22300 | 24100 | 25900 | 27700 | 29450 | 9999 | Washington County | Illinois | 0 |
| IL | 1719199999 | 17 | 191 | NCNTY17191N17191 | Wayne County, IL | Wayne County | 60600 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Wayne County | Illinois | 0 |
| IL | 1719399999 | 17 | 193 | NCNTY17193N17193 | White County, IL | White County | 62200 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | White County | Illinois | 0 |
| IL | 1719599999 | 17 | 195 | NCNTY17195N17195 | Whiteside County, IL | Whiteside County | 68100 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Whiteside County | Illinois | 0 |
| IL | 1719799999 | 17 | 197 | METRO16980M16980 | Chicago-Joliet-Naperville, IL HUD Metro FMR Area | Will County | 91000 | 19150 | 21850 | 24600 | 27300 | 29500 | 31700 | 33900 | 36050 | 1600 | Will County | Illinois | 1 |
| IL | 1719999999 | 17 | 199 | METRO16060N17199 | Williamson County, IL HUD Metro FMR Area | Williamson County | 73000 | 15350 | 17550 | 19750 | 21900 | 23700 | 25450 | 27200 | 28950 | 9999 | Williamson County | Illinois | 1 |
| IL | 1720199999 | 17 | 201 | METRO40420M40420 | Rockford, IL MSA | Winnebago County | 69600 | 14650 | 16750 | 18850 | 20900 | 22600 | 24250 | 25950 | 27600 | 6880 | Winnebago County | Illinois | 1 |
| IL | 1720399999 | 17 | 203 | METRO37900M37900 | Peoria, IL MSA | Woodford County | 79600 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 6120 | Woodford County | Illinois | 1 |
| IN | 1800199999 | 18 | 1 | NCNTY18001N18001 | Adams County, IN | Adams County | 64800 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 2760 | Adams County | Indiana | 0 |
| IN | 1800399999 | 18 | 3 | METRO23060M23060 | Fort Wayne, IN MSA | Allen County | 71100 | 14950 | 17100 | 19250 | 21350 | 23100 | 24800 | 26500 | 28200 | 2760 | Allen County | Indiana | 1 |
| IN | 1800599999 | 18 | 5 | METRO18020M18020 | Columbus, IN MSA | Bartholomew County | 81300 | 16350 | 18700 | 21050 | 23350 | 25250 | 27100 | 29000 | 30850 | 9999 | Bartholomew County | Indiana | 1 |
| IN | 1800799999 | 18 | 7 | METRO29200M29140 | Lafayette-West Lafayette, IN HUD Metro FMR Area | Benton County | 79100 | 15950 | 18200 | 20500 | 22750 | 24600 | 26400 | 28250 | 30050 | 9999 | Benton County | Indiana | 1 |
| IN | 1800999999 | 18 | 9 | NCNTY18009N18009 | Blackford County, IN | Blackford County | 55000 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Blackford County | Indiana | 0 |
| IN | 1801199999 | 18 | 11 | METRO26900M26900 | Indianapolis-Carmel, IN HUD Metro FMR Area | Boone County | 82000 | 17250 | 19700 | 22150 | 24600 | 26600 | 28550 | 30550 | 32500 | 3480 | Boone County | Indiana | 1 |
| IN | 1801399999 | 18 | 13 | METRO26900M26900 | Indianapolis-Carmel, IN HUD Metro FMR Area | Brown County | 82000 | 17250 | 19700 | 22150 | 24600 | 26600 | 28550 | 30550 | 32500 | 9999 | Brown County | Indiana | 1 |
| IN | 1801599999 | 18 | 15 | METRO29200N18015 | Carroll County, IN HUD Metro FMR Area | Carroll County | 67400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Carroll County | Indiana | 1 |
| IN | 1801799999 | 18 | 17 | NCNTY18017N18017 | Cass County, IN | Cass County | 60500 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Cass County | Indiana | 0 |
| IN | 1801999999 | 18 | 19 | METRO31140M31140 | Louisville, KY-IN HUD Metro FMR Area | Clark County | 77500 | 16300 | 18600 | 20950 | 23250 | 25150 | 27000 | 28850 | 30700 | 4520 | Clark County | Indiana | 1 |
| IN | 1802199999 | 18 | 21 | METRO45460M45460 | Terre Haute, IN HUD Metro FMR Area | Clay County | 63900 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 8320 | Clay County | Indiana | 1 |
| IN | 1802399999 | 18 | 23 | NCNTY18023N18023 | Clinton County, IN | Clinton County | 66800 | 14050 | 16050 | 18050 | 20050 | 21700 | 23300 | 24900 | 26500 | 3920 | Clinton County | Indiana | 0 |
| IN | 1802599999 | 18 | 25 | NCNTY18025N18025 | Crawford County, IN | Crawford County | 52900 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Crawford County | Indiana | 0 |
| IN | 1802799999 | 18 | 27 | NCNTY18027N18027 | Daviess County, IN | Daviess County | 63700 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Daviess County | Indiana | 0 |
| IN | 1802999999 | 18 | 29 | METRO17140M17140 | Cincinnati, OH-KY-IN HUD Metro FMR Area | Dearborn County | 86300 | 18150 | 20750 | 23350 | 25900 | 28000 | 30050 | 32150 | 34200 | 1640 | Dearborn County | Indiana | 1 |
| IN | 1803199999 | 18 | 31 | NCNTY18031N18031 | Decatur County, IN | Decatur County | 64400 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Decatur County | Indiana | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IN | 1803399999 | 18 | 33 | NCNTY18033N18033 | DeKalb County, IN | DeKalb County | 66600 | 14000 | 16000 | 18000 | 20000 | 21600 | 23200 | 24800 | 26400 | 2760 | DeKalb County | Indiana | 0 |
| IN | 1803599999 | 18 | 35 | METRO34620M34620 | Muncie, IN MSA | Delaware County | 64600 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 5280 | Delaware County | Indiana | 1 |
| IN | 1803799999 | 18 | 37 | NCNTY18037N18037 | Dubois County, IN | Dubois County | 77900 | 16350 | 18700 | 21050 | 23350 | 25250 | 27100 | 29000 | 30850 | 9999 | Dubois County | Indiana | 0 |
| IN | 1803999999 | 18 | 39 | METRO21140M21140 | Elkhart-Goshen, IN MSA | Elkhart County | 70200 | 14750 | 16850 | 18950 | 21050 | 22750 | 24450 | 26150 | 27800 | 2330 | Elkhart County | Indiana | 1 |
| IN | 1804199999 | 18 | 41 | NCNTY18041N18041 | Fayette County, IN | Fayette County | 53700 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Fayette County | Indiana | 0 |
| IN | 1804399999 | 18 | 43 | METRO31140M31140 | Louisville, KY-IN HUD Metro FMR Area | Floyd County | 77500 | 16300 | 18600 | 20950 | 23250 | 25150 | 27000 | 28850 | 30700 | 4520 | Floyd County | Indiana | 1 |
| IN | 1804599999 | 18 | 45 | NCNTY18045N18045 | Fountain County, IN | Fountain County | 59600 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Fountain County | Indiana | 0 |
| IN | 1804799999 | 18 | 47 | NCNTY18047N18047 | Franklin County, IN | Franklin County | 69500 | 14600 | 16700 | 18800 | 20850 | 22550 | 24200 | 25900 | 27550 | 9999 | Franklin County | Indiana | 0 |
| IN | 1804999999 | 18 | 49 | NCNTY18049N18049 | Fulton County, IN | Fulton County | 62100 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Fulton County | Indiana | 0 |
| IN | 1805199999 | 18 | 51 | NCNTY18051N18051 | Gibson County, IN | Gibson County | 68300 | 14350 | 16400 | 18450 | 20500 | 22150 | 23800 | 25450 | 27100 | 9999 | Gibson County | Indiana | 0 |
| IN | 1805399999 | 18 | 53 | NCNTY18053N18053 | Grant County, IN | Grant County | 58500 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Grant County | Indiana | 0 |
| IN | 1805599999 | 18 | 55 | NCNTY18055N18055 | Greene County, IN | Greene County | 64700 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Greene County | Indiana | 0 |
| IN | 1805799999 | 18 | 57 | METRO26900M26900 | Indianapolis-Carmel, IN HUD Metro FMR Area | Hamilton County | 82000 | 17250 | 19700 | 22150 | 24600 | 26600 | 28550 | 30550 | 32500 | 3480 | Hamilton County | Indiana | 1 |
| IN | 1805999999 | 18 | 59 | METRO26900M26900 | Indianapolis-Carmel, IN HUD Metro FMR Area | Hancock County | 82000 | 17250 | 19700 | 22150 | 24600 | 26600 | 28550 | 30550 | 32500 | 3480 | Hancock County | Indiana | 1 |
| IN | 1806199999 | 18 | 61 | METRO31140M31140 | Louisville, KY-IN HUD Metro FMR Area | Harrison County | 77500 | 16300 | 18600 | 20950 | 23250 | 25150 | 27000 | 28850 | 30700 | 4520 | Harrison County | Indiana | 1 |
| IN | 1806399999 | 18 | 63 | METRO26900M26900 | Indianapolis-Carmel, IN HUD Metro FMR Area | Hendricks County | 82000 | 17250 | 19700 | 22150 | 24600 | 26600 | 28550 | 30550 | 32500 | 3480 | Hendricks County | Indiana | 1 |
| IN | 1806599999 | 18 | 65 | NCNTY18065N18065 | Henry County, IN | Henry County | 60600 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Henry County | Indiana | 0 |
| IN | 1806799999 | 18 | 67 | METRO29020M29020 | Kokomo, IN MSA | Howard County | 63900 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 3850 | Howard County | Indiana | 1 |
| IN | 1806999999 | 18 | 69 | NCNTY18069N18069 | Huntington County, IN | Huntington County | 64800 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 2760 | Huntington County | Indiana | 0 |
| IN | 1807199999 | 18 | 71 | NCNTY18071N18071 | Jackson County, IN | Jackson County | 64300 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Jackson County | Indiana | 0 |
| IN | 1807399999 | 18 | 73 | METRO16980N18073 | Jasper County, IN HUD Metro FMR Area | Jasper County | 69000 | 14500 | 16600 | 18650 | 20700 | 22400 | 24050 | 25700 | 27350 | 9999 | Jasper County | Indiana | 1 |
| IN | 1807599999 | 18 | 75 | NCNTY18075N18075 | Jay County, IN | Jay County | 58800 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Jay County | Indiana | 0 |
| IN | 1807799999 | 18 | 77 | NCNTY18077N18077 | Jefferson County, IN | Jefferson County | 64100 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Jefferson County | Indiana | 0 |
| IN | 1807999999 | 18 | 79 | NCNTY18079N18079 | Jennings County, IN | Jennings County | 61300 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Jennings County | Indiana | 0 |
| IN | 1808199999 | 18 | 81 | METRO26900M26900 | Indianapolis-Carmel, IN HUD Metro FMR Area | Johnson County | 82000 | 17250 | 19700 | 22150 | 24600 | 26600 | 28550 | 30550 | 32500 | 3480 | Johnson County | Indiana | 1 |
| IN | 1808399999 | 18 | 83 | NCNTY18083N18083 | Knox County, IN | Knox County | 60000 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Knox County | Indiana | 0 |
| IN | 1808599999 | 18 | 85 | NCNTY18085N18085 | Kosciusko County, IN | Kosciusko County | 74700 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Kosciusko County | Indiana | 0 |
| IN | 1808799999 | 18 | 87 | NCNTY18087N18087 | LaGrange County, IN | LaGrange County | 67700 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | LaGrange County | Indiana | 0 |
| IN | 1808999999 | 18 | 89 | METRO16980MM2960 | Gary, IN HUD Metro FMR Area | Lake County | 74900 | 15750 | 18000 | 20250 | 22450 | 24250 | 26050 | 27850 | 29650 | 2960 | Lake County | Indiana | 1 |
| IN | 1809199999 | 18 | 91 | METRO33140M33140 | Michigan City-La Porte, IN MSA | LaPorte County | 65200 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | LaPorte County | Indiana | 1 |
| IN | 1809399999 | 18 | 93 | NCNTY18093N18093 | Lawrence County, IN | Lawrence County | 62800 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Lawrence County | Indiana | 0 |
| IN | 1809599999 | 18 | 95 | METRO26900M11300 | Anderson, IN HUD Metro FMR Area | Madison County | 58000 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 3480 | Madison County | Indiana | 1 |
| IN | 1809799999 | 18 | 97 | METRO26900M26900 | Indianapolis-Carmel, IN HUD Metro FMR Area | Marion County | 82000 | 17250 | 19700 | 22150 | 24600 | 26600 | 28550 | 30550 | 32500 | 3480 | Marion County | Indiana | 1 |
| IN | 1809999999 | 18 | 99 | NCNTY18099N18099 | Marshall County, IN | Marshall County | 65900 | 13850 | 15800 | 17800 | 19750 | 21350 | 22950 | 24500 | 26100 | 9999 | Marshall County | Indiana | 0 |
| IN | 1810199999 | 18 | 101 | NCNTY18101N18101 | Martin County, IN | Martin County | 63100 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Martin County | Indiana | 0 |
| IN | 1810399999 | 18 | 103 | NCNTY18103N18103 | Miami County, IN | Miami County | 61400 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Miami County | Indiana | 0 |
| IN | 1810599999 | 18 | 105 | METRO14020MM1020 | Bloomington, IN HUD Metro FMR Area | Monroe County | 74900 | 15750 | 18000 | 20250 | 22450 | 24250 | 26050 | 27850 | 29650 | 1020 | Monroe County | Indiana | 1 |
| IN | 1810799999 | 18 | 107 | NCNTY18107N18107 | Montgomery County, IN | Montgomery County | 67900 | 14250 | 16300 | 18350 | 20350 | 22000 | 23650 | 25250 | 26900 | 9999 | Montgomery County | Indiana | 0 |
| IN | 1810999999 | 18 | 109 | METRO26900M26900 | Indianapolis-Carmel, IN HUD Metro FMR Area | Morgan County | 82000 | 17250 | 19700 | 22150 | 24600 | 26600 | 28550 | 30550 | 32500 | 3480 | Morgan County | Indiana | 1 |
| IN | 1811199999 | 18 | 111 | METRO16980MM2960 | Gary, IN HUD Metro FMR Area | Newton County | 74900 | 15750 | 18000 | 20250 | 22450 | 24250 | 26050 | 27850 | 29650 | 9999 | Newton County | Indiana | 1 |
| IN | 1811399999 | 18 | 113 | NCNTY18113N18113 | Noble County, IN | Noble County | 67400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Noble County | Indiana | 0 |
| IN | 1811599999 | 18 | 115 | METRO17140M17140 | Cincinnati, OH-KY-IN  HUD Metro FMR Area | Ohio County | 86300 | 18150 | 20750 | 23350 | 25900 | 28000 | 30050 | 32150 | 34200 | 5840 | Ohio County | Indiana | 1 |
| IN | 1811799999 | 18 | 117 | NCNTY18117N18117 | Orange County, IN | Orange County | 57100 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Orange County | Indiana | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IN | 1811999999 | 18 | 119 | METRO14020N18119 | Owen County, IN HUD Metro FMR Area | Owen County | 64300 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Owen County | Indiana | 1 |
| IN | 1812199999 | 18 | 121 | NCNTY18121N18121 | Parke County, IN | Parke County | 56800 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Parke County | Indiana | 0 |
| IN | 1812399999 | 18 | 123 | NCNTY18123N18123 | Perry County, IN | Perry County | 64600 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Perry County | Indiana | 0 |
| IN | 1812599999 | 18 | 125 | NCNTY18125N18125 | Pike County, IN | Pike County | 65800 | 13850 | 15800 | 17800 | 19750 | 21350 | 22950 | 24500 | 26100 | 9999 | Pike County | Indiana | 0 |
| IN | 1812799999 | 18 | 127 | METRO16980MM2960 | Gary, IN HUD Metro FMR Area | Porter County | 74900 | 15750 | 18000 | 20250 | 22450 | 24250 | 26050 | 27850 | 29650 | 2960 | Porter County | Indiana | 1 |
| IN | 1812999999 | 18 | 129 | METRO21780M21780 | Evansville, IN-KY MSA | Posey County | 74800 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 2440 | Posey County | Indiana | 1 |
| IN | 1813199999 | 18 | 131 | NCNTY18131N18131 | Pulaski County, IN | Pulaski County | 59400 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Pulaski County | Indiana | 0 |
| IN | 1813399999 | 18 | 133 | METRO26900N18133 | Putnam County, IN HUD Metro FMR Area | Putnam County | 70100 | 14750 | 16850 | 18950 | 21050 | 22750 | 24450 | 26150 | 27800 | 9999 | Putnam County | Indiana | 1 |
| IN | 1813599999 | 18 | 135 | NCNTY18135N18135 | Randolph County, IN | Randolph County | 59400 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Randolph County | Indiana | 0 |
| IN | 1813799999 | 18 | 137 | NCNTY18137N18137 | Ripley County, IN | Ripley County | 66600 | 14000 | 16000 | 18000 | 20000 | 21600 | 23200 | 24800 | 26400 | 9999 | Ripley County | Indiana | 0 |
| IN | 1813999999 | 18 | 139 | NCNTY18139N18139 | Rush County, IN | Rush County | 62600 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Rush County | Indiana | 0 |
| IN | 1814199999 | 18 | 141 | METRO43780M43780 | South Bend-Mishawaka, IN HUD Metro FMR Area | St. Joseph County | 70800 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 7800 | St. Joseph County | Indiana | 1 |
| IN | 1814399999 | 18 | 143 | METRO31140N18143 | Scott County, IN HUD Metro FMR Area | Scott County | 61600 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 4520 | Scott County | Indiana | 1 |
| IN | 1814599999 | 18 | 145 | METRO26900M26900 | Indianapolis-Carmel, IN HUD Metro FMR Area | Shelby County | 82000 | 17250 | 19700 | 22150 | 24600 | 26600 | 28550 | 30550 | 32500 | 3480 | Shelby County | Indiana | 1 |
| IN | 1814799999 | 18 | 147 | NCNTY18147N18147 | Spencer County, IN | Spencer County | 73500 | 15450 | 17650 | 19850 | 22050 | 23850 | 25600 | 27350 | 29150 | 9999 | Spencer County | Indiana | 0 |
| IN | 1814999999 | 18 | 149 | NCNTY18149N18149 | Starke County, IN | Starke County | 58100 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Starke County | Indiana | 0 |
| IN | 1815199999 | 18 | 151 | NCNTY18151N18151 | Steuben County, IN | Steuben County | 66400 | 13950 | 15950 | 17950 | 19900 | 21500 | 23100 | 24700 | 26300 | 9999 | Steuben County | Indiana | 0 |
| IN | 1815399999 | 18 | 153 | METRO45460N18153 | Sullivan County, IN HUD Metro FMR Area | Sullivan County | 60900 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Sullivan County | Indiana | 1 |
| IN | 1815599999 | 18 | 155 | NCNTY18155N18155 | Switzerland County, IN | Switzerland County | 53700 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Switzerland County | Indiana | 0 |
| IN | 1815799999 | 18 | 157 | METRO29200M29140 | Lafayette-West Lafayette, IN HUD Metro FMR Area | Tippecanoe County | 79100 | 15950 | 18200 | 20500 | 22750 | 24600 | 26400 | 28250 | 30050 | 3920 | Tippecanoe County | Indiana | 1 |
| IN | 1815999999 | 18 | 159 | NCNTY18159N18159 | Tipton County, IN | Tipton County | 70900 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 3850 | Tipton County | Indiana | 0 |
| IN | 1816199999 | 18 | 161 | METRO17140N18161 | Union County, IN HUD Metro FMR Area | Union County | 61300 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Union County | Indiana | 1 |
| IN | 1816399999 | 18 | 163 | METRO21780M21780 | Evansville, IN-KY MSA | Vanderburgh County | 74800 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 2440 | Vanderburgh County | Indiana | 1 |
| IN | 1816599999 | 18 | 165 | METRO45460M45460 | Terre Haute, IN HUD Metro FMR Area | Vermillion County | 63900 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 8320 | Vermillion County | Indiana | 1 |
| IN | 1816799999 | 18 | 167 | METRO45460M45460 | Terre Haute, IN HUD Metro FMR Area | Vigo County | 63900 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 8320 | Vigo County | Indiana | 1 |
| IN | 1816999999 | 18 | 169 | NCNTY18169N18169 | Wabash County, IN | Wabash County | 62200 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Wabash County | Indiana | 0 |
| IN | 1817199999 | 18 | 171 | NCNTY18171N18171 | Warren County, IN | Warren County | 69500 | 14600 | 16700 | 18800 | 20850 | 22550 | 24200 | 25900 | 27550 | 9999 | Warren County | Indiana | 0 |
| IN | 1817399999 | 18 | 173 | METRO21780M21780 | Evansville, IN-KY MSA | Warrick County | 74800 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 2440 | Warrick County | Indiana | 1 |
| IN | 1817599999 | 18 | 175 | METRO31140N18175 | Washington County, IN HUD Metro FMR Area | Washington County | 60400 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Washington County | Indiana | 1 |
| IN | 1817799999 | 18 | 177 | NCNTY18177N18177 | Wayne County, IN | Wayne County | 61600 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Wayne County | Indiana | 0 |
| IN | 1817999999 | 18 | 179 | METRO23060M23060 | Fort Wayne, IN MSA | Wells County | 71100 | 14950 | 17100 | 19250 | 21350 | 23100 | 24800 | 26500 | 28200 | 2760 | Wells County | Indiana | 1 |
| IN | 1818199999 | 18 | 181 | NCNTY18181N18181 | White County, IN | White County | 66200 | 13900 | 15900 | 17900 | 19850 | 21450 | 23050 | 24650 | 26250 | 9999 | White County | Indiana | 0 |
| IN | 1818399999 | 18 | 183 | METRO23060M23060 | Fort Wayne, IN MSA | Whitley County | 71100 | 14950 | 17100 | 19250 | 21350 | 23100 | 24800 | 26500 | 28200 | 2760 | Whitley County | Indiana | 1 |
| IA | 1900199999 | 19 | 1 | NCNTY19001N19001 | Adair County, IA | Adair County | 66600 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Adair County | Iowa | 0 |
| IA | 1900399999 | 19 | 3 | NCNTY19003N19003 | Adams County, IA | Adams County | 65700 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Adams County | Iowa | 0 |
| IA | 1900599999 | 19 | 5 | NCNTY19005N19005 | Allamakee County, IA | Allamakee County | 68400 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Allamakee County | Iowa | 0 |
| IA | 1900799999 | 19 | 7 | NCNTY19007N19007 | Appanoose County, IA | Appanoose County | 57200 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Appanoose County | Iowa | 0 |
| IA | 1900999999 | 19 | 9 | NCNTY19009N19009 | Audubon County, IA | Audubon County | 65700 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Audubon County | Iowa | 0 |
| IA | 1901199999 | 19 | 11 | METRO16300N19011 | Benton County, IA HUD Metro FMR Area | Benton County | 85100 | 17900 | 20450 | 23000 | 25550 | 27600 | 29650 | 31700 | 33750 | 9999 | Benton County | Iowa | 1 |
| IA | 1901399999 | 19 | 13 | METRO47940M47940 | Waterloo-Cedar Falls, IA HUD Metro FMR Area | Black Hawk County | 71600 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 8920 | Black Hawk County | Iowa | 1 |
| IA | 1901599999 | 19 | 15 | NCNTY19015N19015 | Boone County, IA | Boone County | 77700 | 16350 | 18650 | 21000 | 23300 | 25200 | 27050 | 28900 | 30800 | 9999 | Boone County | Iowa | 0 |
| IA | 1901799999 | 19 | 17 | METRO47940N19017 | Bremer County, IA HUD Metro FMR Area | Bremer County | 87600 | 18450 | 21050 | 23700 | 26300 | 28450 | 30550 | 32650 | 34750 | 9999 | Bremer County | Iowa | 1 |
| IA | 1901999999 | 19 | 19 | NCNTY19019N19019 | Buchanan County, IA | Buchanan County | 79200 | 16650 | 19000 | 21400 | 23750 | 25650 | 27550 | 29450 | 31350 | 9999 | Buchanan County | Iowa | 0 |
| IA | 1902199999 | 19 | 21 | NCNTY19021N19021 | Buena Vista County, IA | Buena Vista County | 68600 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Buena Vista County | Iowa | 0 |
| IA | 1902399999 | 19 | 23 | NCNTY19023N19023 | Butler County, IA | Butler County | 71600 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Butler County | Iowa | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA | 1902599999 | 19 | 25 | NCNTY19025N19025 | Calhoun County, IA | Calhoun County | 63000 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Calhoun County | Iowa | 0 |
| IA | 1902799999 | 19 | 27 | NCNTY19027N19027 | Carroll County, IA | Carroll County | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 9999 | Carroll County | Iowa | 0 |
| IA | 1902999999 | 19 | 29 | NCNTY19029N19029 | Cass County, IA | Cass County | 61600 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Cass County | Iowa | 0 |
| IA | 1903199999 | 19 | 31 | NCNTY19031N19031 | Cedar County, IA | Cedar County | 82500 | 17350 | 19800 | 22300 | 24750 | 26750 | 28750 | 30700 | 32700 | 9999 | Cedar County | Iowa | 0 |
| IA | 1903399999 | 19 | 33 | NCNTY19033N19033 | Cerro Gordo County, IA | Cerro Gordo County | 71700 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Cerro Gordo County | Iowa | 0 |
| IA | 1903599999 | 19 | 35 | NCNTY19035N19035 | Cherokee County, IA | Cherokee County | 73200 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Cherokee County | Iowa | 0 |
| IA | 1903799999 | 19 | 37 | NCNTY19037N19037 | Chickasaw County, IA | Chickasaw County | 73200 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Chickasaw County | Iowa | 0 |
| IA | 1903999999 | 19 | 39 | NCNTY19039N19039 | Clarke County, IA | Clarke County | 66000 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Clarke County | Iowa | 0 |
| IA | 1904199999 | 19 | 41 | NCNTY19041N19041 | Clay County, IA | Clay County | 68500 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Clay County | Iowa | 0 |
| IA | 1904399999 | 19 | 43 | NCNTY19043N19043 | Clayton County, IA | Clayton County | 69500 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Clayton County | Iowa | 0 |
| IA | 1904599999 | 19 | 45 | NCNTY19045N19045 | Clinton County, IA | Clinton County | 71700 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Clinton County | Iowa | 0 |
| IA | 1904799999 | 19 | 47 | NCNTY19047N19047 | Crawford County, IA | Crawford County | 63100 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Crawford County | Iowa | 0 |
| IA | 1904999999 | 19 | 49 | METRO19780M19780 | Des Moines-West Des Moines, IA MSA | Dallas County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 2120 | Dallas County | Iowa | 1 |
| IA | 1905199999 | 19 | 51 | NCNTY19051N19051 | Davis County, IA | Davis County | 71000 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Davis County | Iowa | 0 |
| IA | 1905399999 | 19 | 53 | NCNTY19053N19053 | Decatur County, IA | Decatur County | 53500 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Decatur County | Iowa | 0 |
| IA | 1905599999 | 19 | 55 | NCNTY19055N19055 | Delaware County, IA | Delaware County | 76900 | 16150 | 18450 | 20750 | 23050 | 24900 | 26750 | 28600 | 30450 | 9999 | Delaware County | Iowa | 0 |
| IA | 1905799999 | 19 | 57 | NCNTY19057N19057 | Des Moines County, IA | Des Moines County | 64700 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Des Moines County | Iowa | 0 |
| IA | 1905999999 | 19 | 59 | NCNTY19059N19059 | Dickinson County, IA | Dickinson County | 83400 | 17500 | 20000 | 22500 | 25000 | 27000 | 29000 | 31000 | 33000 | 9999 | Dickinson County | Iowa | 0 |
| IA | 1906199999 | 19 | 61 | METRO20220M20220 | Dubuque, IA MSA | Dubuque County | 82900 | 17400 | 19900 | 22400 | 24850 | 26850 | 28850 | 30850 | 32850 | 2200 | Dubuque County | Iowa | 1 |
| IA | 1906399999 | 19 | 63 | NCNTY19063N19063 | Emmet County, IA | Emmet County | 71600 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Emmet County | Iowa | 0 |
| IA | 1906599999 | 19 | 65 | NCNTY19065N19065 | Fayette County, IA | Fayette County | 63900 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Fayette County | Iowa | 0 |
| IA | 1906799999 | 19 | 67 | NCNTY19067N19067 | Floyd County, IA | Floyd County | 67100 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Floyd County | Iowa | 0 |
| IA | 1906999999 | 19 | 69 | NCNTY19069N19069 | Franklin County, IA | Franklin County | 61200 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Franklin County | Iowa | 0 |
| IA | 1907199999 | 19 | 71 | NCNTY19071N19071 | Fremont County, IA | Fremont County | 70100 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Fremont County | Iowa | 0 |
| IA | 1907399999 | 19 | 73 | NCNTY19073N19073 | Greene County, IA | Greene County | 71100 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Greene County | Iowa | 0 |
| IA | 1907599999 | 19 | 75 | METRO47940M47940 | Waterloo-Cedar Falls, IA HUD Metro FMR Area | Grundy County | 71600 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Grundy County | Iowa | 1 |
| IA | 1907799999 | 19 | 77 | METRO19780M19780 | Des Moines-West Des Moines, IA MSA | Guthrie County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Guthrie County | Iowa | 1 |
| IA | 1907999999 | 19 | 79 | NCNTY19079N19079 | Hamilton County, IA | Hamilton County | 73400 | 15400 | 17600 | 19800 | 22000 | 23800 | 25550 | 27300 | 29050 | 9999 | Hamilton County | Iowa | 0 |
| IA | 1908199999 | 19 | 81 | NCNTY19081N19081 | Hancock County, IA | Hancock County | 71500 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Hancock County | Iowa | 0 |
| IA | 1908399999 | 19 | 83 | NCNTY19083N19083 | Hardin County, IA | Hardin County | 74400 | 15650 | 17850 | 20100 | 22300 | 24100 | 25900 | 27700 | 29450 | 9999 | Hardin County | Iowa | 0 |
| IA | 1908599999 | 19 | 85 | METRO36540M36540 | Omaha-Council Bluffs, NE-IA HUD Metro FMR Area | Harrison County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 9999 | Harrison County | Iowa | 1 |
| IA | 1908799999 | 19 | 87 | NCNTY19087N19087 | Henry County, IA | Henry County | 66900 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Henry County | Iowa | 0 |
| IA | 1908999999 | 19 | 89 | NCNTY19089N19089 | Howard County, IA | Howard County | 66200 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Howard County | Iowa | 0 |
| IA | 1909199999 | 19 | 91 | NCNTY19091N19091 | Humboldt County, IA | Humboldt County | 67900 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Humboldt County | Iowa | 0 |
| IA | 1909399999 | 19 | 93 | NCNTY19093N19093 | Ida County, IA | Ida County | 73200 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Ida County | Iowa | 0 |
| IA | 1909599999 | 19 | 95 | NCNTY19095N19095 | Iowa County, IA | Iowa County | 76400 | 16050 | 18350 | 20650 | 22900 | 24750 | 26600 | 28400 | 30250 | 9999 | Iowa County | Iowa | 0 |
| IA | 1909799999 | 19 | 97 | NCNTY19097N19097 | Jackson County, IA | Jackson County | 66300 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Jackson County | Iowa | 0 |
| IA | 1909999999 | 19 | 99 | NCNTY19099N19099 | Jasper County, IA | Jasper County | 72800 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 9999 | Jasper County | Iowa | 0 |
| IA | 1910199999 | 19 | 101 | NCNTY19101N19101 | Jefferson County, IA | Jefferson County | 66200 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Jefferson County | Iowa | 0 |
| IA | 1910399999 | 19 | 103 | METRO26980MM3500 | Iowa City, IA HUD Metro FMR Area | Johnson County | 101200 | 21250 | 24300 | 27350 | 30350 | 32800 | 35250 | 37650 | 40100 | 3500 | Johnson County | Iowa | 1 |
| IA | 1910599999 | 19 | 105 | METRO16300N19105 | Jones County, IA HUD Metro FMR Area | Jones County | 76200 | 16000 | 18300 | 20600 | 22850 | 24700 | 26550 | 28350 | 30200 | 9999 | Jones County | Iowa | 1 |
| IA | 1910799999 | 19 | 107 | NCNTY19107N19107 | Keokuk County, IA | Keokuk County | 69200 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Keokuk County | Iowa | 0 |
| IA | 1910999999 | 19 | 109 | NCNTY19109N19109 | Kossuth County, IA | Kossuth County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Kossuth County | Iowa | 0 |
| IA | 1911199999 | 19 | 111 | NCNTY19111N19111 | Lee County, IA | Lee County | 64400 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Lee County | Iowa | 0 |
| IA | 1911399999 | 19 | 113 | METRO16300M16300 | Cedar Rapids, IA HUD Metro FMR Area | Linn County | 85200 | 17900 | 20450 | 23000 | 25550 | 27600 | 29650 | 31700 | 33750 | 1360 | Linn County | Iowa | 1 |
| IA | 1911599999 | 19 | 115 | NCNTY19115N19115 | Louisa County, IA | Louisa County | 71800 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Louisa County | Iowa | 0 |
| IA | 1911799999 | 19 | 117 | NCNTY19117N19117 | Lucas County, IA | Lucas County | 67100 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Lucas County | Iowa | 0 |
| IA | 1911999999 | 19 | 119 | NCNTY19119N19119 | Lyon County, IA | Lyon County | 74200 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Lyon County | Iowa | 0 |
| IA | 1912199999 | 19 | 121 | METRO19780M19780 | Des Moines-West Des Moines, IA MSA | Madison County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Madison County | Iowa | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA | 1912399999 | 19 | 123 | NCNTY19123N19123 | Mahaska County, IA | Mahaska County | 65100 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Mahaska County | Iowa | 0 |
| IA | 1912599999 | 19 | 125 | NCNTY19125N19125 | Marion County, IA | Marion County | 76400 | 16050 | 18350 | 20650 | 22900 | 24750 | 26600 | 28400 | 30250 | 9999 | Marion County | Iowa | 0 |
| IA | 1912799999 | 19 | 127 | NCNTY19127N19127 | Marshall County, IA | Marshall County | 67200 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Marshall County | Iowa | 0 |
| IA | 1912999999 | 19 | 129 | METRO36540M36540 | Omaha-Council Bluffs, NE-IA HUD Metro FMR Area | Mills County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 9999 | Mills County | Iowa | 1 |
| IA | 1913199999 | 19 | 131 | NCNTY19131N19131 | Mitchell County, IA | Mitchell County | 70700 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Mitchell County | Iowa | 0 |
| IA | 1913399999 | 19 | 133 | NCNTY19133N19133 | Monona County, IA | Monona County | 63900 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Monona County | Iowa | 0 |
| IA | 1913599999 | 19 | 135 | NCNTY19135N19135 | Monroe County, IA | Monroe County | 66900 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Monroe County | Iowa | 0 |
| IA | 1913799999 | 19 | 137 | NCNTY19137N19137 | Montgomery County, IA | Montgomery County | 59300 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Montgomery County | Iowa | 0 |
| IA | 1913999999 | 19 | 139 | NCNTY19139N19139 | Muscatine County, IA | Muscatine County | 73100 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Muscatine County | Iowa | 0 |
| IA | 1914199999 | 19 | 141 | NCNTY19141N19141 | O'Brien County, IA | O'Brien County | 76300 | 16050 | 18350 | 20650 | 22900 | 24750 | 26600 | 28400 | 30250 | 9999 | O'Brien County | Iowa | 0 |
| IA | 1914399999 | 19 | 143 | NCNTY19143N19143 | Osceola County, IA | Osceola County | 68700 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Osceola County | Iowa | 0 |
| IA | 1914599999 | 19 | 145 | NCNTY19145N19145 | Page County, IA | Page County | 64900 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Page County | Iowa | 0 |
| IA | 1914799999 | 19 | 147 | NCNTY19147N19147 | Palo Alto County, IA | Palo Alto County | 71200 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Palo Alto County | Iowa | 0 |
| IA | 1914999999 | 19 | 149 | METRO43580N19149 | Plymouth County, IA HUD Metro FMR Area | Plymouth County | 79100 | 16650 | 19000 | 21400 | 23750 | 25650 | 27550 | 29450 | 31350 | 9999 | Plymouth County | Iowa | 1 |
| IA | 1915199999 | 19 | 151 | NCNTY19151N19151 | Pocahontas County, IA | Pocahontas County | 67000 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Pocahontas County | Iowa | 0 |
| IA | 1915399999 | 19 | 153 | METRO19780M19780 | Des Moines-West Des Moines, IA MSA | Polk County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 2120 | Polk County | Iowa | 1 |
| IA | 1915599999 | 19 | 155 | METRO36540M36540 | Omaha-Council Bluffs, NE-IA HUD Metro FMR Area | Pottawattamie County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 5920 | Pottawattamie County | Iowa | 1 |
| IA | 1915799999 | 19 | 157 | NCNTY19157N19157 | Poweshiek County, IA | Poweshiek County | 73000 | 15350 | 17550 | 19750 | 21900 | 23700 | 25450 | 27200 | 28950 | 9999 | Poweshiek County | Iowa | 0 |
| IA | 1915999999 | 19 | 159 | NCNTY19159N19159 | Ringgold County, IA | Ringgold County | 62200 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Ringgold County | Iowa | 0 |
| IA | 1916199999 | 19 | 161 | NCNTY19161N19161 | Sac County, IA | Sac County | 71000 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Sac County | Iowa | 0 |
| IA | 1916399999 | 19 | 163 | METRO19340M19340 | Davenport-Moline-Rock Island, IA-IL MSA | Scott County | 75400 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 1960 | Scott County | Iowa | 1 |
| IA | 1916599999 | 19 | 165 | NCNTY19165N19165 | Shelby County, IA | Shelby County | 72500 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Shelby County | Iowa | 0 |
| IA | 1916799999 | 19 | 167 | NCNTY19167N19167 | Sioux County, IA | Sioux County | 80600 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Sioux County | Iowa | 0 |
| IA | 1916999999 | 19 | 169 | METRO11180M11180 | Ames, IA MSA | Story County | 104300 | 19900 | 22750 | 25600 | 28400 | 30700 | 32950 | 35250 | 37500 | 9999 | Story County | Iowa | 1 |
| IA | 1917199999 | 19 | 171 | NCNTY19171N19171 | Tama County, IA | Tama County | 71600 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Tama County | Iowa | 0 |
| IA | 1917399999 | 19 | 173 | NCNTY19173N19173 | Taylor County, IA | Taylor County | 62400 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Taylor County | Iowa | 0 |
| IA | 1917599999 | 19 | 175 | NCNTY19175N19175 | Union County, IA | Union County | 66800 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Union County | Iowa | 0 |
| IA | 1917799999 | 19 | 177 | NCNTY19177N19177 | Van Buren County, IA | Van Buren County | 64600 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Van Buren County | Iowa | 0 |
| IA | 1917999999 | 19 | 179 | NCNTY19179N19179 | Wapello County, IA | Wapello County | 58700 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Wapello County | Iowa | 0 |
| IA | 1918199999 | 19 | 181 | METRO19780M19780 | Des Moines-West Des Moines, IA MSA | Warren County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 2120 | Warren County | Iowa | 1 |
| IA | 1918399999 | 19 | 183 | METRO26980N19183 | Washington County, IA HUD Metro FMR Area | Washington County | 78200 | 16450 | 18800 | 21150 | 23450 | 25350 | 27250 | 29100 | 31000 | 9999 | Washington County | Iowa | 1 |
| IA | 1918599999 | 19 | 185 | NCNTY19185N19185 | Wayne County, IA | Wayne County | 58200 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Wayne County | Iowa | 0 |
| IA | 1918799999 | 19 | 187 | NCNTY19187N19187 | Webster County, IA | Webster County | 62700 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Webster County | Iowa | 0 |
| IA | 1918999999 | 19 | 189 | NCNTY19189N19189 | Winnebago County, IA | Winnebago County | 67100 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Winnebago County | Iowa | 0 |
| IA | 1919199999 | 19 | 191 | NCNTY19191N19191 | Winneshiek County, IA | Winneshiek County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Winneshiek County | Iowa | 0 |
| IA | 1919399999 | 19 | 193 | METRO43580M43580 | Sioux City, IA-NE-SD HUD Metro FMR Area | Woodbury County | 75200 | 15750 | 18000 | 20250 | 22500 | 24300 | 26100 | 27900 | 29700 | 7720 | Woodbury County | Iowa | 1 |
| IA | 1919599999 | 19 | 195 | NCNTY19195N19195 | Worth County, IA | Worth County | 68100 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Worth County | Iowa | 0 |
| IA | 1919799999 | 19 | 197 | NCNTY19197N19197 | Wright County, IA | Wright County | 64000 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Wright County | Iowa | 0 |
| KS | 2000199999 | 20 | 1 | NCNTY20001N20001 | Allen County, KS | Allen County | 61600 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Allen County | Kansas | 0 |
| KS | 2000399999 | 20 | 3 | NCNTY20003N20003 | Anderson County, KS | Anderson County | 61100 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Anderson County | Kansas | 0 |
| KS | 2000599999 | 20 | 5 | NCNTY20005N20005 | Atchison County, KS | Atchison County | 61900 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Atchison County | Kansas | 0 |
| KS | 2000799999 | 20 | 7 | NCNTY20007N20007 | Barber County, KS | Barber County | 73900 | 14950 | 17100 | 19250 | 21350 | 23100 | 24800 | 26500 | 28200 | 9999 | Barber County | Kansas | 0 |
| KS | 2000999999 | 20 | 9 | NCNTY20009N20009 | Barton County, KS | Barton County | 66100 | 13900 | 15900 | 17900 | 19850 | 21450 | 23050 | 24650 | 26250 | 9999 | Barton County | Kansas | 0 |
| KS | 2001199999 | 20 | 11 | NCNTY20011N20011 | Bourbon County, KS | Bourbon County | 54300 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Bourbon County | Kansas | 0 |
| KS | 2001399999 | 20 | 13 | NCNTY20013N20013 | Brown County, KS | Brown County | 57900 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Brown County | Kansas | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KS | 2001599999 | 20 | 15 | METRO48620M48620 | Wichita, KS HUD Metro FMR Area | Butler County | 72600 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9040 | Butler County | Kansas | 1 |
| KS | 2001799999 | 20 | 17 | NCNTY20017N20017 | Chase County, KS | Chase County | 65200 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Chase County | Kansas | 0 |
| KS | 2001999999 | 20 | 19 | NCNTY20019N20019 | Chautauqua County, KS | Chautauqua County | 56900 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Chautauqua County | Kansas | 0 |
| KS | 2002199999 | 20 | 21 | NCNTY20021N20021 | Cherokee County, KS | Cherokee County | 56300 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Cherokee County | Kansas | 0 |
| KS | 2002399999 | 20 | 23 | NCNTY20023N20023 | Cheyenne County, KS | Cheyenne County | 63700 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Cheyenne County | Kansas | 0 |
| KS | 2002599999 | 20 | 25 | NCNTY20025N20025 | Clark County, KS | Clark County | 63500 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Clark County | Kansas | 0 |
| KS | 2002799999 | 20 | 27 | NCNTY20027N20027 | Clay County, KS | Clay County | 67800 | 14250 | 16300 | 18350 | 20350 | 22000 | 23650 | 25250 | 26900 | 9999 | Clay County | Kansas | 0 |
| KS | 2002999999 | 20 | 29 | NCNTY20029N20029 | Cloud County, KS | Cloud County | 58000 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Cloud County | Kansas | 0 |
| KS | 2003199999 | 20 | 31 | NCNTY20031N20031 | Coffey County, KS | Coffey County | 76900 | 16150 | 18450 | 20750 | 23050 | 24900 | 26750 | 28600 | 30450 | 9999 | Coffey County | Kansas | 0 |
| KS | 2003399999 | 20 | 33 | NCNTY20033N20033 | Comanche County, KS | Comanche County | 66000 | 13900 | 15850 | 17850 | 19800 | 21400 | 23000 | 24600 | 26150 | 9999 | Comanche County | Kansas | 0 |
| KS | 2003599999 | 20 | 35 | NCNTY20035N20035 | Cowley County, KS | Cowley County | 60200 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Cowley County | Kansas | 0 |
| KS | 2003799999 | 20 | 37 | NCNTY20037N20037 | Crawford County, KS | Crawford County | 61100 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Crawford County | Kansas | 0 |
| KS | 2003999999 | 20 | 39 | NCNTY20039N20039 | Decatur County, KS | Decatur County | 60500 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Decatur County | Kansas | 0 |
| KS | 2004199999 | 20 | 41 | NCNTY20041N20041 | Dickinson County, KS | Dickinson County | 64900 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9999 | Dickinson County | Kansas | 0 |
| KS | 2004399999 | 20 | 43 | METRO41140M41140 | St. Joseph, MO-KS MSA | Doniphan County | 63600 | 13400 | 15300 | 17200 | 19100 | 20650 | 22200 | 23700 | 25250 | 9999 | Doniphan County | Kansas | 1 |
| KS | 2004599999 | 20 | 45 | METRO29940M29940 | Lawrence, KS MSA | Douglas County | 88800 | 18550 | 21200 | 23850 | 26500 | 28650 | 30750 | 32900 | 35000 | 4150 | Douglas County | Kansas | 1 |
| KS | 2004799999 | 20 | 47 | NCNTY20047N20047 | Edwards County, KS | Edwards County | 61100 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Edwards County | Kansas | 0 |
| KS | 2004999999 | 20 | 49 | NCNTY20049N20049 | Elk County, KS | Elk County | 55500 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Elk County | Kansas | 0 |
| KS | 2005199999 | 20 | 51 | NCNTY20051N20051 | Ellis County, KS | Ellis County | 77600 | 16350 | 18650 | 21000 | 23300 | 25200 | 27050 | 28900 | 30800 | 9999 | Ellis County | Kansas | 0 |
| KS | 2005399999 | 20 | 53 | NCNTY20053N20053 | Ellsworth County, KS | Ellsworth County | 67600 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 9999 | Ellsworth County | Kansas | 0 |
| KS | 2005599999 | 20 | 55 | NCNTY20055N20055 | Finney County, KS | Finney County | 62000 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Finney County | Kansas | 0 |
| KS | 2005799999 | 20 | 57 | NCNTY20057N20057 | Ford County, KS | Ford County | 60200 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Ford County | Kansas | 0 |
| KS | 2005999999 | 20 | 59 | NCNTY20059N20059 | Franklin County, KS | Franklin County | 70100 | 14750 | 16850 | 18950 | 21050 | 22750 | 24450 | 26150 | 27800 | 9999 | Franklin County | Kansas | 0 |
| KS | 2006199999 | 20 | 61 | NCNTY20061N20061 | Geary County, KS | Geary County | 53600 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Geary County | Kansas | 0 |
| KS | 2006399999 | 20 | 63 | NCNTY20063N20063 | Gove County, KS | Gove County | 63500 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Gove County | Kansas | 0 |
| KS | 2006599999 | 20 | 65 | NCNTY20065N20065 | Graham County, KS | Graham County | 61800 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Graham County | Kansas | 0 |
| KS | 2006799999 | 20 | 67 | NCNTY20067N20067 | Grant County, KS | Grant County | 72400 | 15200 | 17400 | 19550 | 21700 | 23450 | 25200 | 26950 | 28650 | 9999 | Grant County | Kansas | 0 |
| KS | 2006999999 | 20 | 69 | NCNTY20069N20069 | Gray County, KS | Gray County | 72200 | 15200 | 17350 | 19500 | 21650 | 23400 | 25150 | 26850 | 28600 | 9999 | Gray County | Kansas | 0 |
| KS | 2007199999 | 20 | 71 | NCNTY20071N20071 | Greeley County, KS | Greeley County | 65300 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Greeley County | Kansas | 0 |
| KS | 2007399999 | 20 | 73 | NCNTY20073N20073 | Greenwood County, KS | Greenwood County | 55700 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Greenwood County | Kansas | 0 |
| KS | 2007599999 | 20 | 75 | NCNTY20075N20075 | Hamilton County, KS | Hamilton County | 58700 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Hamilton County | Kansas | 0 |
| KS | 2007799999 | 20 | 77 | NCNTY20077N20077 | Harper County, KS | Harper County | 61600 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Harper County | Kansas | 0 |
| KS | 2007999999 | 20 | 79 | METRO48620M48620 | Wichita, KS HUD Metro FMR Area | Harvey County | 72600 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9040 | Harvey County | Kansas | 1 |
| KS | 2008199999 | 20 | 81 | NCNTY20081N20081 | Haskell County, KS | Haskell County | 63100 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Haskell County | Kansas | 0 |
| KS | 2008399999 | 20 | 83 | NCNTY20083N20083 | Hodgeman County, KS | Hodgeman County | 72700 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Hodgeman County | Kansas | 0 |
| KS | 2008599999 | 20 | 85 | METRO45820M45820 | Topeka, KS MSA | Jackson County | 77700 | 16350 | 18650 | 21000 | 23300 | 25200 | 27050 | 28900 | 30800 | 9999 | Jackson County | Kansas | 1 |
| KS | 2008799999 | 20 | 87 | METRO45820M45820 | Topeka, KS MSA | Jefferson County | 77700 | 16350 | 18650 | 21000 | 23300 | 25200 | 27050 | 28900 | 30800 | 9999 | Jefferson County | Kansas | 1 |
| KS | 2008999999 | 20 | 89 | NCNTY20089N20089 | Jewell County, KS | Jewell County | 56300 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Jewell County | Kansas | 0 |
| KS | 2009199999 | 20 | 91 | METRO28140M28140 | Kansas City, MO-KS HUD Metro FMR Area | Johnson County | 86000 | 18100 | 20650 | 23250 | 25800 | 27900 | 29950 | 32000 | 34100 | 3760 | Johnson County | Kansas | 1 |
| KS | 2009399999 | 20 | 93 | NCNTY20093N20093 | Kearny County, KS | Kearny County | 69400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Kearny County | Kansas | 0 |
| KS | 2009599999 | 20 | 95 | METRO48620N20095 | Kingman County, KS HUD Metro FMR Area | Kingman County | 74300 | 15650 | 17850 | 20100 | 22300 | 24100 | 25900 | 27700 | 29450 | 9999 | Kingman County | Kansas | 1 |
| KS | 2009799999 | 20 | 97 | NCNTY20097N20097 | Kiowa County, KS | Kiowa County | 66600 | 14000 | 16000 | 18000 | 20000 | 21600 | 23200 | 24800 | 26400 | 9999 | Kiowa County | Kansas | 0 |
| KS | 2009999999 | 20 | 99 | NCNTY20099N20099 | Labette County, KS | Labette County | 59100 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Labette County | Kansas | 0 |
| KS | 2010199999 | 20 | 101 | NCNTY20101N20101 | Lane County, KS | Lane County | 72500 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Lane County | Kansas | 0 |
| KS | 2010399999 | 20 | 103 | METRO28140M28140 | Kansas City, MO-KS HUD Metro FMR Area | Leavenworth County | 86000 | 18100 | 20650 | 23250 | 25800 | 27900 | 29950 | 32000 | 34100 | 3760 | Leavenworth County | Kansas | 1 |
| KS | 2010599999 | 20 | 105 | NCNTY20105N20105 | Lincoln County, KS | Lincoln County | 67200 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 9999 | Lincoln County | Kansas | 0 |
| KS | 2010799999 | 20 | 107 | METRO28140M28140 | Kansas City, MO-KS HUD Metro FMR Area | Linn County | 86000 | 18100 | 20650 | 23250 | 25800 | 27900 | 29950 | 32000 | 34100 | 9999 | Linn County | Kansas | 1 |
| KS | 2010999999 | 20 | 109 | NCNTY20109N20109 | Logan County, KS | Logan County | 70600 | 14850 | 17000 | 19100 | 21200 | 22900 | 24600 | 26300 | 28000 | 9999 | Logan County | Kansas | 0 |
| KS | 2011199999 | 20 | 111 | NCNTY20111N20111 | Lyon County, KS | Lyon County | 60800 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Lyon County | Kansas | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KS | 2011399999 | 20 | 113 | NCNTY20113N20113 | McPherson County, KS | McPherson County | 72900 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 9999 | McPherson County | Kansas | 0 |
| KS | 2011599999 | 20 | 115 | NCNTY20115N20115 | Marion County, KS | Marion County | 66500 | 14000 | 16000 | 18000 | 19950 | 21550 | 23150 | 24750 | 26350 | 9999 | Marion County | Kansas | 0 |
| KS | 2011799999 | 20 | 117 | NCNTY20117N20117 | Marshall County, KS | Marshall County | 66600 | 14000 | 16000 | 18000 | 20000 | 21600 | 23200 | 24800 | 26400 | 9999 | Marshall County | Kansas | 0 |
| KS | 2011999999 | 20 | 119 | NCNTY20119N20119 | Meade County, KS | Meade County | 66200 | 13900 | 15900 | 17900 | 19850 | 21450 | 23050 | 24650 | 26250 | 9999 | Meade County | Kansas | 0 |
| KS | 2012199999 | 20 | 121 | METRO28140M28140 | Kansas City, MO-KS HUD Metro FMR Area | Miami County | 86000 | 18100 | 20650 | 23250 | 25800 | 27900 | 29950 | 32000 | 34100 | 3760 | Miami County | Kansas | 1 |
| KS | 2012399999 | 20 | 123 | NCNTY20123N20123 | Mitchell County, KS | Mitchell County | 66800 | 14050 | 16050 | 18050 | 20050 | 21700 | 23300 | 24900 | 26500 | 9999 | Mitchell County | Kansas | 0 |
| KS | 2012599999 | 20 | 125 | NCNTY20125N20125 | Montgomery County, KS | Montgomery County | 56700 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Montgomery County | Kansas | 0 |
| KS | 2012799999 | 20 | 127 | NCNTY20127N20127 | Morris County, KS | Morris County | 67100 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 9999 | Morris County | Kansas | 0 |
| KS | 2012999999 | 20 | 129 | NCNTY20129N20129 | Morton County, KS | Morton County | 60800 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Morton County | Kansas | 0 |
| KS | 2013199999 | 20 | 131 | NCNTY20131N20131 | Nemaha County, KS | Nemaha County | 77300 | 16250 | 18600 | 20900 | 23200 | 25100 | 26950 | 28800 | 30650 | 9999 | Nemaha County | Kansas | 0 |
| KS | 2013399999 | 20 | 133 | NCNTY20133N20133 | Neosho County, KS | Neosho County | 59600 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Neosho County | Kansas | 0 |
| KS | 2013599999 | 20 | 135 | NCNTY20135N20135 | Ness County, KS | Ness County | 62600 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Ness County | Kansas | 0 |
| KS | 2013799999 | 20 | 137 | NCNTY20137N20137 | Norton County, KS | Norton County | 67400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Norton County | Kansas | 0 |
| KS | 2013999999 | 20 | 139 | METRO45820M45820 | Topeka, KS MSA | Osage County | 77700 | 16350 | 18650 | 21000 | 23300 | 25200 | 27050 | 28900 | 30800 | 9999 | Osage County | Kansas | 1 |
| KS | 2014199999 | 20 | 141 | NCNTY20141N20141 | Osborne County, KS | Osborne County | 61400 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Osborne County | Kansas | 0 |
| KS | 2014399999 | 20 | 143 | NCNTY20143N20143 | Ottawa County, KS | Ottawa County | 71100 | 14950 | 17100 | 19250 | 21350 | 23100 | 24800 | 26500 | 28200 | 9999 | Ottawa County | Kansas | 0 |
| KS | 2014599999 | 20 | 145 | NCNTY20145N20145 | Pawnee County, KS | Pawnee County | 60100 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Pawnee County | Kansas | 0 |
| KS | 2014799999 | 20 | 147 | NCNTY20147N20147 | Phillips County, KS | Phillips County | 64600 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Phillips County | Kansas | 0 |
| KS | 2014999999 | 20 | 149 | METRO31740M31740 | Manhattan, KS MSA | Pottawatomie County | 69700 | 15900 | 18150 | 20400 | 22650 | 24500 | 26300 | 28100 | 29900 | 9999 | Pottawatomie County | Kansas | 1 |
| KS | 2015199999 | 20 | 151 | NCNTY20151N20151 | Pratt County, KS | Pratt County | 70500 | 14850 | 16950 | 19050 | 21150 | 22850 | 24550 | 26250 | 27950 | 9999 | Pratt County | Kansas | 0 |
| KS | 2015399999 | 20 | 153 | NCNTY20153N20153 | Rawlins County, KS | Rawlins County | 67200 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 9999 | Rawlins County | Kansas | 0 |
| KS | 2015599999 | 20 | 155 | NCNTY20155N20155 | Reno County, KS | Reno County | 62600 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Reno County | Kansas | 0 |
| KS | 2015799999 | 20 | 157 | NCNTY20157N20157 | Republic County, KS | Republic County | 64900 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9999 | Republic County | Kansas | 0 |
| KS | 2015999999 | 20 | 159 | NCNTY20159N20159 | Rice County, KS | Rice County | 65600 | 13800 | 15800 | 17750 | 19700 | 21300 | 22900 | 24450 | 26050 | 9999 | Rice County | Kansas | 0 |
| KS | 2016199999 | 20 | 161 | METRO31740M31740 | Manhattan, KS MSA | Riley County | 69700 | 15900 | 18150 | 20400 | 22650 | 24500 | 26300 | 28100 | 29900 | 9999 | Riley County | Kansas | 1 |
| KS | 2016399999 | 20 | 163 | NCNTY20163N20163 | Rooks County, KS | Rooks County | 63500 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Rooks County | Kansas | 0 |
| KS | 2016599999 | 20 | 165 | NCNTY20165N20165 | Rush County, KS | Rush County | 68500 | 14400 | 16450 | 18500 | 20550 | 22200 | 23850 | 25500 | 27150 | 9999 | Rush County | Kansas | 0 |
| KS | 2016799999 | 20 | 167 | NCNTY20167N20167 | Russell County, KS | Russell County | 64300 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Russell County | Kansas | 0 |
| KS | 2016999999 | 20 | 169 | NCNTY20169N20169 | Saline County, KS | Saline County | 70200 | 14750 | 16850 | 18950 | 21050 | 22750 | 24450 | 26150 | 27800 | 9999 | Saline County | Kansas | 0 |
| KS | 2017199999 | 20 | 171 | NCNTY20171N20171 | Scott County, KS | Scott County | 71800 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Scott County | Kansas | 0 |
| KS | 2017399999 | 20 | 173 | METRO48620M48620 | Wichita, KS HUD Metro FMR Area | Sedgwick County | 72600 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9040 | Sedgwick County | Kansas | 1 |
| KS | 2017599999 | 20 | 175 | NCNTY20175N20175 | Seward County, KS | Seward County | 52900 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Seward County | Kansas | 0 |
| KS | 2017799999 | 20 | 177 | METRO45820M45820 | Topeka, KS MSA | Shawnee County | 77700 | 16350 | 18650 | 21000 | 23300 | 25200 | 27050 | 28900 | 30800 | 8440 | Shawnee County | Kansas | 1 |
| KS | 2017999999 | 20 | 179 | NCNTY20179N20179 | Sheridan County, KS | Sheridan County | 76000 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Sheridan County | Kansas | 0 |
| KS | 2018199999 | 20 | 181 | NCNTY20181N20181 | Sherman County, KS | Sherman County | 59400 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Sherman County | Kansas | 0 |
| KS | 2018399999 | 20 | 183 | NCNTY20183N20183 | Smith County, KS | Smith County | 60600 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Smith County | Kansas | 0 |
| KS | 2018599999 | 20 | 185 | NCNTY20185N20185 | Stafford County, KS | Stafford County | 64700 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Stafford County | Kansas | 0 |
| KS | 2018799999 | 20 | 187 | NCNTY20187N20187 | Stanton County, KS | Stanton County | 60600 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Stanton County | Kansas | 0 |
| KS | 2018999999 | 20 | 189 | NCNTY20189N20189 | Stevens County, KS | Stevens County | 69600 | 14600 | 16700 | 18800 | 20850 | 22550 | 24200 | 25900 | 27550 | 9999 | Stevens County | Kansas | 0 |
| KS | 2019199999 | 20 | 191 | METRO48620N20191 | Sumner County, KS HUD Metro FMR Area | Sumner County | 71900 | 15100 | 17250 | 19400 | 21550 | 23300 | 25000 | 26750 | 28450 | 9999 | Sumner County | Kansas | 1 |
| KS | 2019399999 | 20 | 193 | NCNTY20193N20193 | Thomas County, KS | Thomas County | 70600 | 14850 | 17000 | 19100 | 21200 | 22900 | 24600 | 26300 | 28000 | 9999 | Thomas County | Kansas | 0 |
| KS | 2019599999 | 20 | 195 | NCNTY20195N20195 | Trego County, KS | Trego County | 73800 | 15550 | 17750 | 19950 | 22150 | 23950 | 25700 | 27500 | 29250 | 9999 | Trego County | Kansas | 0 |
| KS | 2019799999 | 20 | 197 | METRO45820M45820 | Topeka, KS MSA | Wabaunsee County | 77700 | 16350 | 18650 | 21000 | 23300 | 25200 | 27050 | 28900 | 30800 | 9999 | Wabaunsee County | Kansas | 1 |
| KS | 2019999999 | 20 | 199 | NCNTY20199N20199 | Wallace County, KS | Wallace County | 87800 | 18000 | 20600 | 23150 | 25700 | 27800 | 29850 | 31900 | 33950 | 9999 | Wallace County | Kansas | 0 |
| KS | 2020199999 | 20 | 201 | NCNTY20201N20201 | Washington County, KS | Washington County | 62800 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Washington County | Kansas | 0 |
| KS | 2020399999 | 20 | 203 | NCNTY20203N20203 | Wichita County, KS | Wichita County | 68100 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Wichita County | Kansas | 0 |
| KS | 2020599999 | 20 | 205 | NCNTY20205N20205 | Wilson County, KS | Wilson County | 59300 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Wilson County | Kansas | 0 |
| KS | 2020799999 | 20 | 207 | NCNTY20207N20207 | Woodson County, KS | Woodson County | 56000 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Woodson County | Kansas | 0 |
| KS | 2020999999 | 20 | 209 | METRO28140M28140 | Kansas City, MO-KS HUD Metro FMR Area | Wyandotte County | 86000 | 18100 | 20650 | 23250 | 25800 | 27900 | 29950 | 32000 | 34100 | 3760 | Wyandotte County | Kansas | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KY | 2100199999 | 21 | 1 | NCNTY21001N21001 | Adair County, KY | Adair County | 47700 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Adair County | Kentucky | 0 |
| KY | 2100399999 | 21 | 3 | METRO14540N21003 | Allen County, KY HUD Metro FMR Area | Allen County | 54500 | 11450 | 13100 | 14750 | 16350 | 17700 | 19000 | 20300 | 21600 | 9999 | Allen County | Kentucky | 1 |
| KY | 2100599999 | 21 | 5 | NCNTY21005N21005 | Anderson County, KY | Anderson County | 69700 | 14650 | 16750 | 18850 | 20900 | 22600 | 24250 | 25950 | 27600 | 9999 | Anderson County | Kentucky | 0 |
| KY | 2100799999 | 21 | 7 | NCNTY21007N21007 | Ballard County, KY | Ballard County | 58200 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Ballard County | Kentucky | 0 |
| KY | 2100999999 | 21 | 9 | NCNTY21009N21009 | Barren County, KY | Barren County | 50100 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Barren County | Kentucky | 0 |
| KY | 2101199999 | 21 | 11 | NCNTY21011N21011 | Bath County, KY | Bath County | 45000 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Bath County | Kentucky | 0 |
| KY | 2101399999 | 21 | 13 | NCNTY21013N21013 | Bell County, KY | Bell County | 33100 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Bell County | Kentucky | 0 |
| KY | 2101599999 | 21 | 15 | METRO17140M17140 | Cincinnati, OH-KY-IN HUD Metro FMR Area | Boone County | 86300 | 18150 | 20750 | 23350 | 25900 | 28000 | 30050 | 32150 | 34200 | 1640 | Boone County | Kentucky | 1 |
| KY | 2101799999 | 21 | 17 | METRO30460M30460 | Lexington-Fayette, KY MSA | Bourbon County | 79400 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 4280 | Bourbon County | Kentucky | 1 |
| KY | 2101999999 | 21 | 19 | METRO26580M26580 | Huntington-Ashland, WV-KY-OH HUD Metro FMR Area | Boyd County | 59100 | 12450 | 14200 | 16000 | 17750 | 19200 | 20600 | 22050 | 23450 | 3400 | Boyd County | Kentucky | 1 |
| KY | 2102199999 | 21 | 21 | NCNTY21021N21021 | Boyle County, KY | Boyle County | 58600 | 12350 | 14100 | 15850 | 17600 | 19050 | 20450 | 21850 | 23250 | 9999 | Boyle County | Kentucky | 0 |
| KY | 2102399999 | 21 | 23 | METRO17140M17140 | Cincinnati, OH-KY-IN HUD Metro FMR Area | Bracken County | 86300 | 18150 | 20750 | 23350 | 25900 | 28000 | 30050 | 32150 | 34200 | 9999 | Bracken County | Kentucky | 1 |
| KY | 2102599999 | 21 | 25 | NCNTY21025N21025 | Breathitt County, KY | Breathitt County | 33700 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Breathitt County | Kentucky | 0 |
| KY | 2102799999 | 21 | 27 | NCNTY21027N21027 | Breckinridge County, KY | Breckinridge County | 62300 | 13100 | 15000 | 16850 | 18700 | 20200 | 21700 | 23200 | 24700 | 9999 | Breckinridge County | Kentucky | 0 |
| KY | 2102999999 | 21 | 29 | METRO31140M31140 | Louisville, KY-IN HUD Metro FMR Area | Bullitt County | 77500 | 16300 | 18600 | 20950 | 23250 | 25150 | 27000 | 28850 | 30700 | 4520 | Bullitt County | Kentucky | 1 |
| KY | 2103199999 | 21 | 31 | METRO14540N21031 | Butler County, KY HUD Metro FMR Area | Butler County | 54600 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Butler County | Kentucky | 1 |
| KY | 2103399999 | 21 | 33 | NCNTY21033N21033 | Caldwell County, KY | Caldwell County | 58200 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Caldwell County | Kentucky | 0 |
| KY | 2103599999 | 21 | 35 | NCNTY21035N21035 | Calloway County, KY | Calloway County | 60100 | 12650 | 14450 | 16250 | 18050 | 19500 | 20950 | 22400 | 23850 | 9999 | Calloway County | Kentucky | 0 |
| KY | 2103799999 | 21 | 37 | METRO17140M17140 | Cincinnati, OH-KY-IN HUD Metro FMR Area | Campbell County | 86300 | 18150 | 20750 | 23350 | 25900 | 28000 | 30050 | 32150 | 34200 | 1640 | Campbell County | Kentucky | 1 |
| KY | 2103999999 | 21 | 39 | NCNTY21039N21039 | Carlisle County, KY | Carlisle County | 55200 | 11600 | 13250 | 14900 | 16550 | 17900 | 19200 | 20550 | 21850 | 9999 | Carlisle County | Kentucky | 0 |
| KY | 2104199999 | 21 | 41 | NCNTY21041N21041 | Carroll County, KY | Carroll County | 51400 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Carroll County | Kentucky | 0 |
| KY | 2104399999 | 21 | 43 | NCNTY21043N21043 | Carter County, KY | Carter County | 45400 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 3400 | Carter County | Kentucky | 0 |
| KY | 2104599999 | 21 | 45 | NCNTY21045N21045 | Casey County, KY | Casey County | 45400 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Casey County | Kentucky | 0 |
| KY | 2104799999 | 21 | 47 | METRO17300M17300 | Clarksville, TN-KY MSA | Christian County | 68900 | 13800 | 15800 | 17750 | 19700 | 21300 | 22900 | 24450 | 26050 | 1660 | Christian County | Kentucky | 1 |
| KY | 2104999999 | 21 | 49 | METRO30460M30460 | Lexington-Fayette, KY MSA | Clark County | 79400 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 4280 | Clark County | Kentucky | 1 |
| KY | 2105199999 | 21 | 51 | NCNTY21051N21051 | Clay County, KY | Clay County | 34000 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Clay County | Kentucky | 0 |
| KY | 2105399999 | 21 | 53 | NCNTY21053N21053 | Clinton County, KY | Clinton County | 39600 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Clinton County | Kentucky | 0 |
| KY | 2105599999 | 21 | 55 | NCNTY21055N21055 | Crittenden County, KY | Crittenden County | 58900 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Crittenden County | Kentucky | 0 |
| KY | 2105799999 | 21 | 57 | NCNTY21057N21057 | Cumberland County, KY | Cumberland County | 45700 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Cumberland County | Kentucky | 0 |
| KY | 2105999999 | 21 | 59 | METRO36980M36980 | Owensboro, KY MSA | Daviess County | 63400 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 5990 | Daviess County | Kentucky | 1 |
| KY | 2106199999 | 21 | 61 | METRO14540M14540 | Bowling Green, KY HUD Metro FMR Area | Edmonson County | 64400 | 13150 | 15000 | 16900 | 18750 | 20250 | 21750 | 23250 | 24750 | 9999 | Edmonson County | Kentucky | 1 |
| KY | 2106399999 | 21 | 63 | NCNTY21063N21063 | Elliott County, KY | Elliott County | 34900 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Elliott County | Kentucky | 0 |
| KY | 2106599999 | 21 | 65 | NCNTY21065N21065 | Estill County, KY | Estill County | 42300 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Estill County | Kentucky | 0 |
| KY | 2106799999 | 21 | 67 | METRO30460M30460 | Lexington-Fayette, KY MSA | Fayette County | 79400 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 4280 | Fayette County | Kentucky | 1 |
| KY | 2106999999 | 21 | 69 | NCNTY21069N21069 | Fleming County, KY | Fleming County | 53600 | 11300 | 12900 | 14500 | 16100 | 17400 | 18700 | 20000 | 21300 | 9999 | Fleming County | Kentucky | 0 |
| KY | 2107199999 | 21 | 71 | NCNTY21071N21071 | Floyd County, KY | Floyd County | 40200 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Floyd County | Kentucky | 0 |
| KY | 2107399999 | 21 | 73 | NCNTY21073N21073 | Franklin County, KY | Franklin County | 71100 | 14950 | 17100 | 19250 | 21350 | 23100 | 24800 | 26500 | 28200 | 9999 | Franklin County | Kentucky | 0 |
| KY | 2107599999 | 21 | 75 | NCNTY21075N21075 | Fulton County, KY | Fulton County | 43100 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Fulton County | Kentucky | 0 |
| KY | 2107799999 | 21 | 77 | METRO17140M17140 | Cincinnati, OH-KY-IN HUD Metro FMR Area | Gallatin County | 86300 | 18150 | 20750 | 23350 | 25900 | 28000 | 30050 | 32150 | 34200 | 2910 | Gallatin County | Kentucky | 1 |
| KY | 2107999999 | 21 | 79 | NCNTY21079N21079 | Garrard County, KY | Garrard County | 62900 | 13200 | 15100 | 17000 | 18850 | 20400 | 21900 | 23400 | 24900 | 9999 | Garrard County | Kentucky | 0 |
| KY | 2108199999 | 21 | 81 | METRO17140MM3020 | Grant County, KY HUD Metro FMR Area | Grant County | 52900 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 3020 | Grant County | Kentucky | 1 |
| KY | 2108399999 | 21 | 83 | NCNTY21083N21083 | Graves County, KY | Graves County | 56200 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Graves County | Kentucky | 0 |
| KY | 2108599999 | 21 | 85 | NCNTY21085N21085 | Grayson County, KY | Grayson County | 46500 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Grayson County | Kentucky | 0 |
| KY | 2108799999 | 21 | 87 | NCNTY21087N21087 | Green County, KY | Green County | 51800 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Green County | Kentucky | 0 |
| KY | 2108999999 | 21 | 89 | METRO26580M26580 | Huntington-Ashland, WV-KY-OH HUD Metro FMR Area | Greenup County | 59100 | 12450 | 14200 | 16000 | 17750 | 19200 | 20600 | 22050 | 23450 | 3400 | Greenup County | Kentucky | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KY | 2109199999 | 21 | 91 | METRO36980M36980 | Owensboro, KY MSA | Hancock County | 63400 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Hancock County | Kentucky | 1 |
| KY | 2109399999 | 21 | 93 | METRO21060M21060 | Elizabethtown, KY HUD Metro FMR Area | Hardin County | 68600 | 14450 | 16500 | 18550 | 20600 | 22250 | 23900 | 25550 | 27200 | 9999 | Hardin County | Kentucky | 1 |
| KY | 2109599999 | 21 | 95 | NCNTY21095N21095 | Harlan County, KY | Harlan County | 34400 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Harlan County | Kentucky | 0 |
| KY | 2109799999 | 21 | 97 | NCNTY21097N21097 | Harrison County, KY | Harrison County | 61800 | 12750 | 14600 | 16400 | 18200 | 19700 | 21150 | 22600 | 24050 | 9999 | Harrison County | Kentucky | 0 |
| KY | 2109999999 | 21 | 99 | NCNTY21099N21099 | Hart County, KY | Hart County | 48300 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Hart County | Kentucky | 0 |
| KY | 2110199999 | 21 | 101 | METRO21780M21780 | Evansville, IN-KY MSA | Henderson County | 74800 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 2440 | Henderson County | Kentucky | 1 |
| KY | 2110399999 | 21 | 103 | METRO31140M31140 | Louisville, KY-IN HUD Metro FMR Area | Henry County | 77500 | 16300 | 18600 | 20950 | 23250 | 25150 | 27000 | 28850 | 30700 | 9999 | Henry County | Kentucky | 1 |
| KY | 2110599999 | 21 | 105 | NCNTY21105N21105 | Hickman County, KY | Hickman County | 51900 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Hickman County | Kentucky | 0 |
| KY | 2110799999 | 21 | 107 | NCNTY21107N21107 | Hopkins County, KY | Hopkins County | 60100 | 12650 | 14450 | 16250 | 18050 | 19500 | 20950 | 22400 | 23850 | 9999 | Hopkins County | Kentucky | 0 |
| KY | 2110999999 | 21 | 109 | NCNTY21109N21109 | Jackson County, KY | Jackson County | 40700 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Jackson County | Kentucky | 0 |
| KY | 2111199999 | 21 | 111 | METRO31140M31140 | Louisville, KY-IN HUD Metro FMR Area | Jefferson County | 77500 | 16300 | 18600 | 20950 | 23250 | 25150 | 27000 | 28850 | 30700 | 4520 | Jefferson County | Kentucky | 1 |
| KY | 2111399999 | 21 | 113 | METRO30460M30460 | Lexington-Fayette, KY MSA | Jessamine County | 79400 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 4280 | Jessamine County | Kentucky | 1 |
| KY | 2111599999 | 21 | 115 | NCNTY21115N21115 | Johnson County, KY | Johnson County | 49800 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Johnson County | Kentucky | 0 |
| KY | 2111799999 | 21 | 117 | METRO17140M17140 | Cincinnati, OH-KY-IN  HUD Metro FMR Area | Kenton County | 86300 | 18150 | 20750 | 23350 | 25900 | 28000 | 30050 | 32150 | 34200 | 1640 | Kenton County | Kentucky | 1 |
| KY | 2111999999 | 21 | 119 | NCNTY21119N21119 | Knott County, KY | Knott County | 40900 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Knott County | Kentucky | 0 |
| KY | 2112199999 | 21 | 121 | NCNTY21121N21121 | Knox County, KY | Knox County | 34800 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Knox County | Kentucky | 0 |
| KY | 2112399999 | 21 | 123 | METRO21060M21060 | Elizabethtown, KY HUD Metro FMR Area | Larue County | 68600 | 14450 | 16500 | 18550 | 20600 | 22250 | 23900 | 25550 | 27200 | 9999 | Larue County | Kentucky | 1 |
| KY | 2112599999 | 21 | 125 | NCNTY21125N21125 | Laurel County, KY | Laurel County | 48700 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Laurel County | Kentucky | 0 |
| KY | 2112799999 | 21 | 127 | NCNTY21127N21127 | Lawrence County, KY | Lawrence County | 44200 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Lawrence County | Kentucky | 0 |
| KY | 2112999999 | 21 | 129 | NCNTY21129N21129 | Lee County, KY | Lee County | 37200 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Lee County | Kentucky | 0 |
| KY | 2113199999 | 21 | 131 | NCNTY21131N21131 | Leslie County, KY | Leslie County | 39600 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Leslie County | Kentucky | 0 |
| KY | 2113399999 | 21 | 133 | NCNTY21133N21133 | Letcher County, KY | Letcher County | 39900 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Letcher County | Kentucky | 0 |
| KY | 2113599999 | 21 | 135 | NCNTY21135N21135 | Lewis County, KY | Lewis County | 48200 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Lewis County | Kentucky | 0 |
| KY | 2113799999 | 21 | 137 | NCNTY21137N21137 | Lincoln County, KY | Lincoln County | 49200 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Lincoln County | Kentucky | 0 |
| KY | 2113999999 | 21 | 139 | NCNTY21139N21139 | Livingston County, KY | Livingston County | 58500 | 12300 | 14050 | 15800 | 17550 | 19000 | 20400 | 21800 | 23200 | 9999 | Livingston County | Kentucky | 0 |
| KY | 2114199999 | 21 | 141 | NCNTY21141N21141 | Logan County, KY | Logan County | 57600 | 12150 | 13850 | 15600 | 17300 | 18700 | 20100 | 21500 | 22850 | 9999 | Logan County | Kentucky | 0 |
| KY | 2114399999 | 21 | 143 | NCNTY21143N21143 | Lyon County, KY | Lyon County | 64900 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9999 | Lyon County | Kentucky | 0 |
| KY | 2114599999 | 21 | 145 | NCNTY21145N21145 | McCracken County, KY | McCracken County | 80000 | 13250 | 15150 | 17050 | 18900 | 20450 | 21950 | 23450 | 24950 | 9999 | McCracken County | Kentucky | 0 |
| KY | 2114799999 | 21 | 147 | NCNTY21147N21147 | McCreary County, KY | McCreary County | 27000 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | McCreary County | Kentucky | 0 |
| KY | 2114999999 | 21 | 149 | METRO36980M36980 | Owensboro, KY MSA | McLean County | 63400 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | McLean County | Kentucky | 1 |
| KY | 2115199999 | 21 | 151 | NCNTY21151N21151 | Madison County, KY | Madison County | 70600 | 14250 | 16250 | 18300 | 20300 | 21950 | 23550 | 25200 | 26800 | 4280 | Madison County | Kentucky | 0 |
| KY | 2115399999 | 21 | 153 | NCNTY21153N21153 | Magoffin County, KY | Magoffin County | 40600 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Magoffin County | Kentucky | 0 |
| KY | 2115599999 | 21 | 155 | NCNTY21155N21155 | Marion County, KY | Marion County | 56800 | 11600 | 13250 | 14900 | 16550 | 17900 | 19200 | 20550 | 21850 | 9999 | Marion County | Kentucky | 0 |
| KY | 2115799999 | 21 | 157 | NCNTY21157N21157 | Marshall County, KY | Marshall County | 67100 | 13900 | 15900 | 17900 | 19850 | 21450 | 23050 | 24650 | 26250 | 9999 | Marshall County | Kentucky | 0 |
| KY | 2115999999 | 21 | 159 | NCNTY21159N21159 | Martin County, KY | Martin County | 43100 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Martin County | Kentucky | 0 |
| KY | 2116199999 | 21 | 161 | NCNTY21161N21161 | Mason County, KY | Mason County | 61200 | 12150 | 13850 | 15600 | 17300 | 18700 | 20100 | 21500 | 22850 | 9999 | Mason County | Kentucky | 0 |
| KY | 2116399999 | 21 | 163 | METRO21060N21163 | Meade County, KY HUD Metro FMR Area | Meade County | 66300 | 13900 | 15850 | 17850 | 19800 | 21400 | 23000 | 24600 | 26150 | 9999 | Meade County | Kentucky | 1 |
| KY | 2116599999 | 21 | 165 | NCNTY21165N21165 | Menifee County, KY | Menifee County | 49900 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Menifee County | Kentucky | 0 |
| KY | 2116799999 | 21 | 167 | NCNTY21167N21167 | Mercer County, KY | Mercer County | 66000 | 13900 | 15850 | 17850 | 19800 | 21400 | 23000 | 24600 | 26150 | 9999 | Mercer County | Kentucky | 0 |
| KY | 2116999999 | 21 | 169 | NCNTY21169N21169 | Metcalfe County, KY | Metcalfe County | 44900 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Metcalfe County | Kentucky | 0 |
| KY | 2117199999 | 21 | 171 | NCNTY21171N21171 | Monroe County, KY | Monroe County | 52100 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Monroe County | Kentucky | 0 |
| KY | 2117399999 | 21 | 173 | NCNTY21173N21173 | Montgomery County, KY | Montgomery County | 56400 | 11700 | 13350 | 15000 | 16650 | 18000 | 19350 | 20650 | 22000 | 9999 | Montgomery County | Kentucky | 0 |
| KY | 2117599999 | 21 | 175 | NCNTY21175N21175 | Morgan County, KY | Morgan County | 43900 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Morgan County | Kentucky | 0 |
| KY | 2117799999 | 21 | 177 | NCNTY21177N21177 | Muhlenberg County, KY | Muhlenberg County | 55400 | 11650 | 13300 | 14950 | 16600 | 17950 | 19300 | 20600 | 21950 | 9999 | Muhlenberg County | Kentucky | 0 |
| KY | 2117999999 | 21 | 179 | NCNTY21179N21179 | Nelson County, KY | Nelson County | 71200 | 14950 | 17100 | 19250 | 21350 | 23100 | 24800 | 26500 | 28200 | 9999 | Nelson County | Kentucky | 0 |
| KY | 2118199999 | 21 | 181 | NCNTY21181N21181 | Nicholas County, KY | Nicholas County | 54500 | 11450 | 13100 | 14750 | 16350 | 17700 | 19000 | 20300 | 21600 | 9999 | Nicholas County | Kentucky | 0 |
| KY | 2118399999 | 21 | 183 | NCNTY21183N21183 | Ohio County, KY | Ohio County | 50600 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Ohio County | Kentucky | 0 |
| KY | 2118599999 | 21 | 185 | METRO31140M31140 | Louisville, KY-IN HUD Metro FMR Area | Oldham County | 77500 | 16300 | 18600 | 20950 | 23250 | 25150 | 27000 | 28850 | 30700 | 4520 | Oldham County | Kentucky | 1 |
| KY | 2118799999 | 21 | 187 | NCNTY21187N21187 | Owen County, KY | Owen County | 54700 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Owen County | Kentucky | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KY | 2118999999 | 21 | 189 | NCNTY21189N21189 | Owsley County, KY | Owsley County | 41300 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Owsley County | Kentucky | 0 |
| KY | 2119199999 | 21 | 191 | METRO17140M17140 | Cincinnati, OH-KY-IN HUD Metro FMR Area | Pendleton County | 86300 | 18150 | 20750 | 23350 | 25900 | 28000 | 30050 | 32150 | 34200 | 6070 | Pendleton County | Kentucky | 1 |
| KY | 2119399999 | 21 | 193 | NCNTY21193N21193 | Perry County, KY | Perry County | 45700 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Perry County | Kentucky | 0 |
| KY | 2119599999 | 21 | 195 | NCNTY21195N21195 | Pike County, KY | Pike County | 43600 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Pike County | Kentucky | 0 |
| KY | 2119799999 | 21 | 197 | NCNTY21197N21197 | Powell County, KY | Powell County | 52600 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Powell County | Kentucky | 0 |
| KY | 2119999999 | 21 | 199 | NCNTY21199N21199 | Pulaski County, KY | Pulaski County | 50700 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Pulaski County | Kentucky | 0 |
| KY | 2120199999 | 21 | 201 | NCNTY21201N21201 | Robertson County, KY | Robertson County | 54800 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Robertson County | Kentucky | 0 |
| KY | 2120399999 | 21 | 203 | NCNTY21203N21203 | Rockcastle County, KY | Rockcastle County | 50900 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Rockcastle County | Kentucky | 0 |
| KY | 2120599999 | 21 | 205 | NCNTY21205N21205 | Rowan County, KY | Rowan County | 54200 | 11400 | 13000 | 14650 | 16250 | 17550 | 18850 | 20150 | 21450 | 9999 | Rowan County | Kentucky | 0 |
| KY | 2120799999 | 21 | 207 | NCNTY21207N21207 | Russell County, KY | Russell County | 46000 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Russell County | Kentucky | 0 |
| KY | 2120999999 | 21 | 209 | METRO30460M30460 | Lexington-Fayette, KY MSA | Scott County | 79400 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 4280 | Scott County | Kentucky | 1 |
| KY | 2121199999 | 21 | 211 | METRO31140N21211 | Shelby County, KY HUD Metro FMR Area | Shelby County | 78900 | 16600 | 18950 | 21300 | 23650 | 25550 | 27450 | 29350 | 31250 | 9999 | Shelby County | Kentucky | 1 |
| KY | 2121399999 | 21 | 213 | NCNTY21213N21213 | Simpson County, KY | Simpson County | 59300 | 12500 | 14250 | 16050 | 17800 | 19250 | 20650 | 22100 | 23500 | 9999 | Simpson County | Kentucky | 0 |
| KY | 2121599999 | 21 | 215 | METRO31140M31140 | Louisville, KY-IN HUD Metro FMR Area | Spencer County | 77500 | 16300 | 18600 | 20950 | 23250 | 25150 | 27000 | 28850 | 30700 | 9999 | Spencer County | Kentucky | 1 |
| KY | 2121799999 | 21 | 217 | NCNTY21217N21217 | Taylor County, KY | Taylor County | 48600 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Taylor County | Kentucky | 0 |
| KY | 2121999999 | 21 | 219 | NCNTY21219N21219 | Todd County, KY | Todd County | 51100 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Todd County | Kentucky | 0 |
| KY | 2122199999 | 21 | 221 | METRO17300M17300 | Clarksville, TN-KY MSA | Trigg County | 68900 | 13800 | 15800 | 17750 | 19700 | 21300 | 22900 | 24450 | 26050 | 9999 | Trigg County | Kentucky | 1 |
| KY | 2122399999 | 21 | 223 | METRO31140M31140 | Louisville, KY-IN HUD Metro FMR Area | Trimble County | 77500 | 16300 | 18600 | 20950 | 23250 | 25150 | 27000 | 28850 | 30700 | 9999 | Trimble County | Kentucky | 1 |
| KY | 2122599999 | 21 | 225 | NCNTY21225N21225 | Union County, KY | Union County | 56300 | 11850 | 13550 | 15250 | 16900 | 18300 | 19650 | 21000 | 22350 | 9999 | Union County | Kentucky | 0 |
| KY | 2122799999 | 21 | 227 | METRO14540M14540 | Bowling Green, KY HUD Metro FMR Area | Warren County | 64400 | 13150 | 15000 | 16900 | 18750 | 20250 | 21750 | 23250 | 24750 | 9999 | Warren County | Kentucky | 1 |
| KY | 2122999999 | 21 | 229 | NCNTY21229N21229 | Washington County, KY | Washington County | 61500 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Washington County | Kentucky | 0 |
| KY | 2123199999 | 21 | 231 | NCNTY21231N21231 | Wayne County, KY | Wayne County | 45000 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Wayne County | Kentucky | 0 |
| KY | 2123399999 | 21 | 233 | NCNTY21233N21233 | Webster County, KY | Webster County | 52600 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Webster County | Kentucky | 0 |
| KY | 2123599999 | 21 | 235 | NCNTY21235N21235 | Whitley County, KY | Whitley County | 46600 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Whitley County | Kentucky | 0 |
| KY | 2123799999 | 21 | 237 | NCNTY21237N21237 | Wolfe County, KY | Wolfe County | 35200 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Wolfe County | Kentucky | 0 |
| KY | 2123999999 | 21 | 239 | METRO30460M30460 | Lexington-Fayette, KY MSA | Woodford County | 79400 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 4280 | Woodford County | Kentucky | 1 |
| LA | 2200199999 | 22 | 1 | METRO29180N22001 | Acadia Parish, LA HUD Metro FMR Area | Acadia Parish | 55300 | 11600 | 13250 | 14900 | 16550 | 17900 | 19200 | 20550 | 21850 | 3880 | Acadia Parish | Louisiana | 1 |
| LA | 2200399999 | 22 | 3 | NCNTY22003N22003 | Allen Parish, LA | Allen Parish | 58200 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Allen Parish | Louisiana | 0 |
| LA | 2200599999 | 22 | 5 | METRO12940M12940 | Baton Rouge, LA HUD Metro FMR Area | Ascension Parish | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 760 | Ascension Parish | Louisiana | 1 |
| LA | 2200799999 | 22 | 7 | NCNTY22007N22007 | Assumption Parish, LA | Assumption Parish | 64700 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Assumption Parish | Louisiana | 0 |
| LA | 2200999999 | 22 | 9 | NCNTY22009N22009 | Avoyelles Parish, LA | Avoyelles Parish | 52500 | 11050 | 12600 | 14200 | 15750 | 17050 | 18300 | 19550 | 20800 | 9999 | Avoyelles Parish | Louisiana | 0 |
| LA | 2201199999 | 22 | 11 | NCNTY22011N22011 | Beauregard Parish, LA | Beauregard Parish | 65700 | 13800 | 15800 | 17750 | 19700 | 21300 | 22900 | 24450 | 26050 | 9999 | Beauregard Parish | Louisiana | 0 |
| LA | 2201399999 | 22 | 13 | NCNTY22013N22013 | Bienville Parish, LA | Bienville Parish | 47700 | 10550 | 12050 | 13550 | 15050 | 16300 | 17500 | 18700 | 19900 | 9999 | Bienville Parish | Louisiana | 0 |
| LA | 2201599999 | 22 | 15 | METRO43340M43340 | Shreveport-Bossier City, LA HUD Metro FMR Area | Bossier Parish | 56700 | 11900 | 13600 | 15300 | 17000 | 18400 | 19750 | 21100 | 22450 | 7680 | Bossier Parish | Louisiana | 1 |
| LA | 2201799999 | 22 | 17 | METRO43340M43340 | Shreveport-Bossier City, LA HUD Metro FMR Area | Caddo Parish | 56700 | 11900 | 13600 | 15300 | 17000 | 18400 | 19750 | 21100 | 22450 | 7680 | Caddo Parish | Louisiana | 1 |
| LA | 2201999999 | 22 | 19 | METRO29340M29340 | Lake Charles, LA MSA | Calcasieu Parish | 70800 | 12950 | 14800 | 16650 | 18500 | 20000 | 21500 | 22950 | 24450 | 3960 | Calcasieu Parish | Louisiana | 1 |
| LA | 2202199999 | 22 | 21 | NCNTY22021N22021 | Caldwell Parish, LA | Caldwell Parish | 49000 | 10550 | 12050 | 13550 | 15050 | 16300 | 17500 | 18700 | 19900 | 9999 | Caldwell Parish | Louisiana | 0 |
| LA | 2202399999 | 22 | 23 | METRO29340M29340 | Lake Charles, LA MSA | Cameron Parish | 70800 | 12950 | 14800 | 16650 | 18500 | 20000 | 21500 | 22950 | 24450 | 9999 | Cameron Parish | Louisiana | 1 |
| LA | 2202599999 | 22 | 25 | NCNTY22025N22025 | Catahoula Parish, LA | Catahoula Parish | 58100 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Catahoula Parish | Louisiana | 0 |
| LA | 2202799999 | 22 | 27 | NCNTY22027N22027 | Claiborne Parish, LA | Claiborne Parish | 40200 | 10550 | 12050 | 13550 | 15050 | 16300 | 17500 | 18700 | 19900 | 9999 | Claiborne Parish | Louisiana | 0 |
| LA | 2202999999 | 22 | 29 | NCNTY22029N22029 | Concordia Parish, LA | Concordia Parish | 44500 | 10550 | 12050 | 13550 | 15050 | 16300 | 17500 | 18700 | 19900 | 9999 | Concordia Parish | Louisiana | 0 |
| LA | 2203199999 | 22 | 31 | METRO43340M43340 | Shreveport-Bossier City, LA HUD Metro FMR Area | De Soto Parish | 56700 | 11900 | 13600 | 15300 | 17000 | 18400 | 19750 | 21100 | 22450 | 9999 | De Soto Parish | Louisiana | 1 |
| LA | 2203399999 | 22 | 33 | METRO12940M12940 | Baton Rouge, LA HUD Metro FMR Area | East Baton Rouge Parish | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 760 | East Baton Rouge Parish | Louisiana | 1 |
| LA | 2203599999 | 22 | 35 | NCNTY22035N22035 | East Carroll Parish, LA | East Carroll Parish | 29700 | 10550 | 12050 | 13550 | 15050 | 16300 | 17500 | 18700 | 19900 | 9999 | East Carroll Parish | Louisiana | 0 |
| LA | 2203799999 | 22 | 37 | METRO12940M12940 | Baton Rouge, LA HUD Metro FMR Area | East Feliciana Parish | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 9999 | East Feliciana Parish | Louisiana | 1 |
| LA | 2203999999 | 22 | 39 | NCNTY22039N22039 | Evangeline Parish, LA | Evangeline Parish | 44000 | 10550 | 12050 | 13550 | 15050 | 16300 | 17500 | 18700 | 19900 | 9999 | Evangeline Parish | Louisiana | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LA | 2204199999 | 22 | 41 | NCNTY22041N22041 | Franklin Parish, LA | Franklin Parish | 50100 | 10550 | 12050 | 13550 | 15050 | 16300 | 17500 | 18700 | 19900 | 9999 | Franklin Parish | Louisiana | 0 |
| LA | 2204399999 | 22 | 43 | METRO10780M10780 | Alexandria, LA MSA | Grant Parish | 58400 | 12250 | 14000 | 15750 | 17500 | 18900 | 20300 | 21700 | 23100 | 9999 | Grant Parish | Louisiana | 1 |
| LA | 2204599999 | 22 | 45 | METRO29180N22045 | Iberia Parish, LA HUD Metro FMR Area | Iberia Parish | 54800 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Iberia Parish | Louisiana | 1 |
| LA | 2204799999 | 22 | 47 | METRO12940N22047 | Iberville Parish, LA HUD Metro FMR Area | Iberville Parish | 59300 | 12500 | 14250 | 16050 | 17800 | 19250 | 20650 | 22100 | 23500 | 9999 | Iberville Parish | Louisiana | 1 |
| LA | 2204999999 | 22 | 49 | NCNTY22049N22049 | Jackson Parish, LA | Jackson Parish | 50900 | 10700 | 12200 | 13750 | 15250 | 16500 | 17700 | 18950 | 20150 | 9999 | Jackson Parish | Louisiana | 0 |
| LA | 2205199999 | 22 | 51 | METRO35380M35380 | New Orleans-Metairie, LA HUD Metro FMR Area | Jefferson Parish | 70400 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 5560 | Jefferson Parish | Louisiana | 1 |
| LA | 2205399999 | 22 | 53 | NCNTY22053N22053 | Jefferson Davis Parish, LA | Jefferson Davis Parish | 57400 | 12050 | 13800 | 15500 | 17200 | 18600 | 20000 | 21350 | 22750 | 9999 | Jefferson Davis Parish | Louisiana | 0 |
| LA | 2205599999 | 22 | 55 | METRO29180M29180 | Lafayette, LA HUD Metro FMR Area | Lafayette Parish | 65200 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 3880 | Lafayette Parish | Louisiana | 1 |
| LA | 2205799999 | 22 | 57 | METRO26380M26380 | Houma-Thibodaux, LA MSA | Lafourche Parish | 67200 | 13800 | 15800 | 17750 | 19700 | 21300 | 22900 | 24450 | 26050 | 3350 | Lafourche Parish | Louisiana | 1 |
| LA | 2205999999 | 22 | 59 | NCNTY22059N22059 | La Salle Parish, LA | La Salle Parish | 44200 | 10550 | 12050 | 13550 | 15050 | 16300 | 17500 | 18700 | 19900 | 9999 | La Salle Parish | Louisiana | 0 |
| LA | 2206199999 | 22 | 61 | NCNTY22061N22061 | Lincoln Parish, LA | Lincoln Parish | 58000 | 12200 | 13950 | 15700 | 17400 | 18800 | 20200 | 21600 | 23000 | 9999 | Lincoln Parish | Louisiana | 0 |
| LA | 2206399999 | 22 | 63 | METRO12940M12940 | Baton Rouge, LA HUD Metro FMR Area | Livingston Parish | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 760 | Livingston Parish | Louisiana | 1 |
| LA | 2206599999 | 22 | 65 | NCNTY22065N22065 | Madison Parish, LA | Madison Parish | 38300 | 10550 | 12050 | 13550 | 15050 | 16300 | 17500 | 18700 | 19900 | 9999 | Madison Parish | Louisiana | 0 |
| LA | 2206799999 | 22 | 67 | NCNTY22067N22067 | Morehouse Parish, LA | Morehouse Parish | 43900 | 10550 | 12050 | 13550 | 15050 | 16300 | 17500 | 18700 | 19900 | 9999 | Morehouse Parish | Louisiana | 0 |
| LA | 2206999999 | 22 | 69 | NCNTY22069N22069 | Natchitoches Parish, LA | Natchitoches Parish | 49600 | 10550 | 12050 | 13550 | 15050 | 16300 | 17500 | 18700 | 19900 | 9999 | Natchitoches Parish | Louisiana | 0 |
| LA | 2207199999 | 22 | 71 | METRO35380M35380 | New Orleans-Metairie, LA HUD Metro FMR Area | Orleans Parish | 70400 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 5560 | Orleans Parish | Louisiana | 1 |
| LA | 2207399999 | 22 | 73 | METRO33740M33740 | Monroe, LA MSA | Ouachita Parish | 56700 | 11600 | 13250 | 14900 | 16550 | 17900 | 19200 | 20550 | 21850 | 5200 | Ouachita Parish | Louisiana | 1 |
| LA | 2207599999 | 22 | 75 | METRO35380M35380 | New Orleans-Metairie, LA HUD Metro FMR Area | Plaquemines Parish | 70400 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 5560 | Plaquemines Parish | Louisiana | 1 |
| LA | 2207799999 | 22 | 77 | METRO12940M12940 | Baton Rouge, LA HUD Metro FMR Area | Pointe Coupee Parish | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 9999 | Pointe Coupee Parish | Louisiana | 1 |
| LA | 2207999999 | 22 | 79 | METRO10780M10780 | Alexandria, LA MSA | Rapides Parish | 58400 | 12250 | 14000 | 15750 | 17500 | 18900 | 20300 | 21700 | 23100 | 220 | Rapides Parish | Louisiana | 1 |
| LA | 2208199999 | 22 | 81 | NCNTY22081N22081 | Red River Parish, LA | Red River Parish | 53400 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Red River Parish | Louisiana | 0 |
| LA | 2208399999 | 22 | 83 | NCNTY22083N22083 | Richland Parish, LA | Richland Parish | 49300 | 10550 | 12050 | 13550 | 15050 | 16300 | 17500 | 18700 | 19900 | 9999 | Richland Parish | Louisiana | 0 |
| LA | 2208599999 | 22 | 85 | NCNTY22085N22085 | Sabine Parish, LA | Sabine Parish | 57300 | 12050 | 13800 | 15500 | 17200 | 18600 | 20000 | 21350 | 22750 | 9999 | Sabine Parish | Louisiana | 0 |
| LA | 2208799999 | 22 | 87 | METRO35380M35380 | New Orleans-Metairie, LA HUD Metro FMR Area | St. Bernard Parish | 70400 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 5560 | St. Bernard Parish | Louisiana | 1 |
| LA | 2208999999 | 22 | 89 | METRO35380M35380 | New Orleans-Metairie, LA HUD Metro FMR Area | St. Charles Parish | 70400 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 5560 | St. Charles Parish | Louisiana | 1 |
| LA | 2209199999 | 22 | 91 | METRO12940M12940 | Baton Rouge, LA HUD Metro FMR Area | St. Helena Parish | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 9999 | St. Helena Parish | Louisiana | 1 |
| LA | 2209399999 | 22 | 93 | METRO35380N22093 | St. James Parish, LA HUD Metro FMR Area | St. James Parish | 67300 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 6990 | St. James Parish | Louisiana | 1 |
| LA | 2209599999 | 22 | 95 | METRO35380M35380 | New Orleans-Metairie, LA HUD Metro FMR Area | St. John the Baptist Parish | 70400 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 5560 | St. John the Baptist Parish | Louisiana | 1 |
| LA | 2209799999 | 22 | 97 | NCNTY22097N22097 | St. Landry Parish, LA | St. Landry Parish | 43800 | 10550 | 12050 | 13550 | 15050 | 16300 | 17500 | 18700 | 19900 | 3880 | St. Landry Parish | Louisiana | 0 |
| LA | 2209999999 | 22 | 99 | METRO29180M29180 | Lafayette, LA HUD Metro FMR Area | St. Martin Parish | 65200 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 3880 | St. Martin Parish | Louisiana | 1 |
| LA | 2210199999 | 22 | 101 | NCNTY22101N22101 | St. Mary Parish, LA | St. Mary Parish | 54200 | 11400 | 13000 | 14650 | 16250 | 17550 | 18850 | 20150 | 21450 | 9999 | St. Mary Parish | Louisiana | 0 |
| LA | 2210399999 | 22 | 103 | METRO35380M35380 | New Orleans-Metairie, LA HUD Metro FMR Area | St. Tammany Parish | 70400 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 5560 | St. Tammany Parish | Louisiana | 1 |
| LA | 2210599999 | 22 | 105 | METRO25220M25220 | Hammond, LA MSA | Tangipahoa Parish | 54100 | 13250 | 15150 | 17050 | 18900 | 20450 | 21950 | 23450 | 24950 | 9999 | Tangipahoa Parish | Louisiana | 1 |
| LA | 2210799999 | 22 | 107 | NCNTY22107N22107 | Tensas Parish, LA | Tensas Parish | 34100 | 10550 | 12050 | 13550 | 15050 | 16300 | 17500 | 18700 | 19900 | 9999 | Tensas Parish | Louisiana | 0 |
| LA | 2210999999 | 22 | 109 | METRO26380M26380 | Houma-Thibodaux, LA MSA | Terrebonne Parish | 67200 | 13800 | 15800 | 17750 | 19700 | 21300 | 22900 | 24450 | 26050 | 3350 | Terrebonne Parish | Louisiana | 1 |
| LA | 2211199999 | 22 | 111 | METRO33740M33740 | Monroe, LA MSA | Union Parish | 56700 | 11600 | 13250 | 14900 | 16550 | 17900 | 19200 | 20550 | 21850 | 9999 | Union Parish | Louisiana | 1 |
| LA | 2211399999 | 22 | 113 | METRO29180N22113 | Vermilion Parish, LA HUD Metro FMR Area | Vermilion Parish | 62800 | 13200 | 15100 | 17000 | 18850 | 20400 | 21900 | 23400 | 24900 | 9999 | Vermilion Parish | Louisiana | 1 |
| LA | 2211599999 | 22 | 115 | NCNTY22115N22115 | Vernon Parish, LA | Vernon Parish | 56800 | 13100 | 15000 | 16850 | 18700 | 20200 | 21700 | 23200 | 24700 | 9999 | Vernon Parish | Louisiana | 0 |
| LA | 2211799999 | 22 | 117 | NCNTY22117N22117 | Washington Parish, LA | Washington Parish | 46500 | 10550 | 12050 | 13550 | 15050 | 16300 | 17500 | 18700 | 19900 | 9999 | Washington Parish | Louisiana | 0 |
| LA | 2211999999 | 22 | 119 | METRO43340N22119 | Webster Parish, LA HUD Metro FMR Area | Webster Parish | 44000 | 10550 | 12050 | 13550 | 15050 | 16300 | 17500 | 18700 | 19900 | 7680 | Webster Parish | Louisiana | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LA | 2212199999 | 22 | 121 | METRO12940M12940 | Baton Rouge, LA HUD Metro FMR Area | West Baton Rouge Parish | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 760 | West Baton Rouge Parish | Louisiana | 1 |
| LA | 2212399999 | 22 | 123 | NCNTY22123N22123 | West Carroll Parish, LA | West Carroll Parish | 52600 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | West Carroll Parish | Louisiana | 0 |
| LA | 2212599999 | 22 | 125 | METRO12940M12940 | Baton Rouge, LA HUD Metro FMR Area | West Feliciana Parish | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 9999 | West Feliciana Parish | Louisiana | 1 |
| LA | 2212799999 | 22 | 127 | NCNTY22127N22127 | Winn Parish, LA | Winn Parish | 43500 | 10550 | 12050 | 13550 | 15050 | 16300 | 17500 | 18700 | 19900 | 9999 | Winn Parish | Louisiana | 0 |
| ME | 2300102060 | 23 | 1 | METRO30340M30340 | Lewiston-Auburn, ME MSA | Androscoggin County | 75900 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 4240 | Auburn city | Maine | 1 |
| ME | 2300119105 | 23 | 1 | METRO30340M30340 | Lewiston-Auburn, ME MSA | Androscoggin County | 75900 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Durham town | Maine | 1 |
| ME | 2300129255 | 23 | 1 | METRO30340M30340 | Lewiston-Auburn, ME MSA | Androscoggin County | 75900 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 4240 | Greene town | Maine | 1 |
| ME | 2300138565 | 23 | 1 | METRO30340M30340 | Lewiston-Auburn, ME MSA | Androscoggin County | 75900 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Leeds town | Maine | 1 |
| ME | 2300138740 | 23 | 1 | METRO30340M30340 | Lewiston-Auburn, ME MSA | Androscoggin County | 75900 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 4240 | Lewiston city | Maine | 1 |
| ME | 2300140035 | 23 | 1 | METRO30340M30340 | Lewiston-Auburn, ME MSA | Androscoggin County | 75900 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 4240 | Lisbon town | Maine | 1 |
| ME | 2300140665 | 23 | 1 | METRO30340M30340 | Lewiston-Auburn, ME MSA | Androscoggin County | 75900 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Livermore town | Maine | 1 |
| ME | 2300140770 | 23 | 1 | METRO30340M30340 | Lewiston-Auburn, ME MSA | Androscoggin County | 75900 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Livermore Falls town | Maine | 1 |
| ME | 2300144585 | 23 | 1 | METRO30340M30340 | Lewiston-Auburn, ME MSA | Androscoggin County | 75900 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 4240 | Mechanic Falls town | Maine | 1 |
| ME | 2300146160 | 23 | 1 | METRO30340M30340 | Lewiston-Auburn, ME MSA | Androscoggin County | 75900 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Minot town | Maine | 1 |
| ME | 2300160020 | 23 | 1 | METRO30340M30340 | Lewiston-Auburn, ME MSA | Androscoggin County | 75900 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 4240 | Poland town | Maine | 1 |
| ME | 2300164570 | 23 | 1 | METRO30340M30340 | Lewiston-Auburn, ME MSA | Androscoggin County | 75900 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 4240 | Sabattus town | Maine | 1 |
| ME | 2300177800 | 23 | 1 | METRO30340M30340 | Lewiston-Auburn, ME MSA | Androscoggin County | 75900 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 4240 | Turner town | Maine | 1 |
| ME | 2300179585 | 23 | 1 | METRO30340M30340 | Lewiston-Auburn, ME MSA | Androscoggin County | 75900 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 4240 | Wales town | Maine | 1 |
| ME | 2300300800 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Allagash town | Maine | 0 |
| ME | 2300301220 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Amity town | Maine | 0 |
| ME | 2300301710 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Ashland town | Maine | 0 |
| ME | 2300302760 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Bancroft town | Maine | 0 |
| ME | 2300305385 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Blaine town | Maine | 0 |
| ME | 2300307065 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Bridgewater town | Maine | 0 |
| ME | 2300310565 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Caribou city | Maine | 0 |
| ME | 2300311020 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Cary plantation | Maine | 0 |
| ME | 2300311300 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Castle Hill town | Maine | 0 |
| ME | 2300311335 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Caswell town | Maine | 0 |
| ME | 2300311785 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Central Aroostook UT | Maine | 0 |
| ME | 2300312000 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Chapman town | Maine | 0 |
| ME | 2300313900 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Connor UT | Maine | 0 |
| ME | 2300315395 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Crystal town | Maine | 0 |
| ME | 2300315990 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Cyr plantation | Maine | 0 |
| ME | 2300319210 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Dyer Brook town | Maine | 0 |
| ME | 2300319420 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Eagle Lake town | Maine | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ME | 2300321380 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Easton town | Maine | 0 |
| ME | 2300325615 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Fort Fairfield town | Maine | 0 |
| ME | 2300325755 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Fort Kent town | Maine | 0 |
| ME | 2300326735 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Frenchville town | Maine | 0 |
| ME | 2300327120 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Garfield plantation | Maine | 0 |
| ME | 2300327855 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Glenwood plantation | Maine | 0 |
| ME | 2300328590 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Grand Isle town | Maine | 0 |
| ME | 2300330690 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Hamlin town | Maine | 0 |
| ME | 2300330725 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Hammond town | Maine | 0 |
| ME | 2300332195 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Haynesville town | Maine | 0 |
| ME | 2300332685 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Hersey town | Maine | 0 |
| ME | 2300333385 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Hodgdon town | Maine | 0 |
| ME | 2300333980 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Houlton town | Maine | 0 |
| ME | 2300335065 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Island Falls town | Maine | 0 |
| ME | 2300339300 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Limestone town | Maine | 0 |
| ME | 2300339965 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Linneus town | Maine | 0 |
| ME | 2300340595 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Littleton town | Maine | 0 |
| ME | 2300341715 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Ludlow town | Maine | 0 |
| ME | 2300342450 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Macwahoc plantation | Maine | 0 |
| ME | 2300342520 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Madawaska town | Maine | 0 |
| ME | 2300343255 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Mapleton town | Maine | 0 |
| ME | 2300343710 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Mars Hill town | Maine | 0 |
| ME | 2300343990 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Masardis town | Maine | 0 |
| ME | 2300345180 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Merrill town | Maine | 0 |
| ME | 2300346685 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Monticello town | Maine | 0 |
| ME | 2300347175 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Moro plantation | Maine | 0 |
| ME | 2300348120 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Nashville plantation | Maine | 0 |
| ME | 2300348575 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | New Canada town | Maine | 0 |
| ME | 2300348960 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | New Limerick town | Maine | 0 |
| ME | 2300349415 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | New Sweden town | Maine | 0 |
| ME | 2300353602 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Northwest Aroostook UT | Maine | 0 |
| ME | 2300354385 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Oakfield town | Maine | 0 |
| ME | 2300355435 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Orient town | Maine | 0 |
| ME | 2300356205 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Oxbow plantation | Maine | 0 |
| ME | 2300357936 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Penobscot Indian Island Reservation | Maine | 0 |
| ME | 2300358060 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Perham town | Maine | 0 |
| ME | 2300360300 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Portage Lake town | Maine | 0 |
| ME | 2300360825 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Presque Isle city | Maine | 0 |
| ME | 2300362400 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Reed plantation | Maine | 0 |
| ME | 2300364780 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | St. Agatha town | Maine | 0 |
| ME | 2300365025 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | St. Francis town | Maine | 0 |
| ME | 2300365200 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | St. John plantation | Maine | 0 |
| ME | 2300367790 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Sherman town | Maine | 0 |
| ME | 2300369260 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Smyrna town | Maine | 0 |
| ME | 2300369930 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | South Aroostook UT | Maine | 0 |
| ME | 2300373472 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Square Lake UT | Maine | 0 |
| ME | 2300374405 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Stockholm town | Maine | 0 |
| ME | 2300378570 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Van Buren town | Maine | 0 |
| ME | 2300379270 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Wade town | Maine | 0 |
| ME | 2300379865 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Wallagrass town | Maine | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ME | 2300380285 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Washburn town | Maine | 0 |
| ME | 2300382770 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Westfield town | Maine | 0 |
| ME | 2300383540 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Westmanland town | Maine | 0 |
| ME | 2300383785 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Weston town | Maine | 0 |
| ME | 2300386865 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Winterville plantation | Maine | 0 |
| ME | 2300387215 | 23 | 3 | NCNTY23003N23003 | Aroostook County, ME | Aroostook County | 55000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Woodland town | Maine | 0 |
| ME | 2300502655 | 23 | 5 | METRO38860N23005 | Cumberland County, ME (part) HUD Metro FMR Area | Cumberland County | 78100 | 16450 | 18800 | 21150 | 23450 | 25350 | 27250 | 29100 | 31000 | 9999 | Baldwin town | Maine | 1 |
| ME | 2300507170 | 23 | 5 | METRO38860N23005 | Cumberland County, ME (part) HUD Metro FMR Area | Cumberland County | 78100 | 16450 | 18800 | 21150 | 23450 | 25350 | 27250 | 29100 | 31000 | 9999 | Bridgton town | Maine | 1 |
| ME | 2300508430 | 23 | 5 | METRO38860N23005 | Cumberland County, ME (part) HUD Metro FMR Area | Cumberland County | 78100 | 16450 | 18800 | 21150 | 23450 | 25350 | 27250 | 29100 | 31000 | 9999 | Brunswick town | Maine | 1 |
| ME | 2300510180 | 23 | 5 | METRO38860MM6400 | Portland, ME HUD Metro FMR Area | Cumberland County | 100900 | 21100 | 24100 | 27100 | 30100 | 32550 | 34950 | 37350 | 39750 | 6400 | Cape Elizabeth town | Maine | 1 |
| ME | 2300511125 | 23 | 5 | METRO38860MM6400 | Portland, ME HUD Metro FMR Area | Cumberland County | 100900 | 21100 | 24100 | 27100 | 30100 | 32550 | 34950 | 37350 | 39750 | 6400 | Casco town | Maine | 1 |
| ME | 2300512300 | 23 | 5 | METRO38860MM6400 | Portland, ME HUD Metro FMR Area | Cumberland County | 100900 | 21100 | 24100 | 27100 | 30100 | 32550 | 34950 | 37350 | 39750 |  | Chebeague Island town | Maine | 1 |
| ME | 2300515430 | 23 | 5 | METRO38860MM6400 | Portland, ME HUD Metro FMR Area | Cumberland County | 100900 | 21100 | 24100 | 27100 | 30100 | 32550 | 34950 | 37350 | 39750 | 6400 | Cumberland town | Maine | 1 |
| ME | 2300524495 | 23 | 5 | METRO38860MM6400 | Portland, ME HUD Metro FMR Area | Cumberland County | 100900 | 21100 | 24100 | 27100 | 30100 | 32550 | 34950 | 37350 | 39750 | 6400 | Falmouth town | Maine | 1 |
| ME | 2300526525 | 23 | 5 | METRO38860MM6400 | Portland, ME HUD Metro FMR Area | Cumberland County | 100900 | 21100 | 24100 | 27100 | 30100 | 32550 | 34950 | 37350 | 39750 | 6400 | Freeport town | Maine | 1 |
| ME | 2300527025 | 23 | 5 | METRO38860MM6400 | Portland, ME HUD Metro FMR Area | Cumberland County | 100900 | 21100 | 24100 | 27100 | 30100 | 32550 | 34950 | 37350 | 39750 | 6400 | Frye Island town | Maine | 1 |
| ME | 2300528240 | 23 | 5 | METRO38860MM6400 | Portland, ME HUD Metro FMR Area | Cumberland County | 100900 | 21100 | 24100 | 27100 | 30100 | 32550 | 34950 | 37350 | 39750 | 6400 | Gorham town | Maine | 1 |
| ME | 2300528870 | 23 | 5 | METRO38860MM6400 | Portland, ME HUD Metro FMR Area | Cumberland County | 100900 | 21100 | 24100 | 27100 | 30100 | 32550 | 34950 | 37350 | 39750 | 6400 | Gray town | Maine | 1 |
| ME | 2300531390 | 23 | 5 | METRO38860N23005 | Cumberland County, ME (part) HUD Metro FMR Area | Cumberland County | 78100 | 16450 | 18800 | 21150 | 23450 | 25350 | 27250 | 29100 | 31000 | 9999 | Harpswell town | Maine | 1 |
| ME | 2300531600 | 23 | 5 | METRO38860N23005 | Cumberland County, ME (part) HUD Metro FMR Area | Cumberland County | 78100 | 16450 | 18800 | 21150 | 23450 | 25350 | 27250 | 29100 | 31000 | 9999 | Harrison town | Maine | 1 |
| ME | 2300541067 | 23 | 5 | METRO38860MM6400 | Portland, ME HUD Metro FMR Area | Cumberland County | 100900 | 21100 | 24100 | 27100 | 30100 | 32550 | 34950 | 37350 | 39750 | 6400 | Long Island town | Maine | 1 |
| ME | 2300548085 | 23 | 5 | METRO38860N23005 | Cumberland County, ME (part) HUD Metro FMR Area | Cumberland County | 78100 | 16450 | 18800 | 21150 | 23450 | 25350 | 27250 | 29100 | 31000 | 9999 | Naples town | Maine | 1 |
| ME | 2300548820 | 23 | 5 | METRO38860N23005 | Cumberland County, ME (part) HUD Metro FMR Area | Cumberland County | 78100 | 16450 | 18800 | 21150 | 23450 | 25350 | 27250 | 29100 | 31000 | 9999 | New Gloucester town | Maine | 1 |
| ME | 2300553860 | 23 | 5 | METRO38860MM6400 | Portland, ME HUD Metro FMR Area | Cumberland County | 100900 | 21100 | 24100 | 27100 | 30100 | 32550 | 34950 | 37350 | 39750 | 6400 | North Yarmouth town | Maine | 1 |
| ME | 2300560545 | 23 | 5 | METRO38860MM6400 | Portland, ME HUD Metro FMR Area | Cumberland County | 100900 | 21100 | 24100 | 27100 | 30100 | 32550 | 34950 | 37350 | 39750 | 6400 | Portland city | Maine | 1 |
| ME | 2300560685 | 23 | 5 | METRO38860N23005 | Cumberland County, ME (part) HUD Metro FMR Area | Cumberland County | 78100 | 16450 | 18800 | 21150 | 23450 | 25350 | 27250 | 29100 | 31000 | 9999 | Pownal town | Maine | 1 |
| ME | 2300561945 | 23 | 5 | METRO38860MM6400 | Portland, ME HUD Metro FMR Area | Cumberland County | 100900 | 21100 | 24100 | 27100 | 30100 | 32550 | 34950 | 37350 | 39750 | 6400 | Raymond town | Maine | 1 |
| ME | 2300566145 | 23 | 5 | METRO38860MM6400 | Portland, ME HUD Metro FMR Area | Cumberland County | 100900 | 21100 | 24100 | 27100 | 30100 | 32550 | 34950 | 37350 | 39750 | 6400 | Scarborough town | Maine | 1 |
| ME | 2300566775 | 23 | 5 | METRO38860N23005 | Cumberland County, ME (part) HUD Metro FMR Area | Cumberland County | 78100 | 16450 | 18800 | 21150 | 23450 | 25350 | 27250 | 29100 | 31000 | 9999 | Sebago town | Maine | 1 |
| ME | 2300571990 | 23 | 5 | METRO38860MM6400 | Portland, ME HUD Metro FMR Area | Cumberland County | 100900 | 21100 | 24100 | 27100 | 30100 | 32550 | 34950 | 37350 | 39750 | 6400 | South Portland city | Maine | 1 |
| ME | 2300573670 | 23 | 5 | METRO38860MM6400 | Portland, ME HUD Metro FMR Area | Cumberland County | 100900 | 21100 | 24100 | 27100 | 30100 | 32550 | 34950 | 37350 | 39750 | 6400 | Standish town | Maine | 1 |
| ME | 2300582105 | 23 | 5 | METRO38860MM6400 | Portland, ME HUD Metro FMR Area | Cumberland County | 100900 | 21100 | 24100 | 27100 | 30100 | 32550 | 34950 | 37350 | 39750 | 6400 | Westbrook city | Maine | 1 |
| ME | 2300586025 | 23 | 5 | METRO38860MM6400 | Portland, ME HUD Metro FMR Area | Cumberland County | 100900 | 21100 | 24100 | 27100 | 30100 | 32550 | 34950 | 37350 | 39750 | 6400 | Windham town | Maine | 1 |
| ME | 2300587845 | 23 | 5 | METRO38860MM6400 | Portland, ME HUD Metro FMR Area | Cumberland County | 100900 | 21100 | 24100 | 27100 | 30100 | 32550 | 34950 | 37350 | 39750 | 6400 | Yarmouth town | Maine | 1 |
| ME | 2300702235 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Avon town | Maine | 0 |
| ME | 2300710740 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Carrabassett Valley town | Maine | 0 |
| ME | 2300710915 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Carthage town | Maine | 0 |
| ME | 2300712595 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Chesterville town | Maine | 0 |
| ME | 2300714205 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Coplin plantation | Maine | 0 |
| ME | 2300716165 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Dallas plantation | Maine | 0 |
| ME | 2300719865 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | East Central Franklin UT | Maine | 0 |
| ME | 2300724005 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Eustis town | Maine | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ME | 2300724775 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Farmington town | Maine | 0 |
| ME | 2300734820 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Industry town | Maine | 0 |
| ME | 2300735625 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Jay town | Maine | 0 |
| ME | 2300737025 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Kingfield town | Maine | 0 |
| ME | 2300749345 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | New Sharon town | Maine | 0 |
| ME | 2300749520 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | New Vineyard town | Maine | 0 |
| ME | 2300751400 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | North Franklin UT | Maine | 0 |
| ME | 2300758445 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Phillips town | Maine | 0 |
| ME | 2300761840 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Rangeley town | Maine | 0 |
| ME | 2300761875 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Rangeley plantation | Maine | 0 |
| ME | 2300765655 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Sandy River plantation | Maine | 0 |
| ME | 2300770760 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | South Franklin UT | Maine | 0 |
| ME | 2300774825 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Strong town | Maine | 0 |
| ME | 2300775980 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Temple town | Maine | 0 |
| ME | 2300781300 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Weld town | Maine | 0 |
| ME | 2300782235 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | West Central Franklin UT | Maine | 0 |
| ME | 2300785850 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Wilton town | Maine | 0 |
| ME | 2300787680 | 23 | 7 | NCNTY23007N23007 | Franklin County, ME | Franklin County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Wyman UT | Maine | 0 |
| ME | 2300901185 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Amherst town | Maine | 0 |
| ME | 2300902165 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Aurora town | Maine | 0 |
| ME | 2300902865 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Bar Harbor town | Maine | 0 |
| ME | 2300905700 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Blue Hill town | Maine | 0 |
| ME | 2300907800 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Brooklin town | Maine | 0 |
| ME | 2300907975 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Brooksville town | Maine | 0 |
| ME | 2300908815 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Bucksport town | Maine | 0 |
| ME | 2300911265 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Castine town | Maine | 0 |
| ME | 2300911800 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Central Hancock UT | Maine | 0 |
| ME | 2300914905 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Cranberry Isles town | Maine | 0 |
| ME | 2300916935 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Dedham town | Maine | 0 |
| ME | 2300917145 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Deer Isle town | Maine | 0 |
| ME | 2300919770 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Eastbrook town | Maine | 0 |
| ME | 2300920405 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | East Hancock UT | Maine | 0 |
| ME | 2300923200 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Ellsworth city | Maine | 0 |
| ME | 2300926350 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Franklin town | Maine | 0 |
| ME | 2300926595 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Frenchboro town | Maine | 0 |
| ME | 2300928450 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Gouldsboro town | Maine | 0 |
| ME | 2300928975 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Great Pond town | Maine | 0 |
| ME | 2300930970 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Hancock town | Maine | 0 |
| ME | 2300938180 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Lamoine town | Maine | 0 |
| ME | 2300943430 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Mariaville town | Maine | 0 |
| ME | 2300943578 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Marshall Island UT | Maine | 0 |
| ME | 2300947630 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Mount Desert town | Maine | 0 |
| ME | 2300953620 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Northwest Hancock UT | Maine | 0 |
| ME | 2300955505 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Orland town | Maine | 0 |
| ME | 2300955855 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Osborn town | Maine | 0 |
| ME | 2300955890 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Otis town | Maine | 0 |
| ME | 2300957920 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Penobscot town | Maine | 0 |
| ME | 2300967300 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Sedgwick town | Maine | 0 |
| ME | 2300969750 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Sorrento town | Maine | 0 |
| ME | 2300972865 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Southwest Harbor town | Maine | 0 |
| ME | 2300974580 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Stonington town | Maine | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ME | 2300974965 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Sullivan town | Maine | 0 |
| ME | 2300975280 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Surry town | Maine | 0 |
| ME | 2300975455 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Swans Island town | Maine | 0 |
| ME | 2300977345 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Tremont town | Maine | 0 |
| ME | 2300977415 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Trenton town | Maine | 0 |
| ME | 2300978925 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Verona Island town | Maine | 0 |
| ME | 2300980040 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Waltham town | Maine | 0 |
| ME | 2300986655 | 23 | 9 | NCNTY23009N23009 | Hancock County, ME | Hancock County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Winter Harbor town | Maine | 0 |
| ME | 2301100590 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Albion town | Maine | 0 |
| ME | 2301102100 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Augusta city | Maine | 0 |
| ME | 2301104020 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Belgrade town | Maine | 0 |
| ME | 2301104475 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Benton town | Maine | 0 |
| ME | 2301112350 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Chelsea town | Maine | 0 |
| ME | 2301112735 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | China town | Maine | 0 |
| ME | 2301113470 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Clinton town | Maine | 0 |
| ME | 2301124670 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Farmingdale town | Maine | 0 |
| ME | 2301124950 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Fayette town | Maine | 0 |
| ME | 2301127085 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Gardiner city | Maine | 0 |
| ME | 2301130550 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Hallowell city | Maine | 0 |
| ME | 2301140175 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Litchfield town | Maine | 0 |
| ME | 2301143080 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Manchester town | Maine | 0 |
| ME | 2301146405 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Monmouth town | Maine | 0 |
| ME | 2301147770 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Mount Vernon town | Maine | 0 |
| ME | 2301154560 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Oakland town | Maine | 0 |
| ME | 2301159110 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Pittston town | Maine | 0 |
| ME | 2301161700 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Randolph town | Maine | 0 |
| ME | 2301162190 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Readfield town | Maine | 0 |
| ME | 2301163835 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Rome town | Maine | 0 |
| ME | 2301168385 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Sidney town | Maine | 0 |
| ME | 2301178190 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Unity UT | Maine | 0 |
| ME | 2301178745 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Vassalboro town | Maine | 0 |
| ME | 2301179025 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Vienna town | Maine | 0 |
| ME | 2301180740 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Waterville city | Maine | 0 |
| ME | 2301180880 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Wayne town | Maine | 0 |
| ME | 2301182945 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | West Gardiner town | Maine | 0 |
| ME | 2301186165 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Windsor town | Maine | 0 |
| ME | 2301186515 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Winslow town | Maine | 0 |
| ME | 2301186970 | 23 | 11 | NCNTY23011N23011 | Kennebec County, ME | Kennebec County | 77700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Winthrop town | Maine | 0 |
| ME | 2301301465 | 23 | 13 | NCNTY23013N23013 | Knox County, ME | Knox County | 68200 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Appleton town | Maine | 0 |
| ME | 2301309725 | 23 | 13 | NCNTY23013N23013 | Knox County, ME | Knox County | 68200 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Camden town | Maine | 0 |
| ME | 2301315125 | 23 | 13 | NCNTY23013N23013 | Knox County, ME | Knox County | 68200 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Criehaven UT | Maine | 0 |
| ME | 2301315780 | 23 | 13 | NCNTY23013N23013 | Knox County, ME | Knox County | 68200 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Cushing town | Maine | 0 |
| ME | 2301326805 | 23 | 13 | NCNTY23013N23013 | Knox County, ME | Knox County | 68200 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Friendship town | Maine | 0 |
| ME | 2301333840 | 23 | 13 | NCNTY23013N23013 | Knox County, ME | Knox County | 68200 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Hope town | Maine | 0 |
| ME | 2301335135 | 23 | 13 | NCNTY23013N23013 | Knox County, ME | Knox County | 68200 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Isle au Haut town | Maine | 0 |
| ME | 2301344165 | 23 | 13 | NCNTY23013N23013 | Knox County, ME | Knox County | 68200 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Matinicus Isle plantation | Maine | 0 |
| ME | 2301347962 | 23 | 13 | NCNTY23013N23013 | Knox County, ME | Knox County | 68200 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Muscle Ridge Island UT | Maine | 0 |
| ME | 2301351620 | 23 | 13 | NCNTY23013N23013 | Knox County, ME | Knox County | 68200 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | North Haven town | Maine | 0 |
| ME | 2301356135 | 23 | 13 | NCNTY23013N23013 | Knox County, ME | Knox County | 68200 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Owls Head town | Maine | 0 |
| ME | 2301363590 | 23 | 13 | NCNTY23013N23013 | Knox County, ME | Knox County | 68200 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Rockland city | Maine | 0 |
| ME | 2301363660 | 23 | 13 | NCNTY23013N23013 | Knox County, ME | Knox County | 68200 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Rockport town | Maine | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | I30_1 | I30_2 | I30_3 | I30_4 | I30_5 | I30_6 | I30_7 | I30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ME | 2301365130 | 23 | 13 | NCNTY23013N23013 | Knox County, ME | Knox County | 68200 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | St. George town | Maine | 0 |
| ME | 2301372585 | 23 | 13 | NCNTY23013N23013 | Knox County, ME | Knox County | 68200 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | South Thomaston town | Maine | 0 |
| ME | 2301376365 | 23 | 13 | NCNTY23013N23013 | Knox County, ME | Knox County | 68200 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Thomaston town | Maine | 0 |
| ME | 2301378115 | 23 | 13 | NCNTY23013N23013 | Knox County, ME | Knox County | 68200 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Union town | Maine | 0 |
| ME | 2301379130 | 23 | 13 | NCNTY23013N23013 | Knox County, ME | Knox County | 68200 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Vinalhaven town | Maine | 0 |
| ME | 2301380215 | 23 | 13 | NCNTY23013N23013 | Knox County, ME | Knox County | 68200 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Warren town | Maine | 0 |
| ME | 2301380425 | 23 | 13 | NCNTY23013N23013 | Knox County, ME | Knox County | 68200 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Washington town | Maine | 0 |
| ME | 2301501010 | 23 | 15 | NCNTY23015N23015 | Lincoln County, ME | Lincoln County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Alna town | Maine | 0 |
| ME | 2301506050 | 23 | 15 | NCNTY23015N23015 | Lincoln County, ME | Lincoln County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Boothbay town | Maine | 0 |
| ME | 2301506120 | 23 | 15 | NCNTY23015N23015 | Lincoln County, ME | Lincoln County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Boothbay Harbor town | Maine | 0 |
| ME | 2301506855 | 23 | 15 | NCNTY23015N23015 | Lincoln County, ME | Lincoln County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Bremen town | Maine | 0 |
| ME | 2301507485 | 23 | 15 | NCNTY23015N23015 | Lincoln County, ME | Lincoln County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Bristol town | Maine | 0 |
| ME | 2301516235 | 23 | 15 | NCNTY23015N23015 | Lincoln County, ME | Lincoln County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Damariscotta town | Maine | 0 |
| ME | 2301518475 | 23 | 15 | NCNTY23015N23015 | Lincoln County, ME | Lincoln County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Dresden town | Maine | 0 |
| ME | 2301522675 | 23 | 15 | NCNTY23015N23015 | Lincoln County, ME | Lincoln County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Edgecomb town | Maine | 0 |
| ME | 2301532715 | 23 | 15 | NCNTY23015N23015 | Lincoln County, ME | Lincoln County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Hibberts gore | Maine | 0 |
| ME | 2301535695 | 23 | 15 | NCNTY23015N23015 | Lincoln County, ME | Lincoln County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Jefferson town | Maine | 0 |
| ME | 2301541280 | 23 | 15 | NCNTY23015N23015 | Lincoln County, ME | Lincoln County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Louds Island UT | Maine | 0 |
| ME | 2301546335 | 23 | 15 | NCNTY23015N23015 | Lincoln County, ME | Lincoln County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Monhegan plantation | Maine | 0 |
| ME | 2301548645 | 23 | 15 | NCNTY23015N23015 | Lincoln County, ME | Lincoln County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Newcastle town | Maine | 0 |
| ME | 2301549660 | 23 | 15 | NCNTY23015N23015 | Lincoln County, ME | Lincoln County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Nobleboro town | Maine | 0 |
| ME | 2301569645 | 23 | 15 | NCNTY23015N23015 | Lincoln County, ME | Lincoln County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Somerville town | Maine | 0 |
| ME | 2301570240 | 23 | 15 | NCNTY23015N23015 | Lincoln County, ME | Lincoln County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | South Bristol town | Maine | 0 |
| ME | 2301571955 | 23 | 15 | NCNTY23015N23015 | Lincoln County, ME | Lincoln County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Southport town | Maine | 0 |
| ME | 2301579550 | 23 | 15 | NCNTY23015N23015 | Lincoln County, ME | Lincoln County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Waldoboro town | Maine | 0 |
| ME | 2301584140 | 23 | 15 | NCNTY23015N23015 | Lincoln County, ME | Lincoln County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Westport Island town | Maine | 0 |
| ME | 2301585010 | 23 | 15 | NCNTY23015N23015 | Lincoln County, ME | Lincoln County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Whitefield town | Maine | 0 |
| ME | 2301587075 | 23 | 15 | NCNTY23015N23015 | Lincoln County, ME | Lincoln County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Wiscasset town | Maine | 0 |
| ME | 2301701325 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Andover town | Maine | 0 |
| ME | 2301704825 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Bethel town | Maine | 0 |
| ME | 2301708150 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Brownfield town | Maine | 0 |
| ME | 2301708710 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Buckfield town | Maine | 0 |
| ME | 2301709550 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Byron town | Maine | 0 |
| ME | 2301710005 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Canton town | Maine | 0 |
| ME | 2301717250 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Denmark town | Maine | 0 |
| ME | 2301717740 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Dixfield town | Maine | 0 |
| ME | 2301726910 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Fryeburg town | Maine | 0 |
| ME | 2301727505 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Gilead town | Maine | 0 |
| ME | 2301729710 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Greenwood town | Maine | 0 |
| ME | 2301731110 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Hanover town | Maine | 0 |
| ME | 2301731670 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Hartford town | Maine | 0 |
| ME | 2301732370 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Hebron town | Maine | 0 |
| ME | 2301733315 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Hiram town | Maine | 0 |
| ME | 2301739422 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Lincoln plantation | Maine | 0 |
| ME | 2301741365 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Lovell town | Maine | 0 |
| ME | 2301742835 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Magalloway plantation | Maine | 0 |
| ME | 2301745285 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Mexico town | Maine | 0 |
| ME | 2301746105 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Milton UT | Maine | 0 |
| ME | 2301749275 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Newry town | Maine | 0 |
| ME | 2301752575 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | North Oxford UT | Maine | 0 |
| ME | 2301754000 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Norway town | Maine | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ME | 2301755960 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Otisfield town | Maine | 0 |
| ME | 2301756310 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Oxford town | Maine | 0 |
| ME | 2301756625 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Paris town | Maine | 0 |
| ME | 2301758270 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Peru town | Maine | 0 |
| ME | 2301760405 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Porter town | Maine | 0 |
| ME | 2301764185 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Roxbury town | Maine | 0 |
| ME | 2301764290 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Rumford town | Maine | 0 |
| ME | 2301771755 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | South Oxford UT | Maine | 0 |
| ME | 2301774510 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Stoneham town | Maine | 0 |
| ME | 2301774685 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Stow town | Maine | 0 |
| ME | 2301775035 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Sumner town | Maine | 0 |
| ME | 2301775595 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Sweden town | Maine | 0 |
| ME | 2301778465 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Upton town | Maine | 0 |
| ME | 2301780635 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Waterford town | Maine | 0 |
| ME | 2301783890 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | West Paris town | Maine | 0 |
| ME | 2301787355 | 23 | 17 | NCNTY23017N23017 | Oxford County, ME | Oxford County | 58400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Woodstock town | Maine | 0 |
| ME | 2301901115 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Alton town | Maine | 1 |
| ME | 2301901500 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Argyle UT | Maine | 1 |
| ME | 2301902795 | 23 | 19 | METRO12620MM0730 | Bangor, ME HUD Metro FMR Area | Penobscot County | 72900 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 730 | Bangor city | Maine | 1 |
| ME | 2301906575 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Bradford town | Maine | 1 |
| ME | 2301906680 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Bradley town | Maine | 1 |
| ME | 2301906925 | 23 | 19 | METRO12620MM0730 | Bangor, ME HUD Metro FMR Area | Penobscot County | 72900 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 730 | Brewer city | Maine | 1 |
| ME | 2301909200 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Burlington town | Maine | 1 |
| ME | 2301910670 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Carmel town | Maine | 1 |
| ME | 2301910810 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Carroll plantation | Maine | 1 |
| ME | 2301912105 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Charleston town | Maine | 1 |
| ME | 2301912525 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Chester town | Maine | 1 |
| ME | 2301913365 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Clifton town | Maine | 1 |
| ME | 2301914310 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Corinna town | Maine | 1 |
| ME | 2301914380 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Corinth town | Maine | 1 |
| ME | 2301917530 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Dexter town | Maine | 1 |
| ME | 2301917950 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Dixmont town | Maine | 1 |
| ME | 2301918580 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Drew plantation | Maine | 1 |
| ME | 2301919868 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | East Central Penobscot UT | Maine | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ME | 2301921030 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | East Millinocket town | Maine | 1 |
| ME | 2301922535 | 23 | 19 | METRO12620MM0730 | Bangor, ME HUD Metro FMR Area | Penobscot County | 72900 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 730 | Eddington town | Maine | 1 |
| ME | 2301922710 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Edinburg town | Maine | 1 |
| ME | 2301923620 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Enfield town | Maine | 1 |
| ME | 2301923865 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Etna town | Maine | 1 |
| ME | 2301924110 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Exeter town | Maine | 1 |
| ME | 2301927190 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Garland town | Maine | 1 |
| ME | 2301927645 | 23 | 19 | METRO12620MM0730 | Bangor, ME HUD Metro FMR Area | Penobscot County | 72900 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 730 | Glenburn town | Maine | 1 |
| ME | 2301929185 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Greenbush town | Maine | 1 |
| ME | 2301930795 | 23 | 19 | METRO12620MM0730 | Bangor, ME HUD Metro FMR Area | Penobscot County | 72900 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 730 | Hampden town | Maine | 1 |
| ME | 2301932510 | 23 | 19 | METRO12620MM0730 | Bangor, ME HUD Metro FMR Area | Penobscot County | 72900 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 730 | Hermon town | Maine | 1 |
| ME | 2301933490 | 23 | 19 | METRO12620MM0730 | Bangor, ME HUD Metro FMR Area | Penobscot County | 72900 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 730 | Holden town | Maine | 1 |
| ME | 2301934190 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Howland town | Maine | 1 |
| ME | 2301934365 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Hudson town | Maine | 1 |
| ME | 2301936325 | 23 | 19 | METRO12620MM0730 | Bangor, ME HUD Metro FMR Area | Penobscot County | 72900 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 730 | Kenduskeag town | Maine | 1 |
| ME | 2301937075 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Kingman UT | Maine | 1 |
| ME | 2301937760 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Lagrange town | Maine | 1 |
| ME | 2301938005 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Lakeville town | Maine | 1 |
| ME | 2301938530 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Lee town | Maine | 1 |
| ME | 2301938705 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Levant town | Maine | 1 |
| ME | 2301939475 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Lincoln town | Maine | 1 |
| ME | 2301941435 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Lowell town | Maine | 1 |
| ME | 2301944270 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Mattawamkeag town | Maine | 1 |
| ME | 2301944340 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Maxfield town | Maine | 1 |
| ME | 2301945005 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Medway town | Maine | 1 |
| ME | 2301945670 | 23 | 19 | METRO12620MM0730 | Bangor, ME HUD Metro FMR Area | Penobscot County | 72900 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 730 | Milford town | Maine | 1 |
| ME | 2301945810 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Millinocket town | Maine | 1 |
| ME | 2301947560 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Mount Chase town | Maine | 1 |
| ME | 2301948505 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Newburgh town | Maine | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ME | 2301949065 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Newport town | Maine | 1 |
| ME | 2301952710 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | North Penobscot UT | Maine | 1 |
| ME | 2301955225 | 23 | 19 | METRO12620MM0730 | Bangor, ME HUD Metro FMR Area | Penobscot County | 72900 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 730 | Old Town city | Maine | 1 |
| ME | 2301955565 | 23 | 19 | METRO12620MM0730 | Bangor, ME HUD Metro FMR Area | Penobscot County | 72900 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 730 | Orono town | Maine | 1 |
| ME | 2301955680 | 23 | 19 | METRO12620MM0730 | Bangor, ME HUD Metro FMR Area | Penobscot County | 72900 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 730 | Orrington town | Maine | 1 |
| ME | 2301957045 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Passadumkeag town | Maine | 1 |
| ME | 2301957150 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Patten town | Maine | 1 |
| ME | 2301957936 | 23 | 19 | METRO12620MM0730 | Bangor, ME HUD Metro FMR Area | Penobscot County | 72900 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 730 | Penobscot Indian Island Reservation | Maine | 1 |
| ME | 2301959950 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Plymouth town | Maine | 1 |
| ME | 2301960790 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Prentiss UT | Maine | 1 |
| ME | 2301967160 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Seboeis plantation | Maine | 1 |
| ME | 2301973250 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Springfield town | Maine | 1 |
| ME | 2301973600 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Stacyville town | Maine | 1 |
| ME | 2301974055 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Stetson town | Maine | 1 |
| ME | 2301978015 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Twombly UT | Maine | 1 |
| ME | 2301978780 | 23 | 19 | METRO12620MM0730 | Bangor, ME HUD Metro FMR Area | Penobscot County | 72900 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 730 | Veazie town | Maine | 1 |
| ME | 2301981055 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Webster plantation | Maine | 1 |
| ME | 2301985230 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Whitney UT | Maine | 1 |
| ME | 2301986305 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Winn town | Maine | 1 |
| ME | 2301987390 | 23 | 19 | METRO12620N23019 | Penobscot County, ME (part) HUD Metro FMR Area | Penobscot County | 57400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Woodville town | Maine | 1 |
| ME | 2302100100 | 23 | 21 | NCNTY23021N23021 | Piscataquis County, ME | Piscataquis County | 52800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Abbot town | Maine | 0 |
| ME | 2302101920 | 23 | 21 | NCNTY23021N23021 | Piscataquis County, ME | Piscataquis County | 52800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Atkinson town | Maine | 0 |
| ME | 2302103740 | 23 | 21 | NCNTY23021N23021 | Piscataquis County, ME | Piscataquis County | 52800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Beaver Cove town | Maine | 0 |
| ME | 2302105560 | 23 | 21 | NCNTY23021N23021 | Piscataquis County, ME | Piscataquis County | 52800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Blanchard UT | Maine | 0 |
| ME | 2302106400 | 23 | 21 | NCNTY23021N23021 | Piscataquis County, ME | Piscataquis County | 52800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Bowerbank town | Maine | 0 |
| ME | 2302108325 | 23 | 21 | NCNTY23021N23021 | Piscataquis County, ME | Piscataquis County | 52800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Brownville town | Maine | 0 |
| ME | 2302118195 | 23 | 21 | NCNTY23021N23021 | Piscataquis County, ME | Piscataquis County | 52800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Dover-Foxcroft town | Maine | 0 |
| ME | 2302129535 | 23 | 21 | NCNTY23021N23021 | Piscataquis County, ME | Piscataquis County | 52800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Greenville town | Maine | 0 |
| ME | 2302130095 | 23 | 21 | NCNTY23021N23021 | Piscataquis County, ME | Piscataquis County | 52800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Guilford town | Maine | 0 |
| ME | 2302137095 | 23 | 21 | NCNTY23021N23021 | Piscataquis County, ME | Piscataquis County | 52800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Kingsbury plantation | Maine | 0 |
| ME | 2302137970 | 23 | 21 | NCNTY23021N23021 | Piscataquis County, ME | Piscataquis County | 52800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Lake View plantation | Maine | 0 |
| ME | 2302144830 | 23 | 21 | NCNTY23021N23021 | Piscataquis County, ME | Piscataquis County | 52800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Medford town | Maine | 0 |
| ME | 2302146020 | 23 | 21 | NCNTY23021N23021 | Piscataquis County, ME | Piscataquis County | 52800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Milo town | Maine | 0 |
| ME | 2302146580 | 23 | 21 | NCNTY23021N23021 | Piscataquis County, ME | Piscataquis County | 52800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Monson town | Maine | 0 |
| ME | 2302151105 | 23 | 21 | NCNTY23021N23021 | Piscataquis County, ME | Piscataquis County | 52800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Northeast Piscataquis UT | Maine | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ME | 2302153628 | 23 | 21 | NCNTY23021N23021 | Piscataquis County, ME | Piscataquis County | 52800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Northwest Piscataquis UT | Maine | 0 |
| ME | 2302156765 | 23 | 21 | NCNTY23021N23021 | Piscataquis County, ME | Piscataquis County | 52800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Parkman town | Maine | 0 |
| ME | 2302165865 | 23 | 21 | NCNTY23021N23021 | Piscataquis County, ME | Piscataquis County | 52800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Sangerville town | Maine | 0 |
| ME | 2302166950 | 23 | 21 | NCNTY23021N23021 | Piscataquis County, ME | Piscataquis County | 52800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Sebec town | Maine | 0 |
| ME | 2302168140 | 23 | 21 | NCNTY23021N23021 | Piscataquis County, ME | Piscataquis County | 52800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Shirley town | Maine | 0 |
| ME | 2302170655 | 23 | 21 | NCNTY23021N23021 | Piscataquis County, ME | Piscataquis County | 52800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Southeast Piscataquis UT | Maine | 0 |
| ME | 2302181405 | 23 | 21 | NCNTY23021N23021 | Piscataquis County, ME | Piscataquis County | 52800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Wellington town | Maine | 0 |
| ME | 2302185710 | 23 | 21 | NCNTY23021N23021 | Piscataquis County, ME | Piscataquis County | 52800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Willimantic town | Maine | 0 |
| ME | 2302301570 | 23 | 23 | METRO38860N23023 | Sagadahoc County, ME HUD Metro FMR Area | Sagadahoc County | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 9999 | Arrowsic town | Maine | 1 |
| ME | 2302303355 | 23 | 23 | METRO38860N23023 | Sagadahoc County, ME HUD Metro FMR Area | Sagadahoc County | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 9999 | Bath city | Maine | 1 |
| ME | 2302306260 | 23 | 23 | METRO38860N23023 | Sagadahoc County, ME HUD Metro FMR Area | Sagadahoc County | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 9999 | Bowdoin town | Maine | 1 |
| ME | 2302306365 | 23 | 23 | METRO38860N23023 | Sagadahoc County, ME HUD Metro FMR Area | Sagadahoc County | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 9999 | Bowdoinham town | Maine | 1 |
| ME | 2302327295 | 23 | 23 | METRO38860N23023 | Sagadahoc County, ME HUD Metro FMR Area | Sagadahoc County | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 9999 | Georgetown town | Maine | 1 |
| ME | 2302358070 | 23 | 23 | METRO38860N23023 | Sagadahoc County, ME HUD Metro FMR Area | Sagadahoc County | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 9999 | Perkins UT | Maine | 1 |
| ME | 2302358515 | 23 | 23 | METRO38860N23023 | Sagadahoc County, ME HUD Metro FMR Area | Sagadahoc County | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 9999 | Phippsburg town | Maine | 1 |
| ME | 2302362645 | 23 | 23 | METRO38860N23023 | Sagadahoc County, ME HUD Metro FMR Area | Sagadahoc County | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 9999 | Richmond town | Maine | 1 |
| ME | 2302376960 | 23 | 23 | METRO38860N23023 | Sagadahoc County, ME HUD Metro FMR Area | Sagadahoc County | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 9999 | Topsham town | Maine | 1 |
| ME | 2302381930 | 23 | 23 | METRO38860N23023 | Sagadahoc County, ME HUD Metro FMR Area | Sagadahoc County | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 9999 | West Bath town | Maine | 1 |
| ME | 2302387460 | 23 | 23 | METRO38860N23023 | Sagadahoc County, ME HUD Metro FMR Area | Sagadahoc County | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 9999 | Woolwich town | Maine | 1 |
| ME | 2302501395 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Anson town | Maine | 0 |
| ME | 2302501885 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Athens town | Maine | 0 |
| ME | 2302505000 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Bingham town | Maine | 0 |
| ME | 2302507380 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Brighton plantation | Maine | 0 |
| ME | 2302509655 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Cambridge town | Maine | 0 |
| ME | 2302509935 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Canaan town | Maine | 0 |
| ME | 2302510495 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Caratunk town | Maine | 0 |
| ME | 2302511820 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Central Somerset UT | Maine | 0 |
| ME | 2302514555 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Cornville town | Maine | 0 |
| ME | 2302517285 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Dennistown plantation | Maine | 0 |
| ME | 2302517460 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Detroit town | Maine | 0 |
| ME | 2302523410 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Embden town | Maine | 0 |
| ME | 2302524320 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Fairfield town | Maine | 0 |
| ME | 2302531355 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Harmony town | Maine | 0 |
| ME | 2302531740 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Hartland town | Maine | 0 |
| ME | 2302532895 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Highland plantation | Maine | 0 |
| ME | 2302535345 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Jackman town | Maine | 0 |
| ME | 2302542660 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Madison town | Maine | 0 |
| ME | 2302545110 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Mercer town | Maine | 0 |
| ME | 2302547140 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Moose River town | Maine | 0 |
| ME | 2302547455 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Moscow town | Maine | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ME | 2302549205 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | New Portland town | Maine | 0 |
| ME | 2302549835 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Norridgewock town | Maine | 0 |
| ME | 2302551114 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Northeast Somerset UT | Maine | 0 |
| ME | 2302553636 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Northwest Somerset UT | Maine | 0 |
| ME | 2302556520 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Palmyra town | Maine | 0 |
| ME | 2302559005 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Pittsfield town | Maine | 0 |
| ME | 2302559705 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Pleasant Ridge plantation | Maine | 0 |
| ME | 2302562995 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Ripley town | Maine | 0 |
| ME | 2302564850 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | St. Albans town | Maine | 0 |
| ME | 2302567238 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Seboomook Lake UT | Maine | 0 |
| ME | 2302568910 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Skowhegan town | Maine | 0 |
| ME | 2302569155 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Smithfield town | Maine | 0 |
| ME | 2302569505 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Solon town | Maine | 0 |
| ME | 2302573845 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Starks town | Maine | 0 |
| ME | 2302576190 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | The Forks plantation | Maine | 0 |
| ME | 2302582840 | 23 | 25 | NCNTY23025N23025 | Somerset County, ME | Somerset County | 57500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | West Forks plantation | Maine | 0 |
| ME | 2302703950 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Belfast city | Maine | 0 |
| ME | 2302704125 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Belmont town | Maine | 0 |
| ME | 2302707870 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Brooks town | Maine | 0 |
| ME | 2302709270 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Burnham town | Maine | 0 |
| ME | 2302726280 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Frankfort town | Maine | 0 |
| ME | 2302726420 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Freedom town | Maine | 0 |
| ME | 2302735240 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Islesboro town | Maine | 0 |
| ME | 2302735450 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Jackson town | Maine | 0 |
| ME | 2302737585 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Knox town | Maine | 0 |
| ME | 2302739055 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Liberty town | Maine | 0 |
| ME | 2302739755 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Lincolnville town | Maine | 0 |
| ME | 2302746475 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Monroe town | Maine | 0 |
| ME | 2302746790 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Montville town | Maine | 0 |
| ME | 2302747245 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Morrill town | Maine | 0 |
| ME | 2302752845 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Northport town | Maine | 0 |
| ME | 2302756450 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Palermo town | Maine | 0 |
| ME | 2302761210 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Prospect town | Maine | 0 |
| ME | 2302766565 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Searsmont town | Maine | 0 |
| ME | 2302766635 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Searsport town | Maine | 0 |
| ME | 2302774475 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Stockton Springs town | Maine | 0 |
| ME | 2302775525 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Swanville town | Maine | 0 |
| ME | 2302776610 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Thorndike town | Maine | 0 |
| ME | 2302777625 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Troy town | Maine | 0 |
| ME | 2302778255 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Unity town | Maine | 0 |
| ME | 2302779480 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Waldo town | Maine | 0 |
| ME | 2302786760 | 23 | 27 | NCNTY23027N23027 | Waldo County, ME | Waldo County | 65500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 730 | Winterport town | Maine | 0 |
| ME | 2302900380 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Addison town | Maine | 0 |
| ME | 2302900660 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Alexander town | Maine | 0 |
| ME | 2302902480 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Baileyville town | Maine | 0 |
| ME | 2302902970 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Baring plantation | Maine | 0 |
| ME | 2302903670 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Beals town | Maine | 0 |
| ME | 2302903810 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Beddington town | Maine | 0 |
| ME | 2302909585 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Calais city | Maine | 0 |
| ME | 2302912175 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Charlotte town | Maine | 0 |
| ME | 2302912455 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Cherryfield town | Maine | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ME | 2302913610 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Codyville plantation | Maine | 0 |
| ME | 2302913750 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Columbia town | Maine | 0 |
| ME | 2302913820 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Columbia Falls town | Maine | 0 |
| ME | 2302914100 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Cooper town | Maine | 0 |
| ME | 2302914940 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Crawford town | Maine | 0 |
| ME | 2302915920 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Cutler town | Maine | 0 |
| ME | 2302916410 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Danforth town | Maine | 0 |
| ME | 2302916865 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Deblois town | Maine | 0 |
| ME | 2302917355 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Dennysville town | Maine | 0 |
| ME | 2302919870 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | East Central Washington UT | Maine | 0 |
| ME | 2302920960 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | East Machias town | Maine | 0 |
| ME | 2302921730 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Eastport city | Maine | 0 |
| ME | 2302928660 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Grand Lake Stream plantation | Maine | 0 |
| ME | 2302931530 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Harrington town | Maine | 0 |
| ME | 2302935905 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Jonesboro town | Maine | 0 |
| ME | 2302936010 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Jonesport town | Maine | 0 |
| ME | 2302941610 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Lubec town | Maine | 0 |
| ME | 2302941960 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Machias town | Maine | 0 |
| ME | 2302942100 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Machiasport town | Maine | 0 |
| ME | 2302943640 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Marshfield town | Maine | 0 |
| ME | 2302944760 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Meddybemps town | Maine | 0 |
| ME | 2302945600 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Milbridge town | Maine | 0 |
| ME | 2302951375 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Northfield town | Maine | 0 |
| ME | 2302953500 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | North Washington UT | Maine | 0 |
| ME | 2302957082 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Passamaquoddy Indian Township Reservation | Maine | 0 |
| ME | 2302957090 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Passamaquoddy Pleasant Point Reservation | Maine | 0 |
| ME | 2302957780 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Pembroke town | Maine | 0 |
| ME | 2302958165 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Perry town | Maine | 0 |
| ME | 2302961035 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Princeton town | Maine | 0 |
| ME | 2302963275 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Robbinston town | Maine | 0 |
| ME | 2302963940 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Roque Bluffs town | Maine | 0 |
| ME | 2302974125 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Steuben town | Maine | 0 |
| ME | 2302975770 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Talmadge town | Maine | 0 |
| ME | 2302976895 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Topsfield town | Maine | 0 |
| ME | 2302978675 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Vanceboro town | Maine | 0 |
| ME | 2302979375 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Waite town | Maine | 0 |
| ME | 2302981685 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Wesley town | Maine | 0 |
| ME | 2302985185 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Whiting town | Maine | 0 |
| ME | 2302985290 | 23 | 29 | NCNTY23029N23029 | Washington County, ME | Washington County | 53800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Whitneyville town | Maine | 0 |
| ME | 2303100275 | 23 | 31 | METRO38860N23031 | York County, ME (part) HUD Metro FMR Area | York County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 9999 | Acton town | Maine | 1 |
| ME | 2303100730 | 23 | 31 | METRO38860N23031 | York County, ME (part) HUD Metro FMR Area | York County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 9999 | Alfred town | Maine | 1 |
| ME | 2303101605 | 23 | 31 | METRO38860N23031 | York County, ME (part) HUD Metro FMR Area | York County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 9999 | Arundel town | Maine | 1 |
| ME | 2303104720 | 23 | 31 | METRO38860MM6450 | York-Kittery-South Berwick, ME HUD Metro FMR Area | York County | 100700 | 21150 | 24200 | 27200 | 30200 | 32650 | 35050 | 37450 | 39900 | 6450 | Berwick town | Maine | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ME | 2303104860 | 23 | 31 | METRO38860N23031 | York County, ME (part) HUD Metro FMR Area | York County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 9999 | Biddeford city | Maine | 1 |
| ME | 2303109410 | 23 | 31 | METRO38860MM6400 | Portland, ME HUD Metro FMR Area | York County | 100900 | 21100 | 24100 | 27100 | 30100 | 32550 | 34950 | 37350 | 39750 | 6400 | Buxton town | Maine | 1 |
| ME | 2303114485 | 23 | 31 | METRO38860N23031 | York County, ME (part) HUD Metro FMR Area | York County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 9999 | Cornish town | Maine | 1 |
| ME | 2303116725 | 23 | 31 | METRO38860N23031 | York County, ME (part) HUD Metro FMR Area | York County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 9999 | Dayton town | Maine | 1 |
| ME | 2303122955 | 23 | 31 | METRO38860MM6450 | York-Kittery-South Berwick, ME HUD Metro FMR Area | York County | 100700 | 21150 | 24200 | 27200 | 30200 | 32650 | 35050 | 37450 | 39900 | 6450 | Eliot town | Maine | 1 |
| ME | 2303133665 | 23 | 31 | METRO38860MM6400 | Portland, ME HUD Metro FMR Area | York County | 100900 | 21100 | 24100 | 27100 | 30100 | 32550 | 34950 | 37350 | 39750 | 6400 | Hollis town | Maine | 1 |
| ME | 2303136535 | 23 | 31 | METRO38860N23031 | York County, ME (part) HUD Metro FMR Area | York County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 9999 | Kennebunk town | Maine | 1 |
| ME | 2303136745 | 23 | 31 | METRO38860N23031 | York County, ME (part) HUD Metro FMR Area | York County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 9999 | Kennebunkport town | Maine | 1 |
| ME | 2303137270 | 23 | 31 | METRO38860MM6450 | York-Kittery-South Berwick, ME HUD Metro FMR Area | York County | 100700 | 21150 | 24200 | 27200 | 30200 | 32650 | 35050 | 37450 | 39900 | 6450 | Kittery town | Maine | 1 |
| ME | 2303138425 | 23 | 31 | METRO38860N23031 | York County, ME (part) HUD Metro FMR Area | York County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 9999 | Lebanon town | Maine | 1 |
| ME | 2303139195 | 23 | 31 | METRO38860N23031 | York County, ME (part) HUD Metro FMR Area | York County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 9999 | Limerick town | Maine | 1 |
| ME | 2303139405 | 23 | 31 | METRO38860MM6400 | Portland, ME HUD Metro FMR Area | York County | 100900 | 21100 | 24100 | 27100 | 30100 | 32550 | 34950 | 37350 | 39750 | 6400 | Limington town | Maine | 1 |
| ME | 2303141750 | 23 | 31 | METRO38860N23031 | York County, ME (part) HUD Metro FMR Area | York County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 9999 | Lyman town | Maine | 1 |
| ME | 2303148750 | 23 | 31 | METRO38860N23031 | York County, ME (part) HUD Metro FMR Area | York County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 9999 | Newfield town | Maine | 1 |
| ME | 2303150325 | 23 | 31 | METRO38860N23031 | York County, ME (part) HUD Metro FMR Area | York County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 9999 | North Berwick town | Maine | 1 |
| ME | 2303154980 | 23 | 31 | METRO38860N23031 | York County, ME (part) HUD Metro FMR Area | York County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 9999 | Ogunquit town | Maine | 1 |
| ME | 2303155085 | 23 | 31 | METRO38860MM6400 | Portland, ME HUD Metro FMR Area | York County | 100900 | 21100 | 24100 | 27100 | 30100 | 32550 | 34950 | 37350 | 39750 | 6400 | Old Orchard Beach town | Maine | 1 |
| ME | 2303156870 | 23 | 31 | METRO38860N23031 | York County, ME (part) HUD Metro FMR Area | York County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 9999 | Parsonsfield town | Maine | 1 |
| ME | 2303164675 | 23 | 31 | METRO38860N23031 | York County, ME (part) HUD Metro FMR Area | York County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 9999 | Saco city | Maine | 1 |
| ME | 2303165725 | 23 | 31 | METRO38860N23031 | York County, ME (part) HUD Metro FMR Area | York County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 9999 | Sanford city | Maine | 1 |
| ME | 2303167475 | 23 | 31 | METRO38860N23031 | York County, ME (part) HUD Metro FMR Area | York County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 9999 | Shapleigh town | Maine | 1 |
| ME | 2303170030 | 23 | 31 | METRO38860MM6450 | York-Kittery-South Berwick, ME HUD Metro FMR Area | York County | 100700 | 21150 | 24200 | 27200 | 30200 | 32650 | 35050 | 37450 | 39900 | 6450 | South Berwick town | Maine | 1 |
| ME | 2303180530 | 23 | 31 | METRO38860N23031 | York County, ME (part) HUD Metro FMR Area | York County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 9999 | Waterboro town | Maine | 1 |
| ME | 2303181475 | 23 | 31 | METRO38860N23031 | York County, ME (part) HUD Metro FMR Area | York County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 9999 | Wells town | Maine | 1 |
| ME | 2303187985 | 23 | 31 | METRO38860MM6450 | York-Kittery-South Berwick, ME HUD Metro FMR Area | York County | 100700 | 21150 | 24200 | 27200 | 30200 | 32650 | 35050 | 37450 | 39900 | 6450 | York town | Maine | 1 |
| MD | 2400199999 | 24 | 1 | METRO19060M19060 | Cumberland, MD-WV MSA | Allegany County | 61900 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 1900 | Allegany County | Maryland | 1 |
| MD | 2400399999 | 24 | 3 | METRO12580M12580 | Baltimore-Columbia-Towson, MD MSA | Anne Arundel County | 104000 | 21850 | 25000 | 28100 | 31200 | 33700 | 36200 | 38700 | 41200 | 720 | Anne Arundel County | Maryland | 1 |
| MD | 2400599999 | 24 | 5 | METRO12580M12580 | Baltimore-Columbia-Towson, MD MSA | Baltimore County | 104000 | 21850 | 25000 | 28100 | 31200 | 33700 | 36200 | 38700 | 41200 | 720 | Baltimore County | Maryland | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MD | 2400999999 | 24 | 9 | METRO47900M47900 | Washington-Arlington-Alexandria, DC-VA-MD HUD Metro FMR Area | Calvert County | 126000 | 26500 | 30250 | 34050 | 37800 | 40850 | 43850 | 46900 | 49900 | 8840 | Calvert County | Maryland | 1 |
| MD | 2401199999 | 24 | 11 | NCNTY24011N24011 | Caroline County, MD | Caroline County | 67500 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 9999 | Caroline County | Maryland | 0 |
| MD | 2401399999 | 24 | 13 | METRO12580M12580 | Baltimore-Columbia-Towson, MD MSA | Carroll County | 104000 | 21850 | 25000 | 28100 | 31200 | 33700 | 36200 | 38700 | 41200 | 720 | Carroll County | Maryland | 1 |
| MD | 2401599999 | 24 | 15 | METRO37980M37980 | Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA | Cecil County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 9160 | Cecil County | Maryland | 1 |
| MD | 2401799999 | 24 | 17 | METRO47900M47900 | Washington-Arlington-Alexandria, DC-VA-MD HUD Metro FMR Area | Charles County | 126000 | 26500 | 30250 | 34050 | 37800 | 40850 | 43850 | 46900 | 49900 | 8840 | Charles County | Maryland | 1 |
| MD | 2401999999 | 24 | 19 | NCNTY24019N24019 | Dorchester County, MD | Dorchester County | 68400 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 9999 | Dorchester County | Maryland | 0 |
| MD | 2402199999 | 24 | 21 | METRO47900M47900 | Washington-Arlington-Alexandria, DC-VA-MD HUD Metro FMR Area | Frederick County | 126000 | 26500 | 30250 | 34050 | 37800 | 40850 | 43850 | 46900 | 49900 | 8840 | Frederick County | Maryland | 1 |
| MD | 2402399999 | 24 | 23 | NCNTY24023N24023 | Garrett County, MD | Garrett County | 61500 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 9999 | Garrett County | Maryland | 0 |
| MD | 2402599999 | 24 | 25 | METRO12580M12580 | Baltimore-Columbia-Towson, MD MSA | Harford County | 104000 | 21850 | 25000 | 28100 | 31200 | 33700 | 36200 | 38700 | 41200 | 720 | Harford County | Maryland | 1 |
| MD | 2402799999 | 24 | 27 | METRO12580M12580 | Baltimore-Columbia-Towson, MD MSA | Howard County | 104000 | 21850 | 25000 | 28100 | 31200 | 33700 | 36200 | 38700 | 41200 | 720 | Howard County | Maryland | 1 |
| MD | 2402999999 | 24 | 29 | NCNTY24029N24029 | Kent County, MD | Kent County | 78700 | 16550 | 18900 | 21250 | 23600 | 25500 | 27400 | 29300 | 31200 | 9999 | Kent County | Maryland | 0 |
| MD | 2403199999 | 24 | 31 | METRO47900M47900 | Washington-Arlington-Alexandria, DC-VA-MD HUD Metro FMR Area | Montgomery County | 126000 | 26500 | 30250 | 34050 | 37800 | 40850 | 43850 | 46900 | 49900 | 8840 | Montgomery County | Maryland | 1 |
| MD | 2403399999 | 24 | 33 | METRO47900M47900 | Washington-Arlington-Alexandria, DC-VA-MD HUD Metro FMR Area | Prince George's County | 126000 | 26500 | 30250 | 34050 | 37800 | 40850 | 43850 | 46900 | 49900 | 8840 | Prince George's County | Maryland | 1 |
| MD | 2403599999 | 24 | 35 | METRO12580M12580 | Baltimore-Columbia-Towson, MD MSA | Queen Anne's County | 104000 | 21850 | 25000 | 28100 | 31200 | 33700 | 36200 | 38700 | 41200 | 720 | Queen Anne's County | Maryland | 1 |
| MD | 2403799999 | 24 | 37 | METRO15680M15680 | California-Lexington Park, MD MSA | St. Mary's County | 103600 | 21800 | 24900 | 28000 | 31100 | 33600 | 36100 | 38600 | 41100 | 9999 | St. Mary's County | Maryland | 1 |
| MD | 2403999999 | 24 | 39 | METRO41540N24039 | Somerset County, MD HUD Metro FMR Area | Somerset County | 54800 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 9999 | Somerset County | Maryland | 1 |
| MD | 2404199999 | 24 | 41 | NCNTY24041N24041 | Talbot County, MD | Talbot County | 85900 | 18050 | 20600 | 23200 | 25750 | 27850 | 29900 | 31950 | 34000 | 9999 | Talbot County | Maryland | 0 |
| MD | 2404399999 | 24 | 43 | METRO25180MM3180 | Hagerstown, MD HUD Metro FMR Area | Washington County | 79800 | 16800 | 19200 | 21600 | 23950 | 25900 | 27800 | 29700 | 31650 | 3180 | Washington County | Maryland | 1 |
| MD | 2404599999 | 24 | 45 | METRO41540M41540 | Salisbury, MD HUD Metro FMR Area | Wicomico County | 67500 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 9999 | Wicomico County | Maryland | 1 |
| MD | 2404799999 | 24 | 47 | METRO41540N24047 | Worcester County, MD HUD Metro FMR Area | Worcester County | 76000 | 16000 | 18250 | 20550 | 22800 | 24650 | 26450 | 28300 | 30100 | 9999 | Worcester County | Maryland | 1 |
| MD | 2451099999 | 24 | 510 | METRO12580M12580 | Baltimore-Columbia-Towson, MD MSA | Baltimore city | 104000 | 21850 | 25000 | 28100 | 31200 | 33700 | 36200 | 38700 | 41200 | 720 | Baltimore city | Maryland | 1 |
| MA | 2500103690 | 25 | 1 | METRO12700M12700 | Barnstable Town, MA MSA | Barnstable County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 740 | Barnstable Town city | Massachusetts | 1 |
| MA | 2500107175 | 25 | 1 | METRO12700M12700 | Barnstable Town, MA MSA | Barnstable County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 9999 | Bourne town | Massachusetts | 1 |
| MA | 2500107980 | 25 | 1 | METRO12700M12700 | Barnstable Town, MA MSA | Barnstable County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 740 | Brewster town | Massachusetts | 1 |
| MA | 2500112995 | 25 | 1 | METRO12700M12700 | Barnstable Town, MA MSA | Barnstable County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 740 | Chatham town | Massachusetts | 1 |
| MA | 2500116775 | 25 | 1 | METRO12700M12700 | Barnstable Town, MA MSA | Barnstable County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 740 | Dennis town | Massachusetts | 1 |
| MA | 2500119295 | 25 | 1 | METRO12700M12700 | Barnstable Town, MA MSA | Barnstable County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 740 | Eastham town | Massachusetts | 1 |
| MA | 2500123105 | 25 | 1 | METRO12700M12700 | Barnstable Town, MA MSA | Barnstable County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 9999 | Falmouth town | Massachusetts | 1 |
| MA | 2500129020 | 25 | 1 | METRO12700M12700 | Barnstable Town, MA MSA | Barnstable County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 740 | Harwich town | Massachusetts | 1 |
| MA | 2500139100 | 25 | 1 | METRO12700M12700 | Barnstable Town, MA MSA | Barnstable County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 740 | Mashpee town | Massachusetts | 1 |
| MA | 2500151440 | 25 | 1 | METRO12700M12700 | Barnstable Town, MA MSA | Barnstable County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 740 | Orleans town | Massachusetts | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA | 2500155500 | 25 | 1 | METRO12700M12700 | Barnstable Town, MA MSA | Barnstable County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 9999 | Provincetown town | Massachusetts | 1 |
| MA | 2500159735 | 25 | 1 | METRO12700M12700 | Barnstable Town, MA MSA | Barnstable County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 740 | Sandwich town | Massachusetts | 1 |
| MA | 2500170605 | 25 | 1 | METRO12700M12700 | Barnstable Town, MA MSA | Barnstable County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 9999 | Truro town | Massachusetts | 1 |
| MA | 2500174385 | 25 | 1 | METRO12700M12700 | Barnstable Town, MA MSA | Barnstable County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 9999 | Wellfleet town | Massachusetts | 1 |
| MA | 2500182525 | 25 | 1 | METRO12700M12700 | Barnstable Town, MA MSA | Barnstable County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 740 | Yarmouth town | Massachusetts | 1 |
| MA | 2500300555 | 25 | 3 | METRO38340M38340 | Pittsfield, MA HUD Metro FMR Area | Berkshire County | 90900 | 19100 | 21800 | 24550 | 27250 | 29450 | 31650 | 33800 | 36000 | 6320 | Adams town | Massachusetts | 1 |
| MA | 2500300975 | 25 | 3 | METRO38340N25003 | Berkshire County, MA (part) HUD Metro FMR Area | Berkshire County | 80900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Alford town | Massachusetts | 1 |
| MA | 2500304545 | 25 | 3 | METRO38340N25003 | Berkshire County, MA (part) HUD Metro FMR Area | Berkshire County | 80900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Becket town | Massachusetts | 1 |
| MA | 2500313345 | 25 | 3 | METRO38340M38340 | Pittsfield, MA HUD Metro FMR Area | Berkshire County | 90900 | 19100 | 21800 | 24550 | 27250 | 29450 | 31650 | 33800 | 36000 | 6320 | Cheshire town | Massachusetts | 1 |
| MA | 2500314010 | 25 | 3 | METRO38340N25003 | Berkshire County, MA (part) HUD Metro FMR Area | Berkshire County | 80900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Clarksburg town | Massachusetts | 1 |
| MA | 2500316180 | 25 | 3 | METRO38340M38340 | Pittsfield, MA HUD Metro FMR Area | Berkshire County | 90900 | 19100 | 21800 | 24550 | 27250 | 29450 | 31650 | 33800 | 36000 | 6320 | Dalton town | Massachusetts | 1 |
| MA | 2500321360 | 25 | 3 | METRO38340N25003 | Berkshire County, MA (part) HUD Metro FMR Area | Berkshire County | 80900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Egremont town | Massachusetts | 1 |
| MA | 2500324120 | 25 | 3 | METRO38340N25003 | Berkshire County, MA (part) HUD Metro FMR Area | Berkshire County | 80900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Florida town | Massachusetts | 1 |
| MA | 2500326815 | 25 | 3 | METRO38340N25003 | Berkshire County, MA (part) HUD Metro FMR Area | Berkshire County | 80900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Great Barrington town | Massachusetts | 1 |
| MA | 2500328180 | 25 | 3 | METRO38340N25003 | Berkshire County, MA (part) HUD Metro FMR Area | Berkshire County | 80900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Hancock town | Massachusetts | 1 |
| MA | 2500330315 | 25 | 3 | METRO38340M38340 | Pittsfield, MA HUD Metro FMR Area | Berkshire County | 90900 | 19100 | 21800 | 24550 | 27250 | 29450 | 31650 | 33800 | 36000 | 6320 | Hinsdale town | Massachusetts | 1 |
| MA | 2500334340 | 25 | 3 | METRO38340M38340 | Pittsfield, MA HUD Metro FMR Area | Berkshire County | 90900 | 19100 | 21800 | 24550 | 27250 | 29450 | 31650 | 33800 | 36000 | 6320 | Lanesborough town | Massachusetts | 1 |
| MA | 2500334655 | 25 | 3 | METRO38340M38340 | Pittsfield, MA HUD Metro FMR Area | Berkshire County | 90900 | 19100 | 21800 | 24550 | 27250 | 29450 | 31650 | 33800 | 36000 | 6320 | Lee town | Massachusetts | 1 |
| MA | 2500334970 | 25 | 3 | METRO38340M38340 | Pittsfield, MA HUD Metro FMR Area | Berkshire County | 90900 | 19100 | 21800 | 24550 | 27250 | 29450 | 31650 | 33800 | 36000 | 6320 | Lenox town | Massachusetts | 1 |
| MA | 2500342460 | 25 | 3 | METRO38340N25003 | Berkshire County, MA (part) HUD Metro FMR Area | Berkshire County | 80900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Monterey town | Massachusetts | 1 |
| MA | 2500343300 | 25 | 3 | METRO38340N25003 | Berkshire County, MA (part) HUD Metro FMR Area | Berkshire County | 80900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Mount Washington town | Massachusetts | 1 |
| MA | 2500344385 | 25 | 3 | METRO38340N25003 | Berkshire County, MA (part) HUD Metro FMR Area | Berkshire County | 80900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | New Ashford town | Massachusetts | 1 |
| MA | 2500345420 | 25 | 3 | METRO38340N25003 | Berkshire County, MA (part) HUD Metro FMR Area | Berkshire County | 80900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | New Marlborough town | Massachusetts | 1 |
| MA | 2500346225 | 25 | 3 | METRO38340N25003 | Berkshire County, MA (part) HUD Metro FMR Area | Berkshire County | 80900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | North Adams city | Massachusetts | 1 |
| MA | 2500351580 | 25 | 3 | METRO38340N25003 | Berkshire County, MA (part) HUD Metro FMR Area | Berkshire County | 80900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Otis town | Massachusetts | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA | 2500353050 | 25 | 3 | METRO38340N25003 | Berkshire County, MA (part) HUD Metro FMR Area | Berkshire County | 80900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Peru town | Massachusetts | 1 |
| MA | 2500353960 | 25 | 3 | METRO38340M38340 | Pittsfield, MA HUD Metro FMR Area | Berkshire County | 90900 | 19100 | 21800 | 24550 | 27250 | 29450 | 31650 | 33800 | 36000 | 6320 | Pittsfield city | Massachusetts | 1 |
| MA | 2500356795 | 25 | 3 | METRO38340M38340 | Pittsfield, MA HUD Metro FMR Area | Berkshire County | 90900 | 19100 | 21800 | 24550 | 27250 | 29450 | 31650 | 33800 | 36000 | 6320 | Richmond town | Massachusetts | 1 |
| MA | 2500359665 | 25 | 3 | METRO38340N25003 | Berkshire County, MA (part) HUD Metro FMR Area | Berkshire County | 80900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Sandisfield town | Massachusetts | 1 |
| MA | 2500360225 | 25 | 3 | METRO38340N25003 | Berkshire County, MA (part) HUD Metro FMR Area | Berkshire County | 80900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Savoy town | Massachusetts | 1 |
| MA | 2500361065 | 25 | 3 | METRO38340N25003 | Berkshire County, MA (part) HUD Metro FMR Area | Berkshire County | 80900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Sheffield town | Massachusetts | 1 |
| MA | 2500367595 | 25 | 3 | METRO38340M38340 | Pittsfield, MA HUD Metro FMR Area | Berkshire County | 90900 | 19100 | 21800 | 24550 | 27250 | 29450 | 31650 | 33800 | 36000 | 6320 | Stockbridge town | Massachusetts | 1 |
| MA | 2500371095 | 25 | 3 | METRO38340N25003 | Berkshire County, MA (part) HUD Metro FMR Area | Berkshire County | 80900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Tyringham town | Massachusetts | 1 |
| MA | 2500373335 | 25 | 3 | METRO38340N25003 | Berkshire County, MA (part) HUD Metro FMR Area | Berkshire County | 80900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Washington town | Massachusetts | 1 |
| MA | 2500377990 | 25 | 3 | METRO38340N25003 | Berkshire County, MA (part) HUD Metro FMR Area | Berkshire County | 80900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | West Stockbridge town | Massachusetts | 1 |
| MA | 2500379985 | 25 | 3 | METRO38340N25003 | Berkshire County, MA (part) HUD Metro FMR Area | Berkshire County | 80900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Williamstown town | Massachusetts | 1 |
| MA | 2500380685 | 25 | 3 | METRO38340N25003 | Berkshire County, MA (part) HUD Metro FMR Area | Berkshire County | 80900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Windsor town | Massachusetts | 1 |
| MA | 2500500520 | 25 | 5 | METRO39300MM5400 | New Bedford, MA HUD Metro FMR Area | Bristol County | 74300 | 17500 | 20000 | 22500 | 25000 | 27000 | 29000 | 31000 | 33000 | 5400 | Acushnet town | Massachusetts | 1 |
| MA | 2500502690 | 25 | 5 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Bristol County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Attleboro city | Massachusetts | 1 |
| MA | 2500505280 | 25 | 5 | METRO39300MM1120 | Taunton-Mansfield-Norton, MA HUD Metro FMR Area | Bristol County | 111900 | 22100 | 25250 | 28400 | 31550 | 34100 | 36600 | 39150 | 41650 | 1120 | Berkley town | Massachusetts | 1 |
| MA | 2500516425 | 25 | 5 | METRO39300MM5400 | New Bedford, MA HUD Metro FMR Area | Bristol County | 74300 | 17500 | 20000 | 22500 | 25000 | 27000 | 29000 | 31000 | 33000 | 5400 | Dartmouth town | Massachusetts | 1 |
| MA | 2500516950 | 25 | 5 | METRO39300MM1120 | Taunton-Mansfield-Norton, MA HUD Metro FMR Area | Bristol County | 111900 | 22100 | 25250 | 28400 | 31550 | 34100 | 36600 | 39150 | 41650 | 1120 | Dighton town | Massachusetts | 1 |
| MA | 2500520100 | 25 | 5 | METRO39300MM1200 | Easton-Raynham, MA HUD Metro FMR Area | Bristol County | 121300 | 25500 | 29150 | 32800 | 36400 | 39350 | 42250 | 45150 | 48050 | 1200 | Easton town | Massachusetts | 1 |
| MA | 2500522130 | 25 | 5 | METRO39300MM5400 | New Bedford, MA HUD Metro FMR Area | Bristol County | 74300 | 17500 | 20000 | 22500 | 25000 | 27000 | 29000 | 31000 | 33000 | 5400 | Fairhaven town | Massachusetts | 1 |
| MA | 2500523000 | 25 | 5 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Bristol County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Fall River city | Massachusetts | 1 |
| MA | 2500525240 | 25 | 5 | METRO39300MM5400 | New Bedford, MA HUD Metro FMR Area | Bristol County | 74300 | 17500 | 20000 | 22500 | 25000 | 27000 | 29000 | 31000 | 33000 | 5400 | Freetown town | Massachusetts | 1 |
| MA | 2500538225 | 25 | 5 | METRO39300MM1120 | Taunton-Mansfield-Norton, MA HUD Metro FMR Area | Bristol County | 111900 | 22100 | 25250 | 28400 | 31550 | 34100 | 36600 | 39150 | 41650 | 1120 | Mansfield town | Massachusetts | 1 |
| MA | 2500545000 | 25 | 5 | METRO39300MM5400 | New Bedford, MA HUD Metro FMR Area | Bristol County | 74300 | 17500 | 20000 | 22500 | 25000 | 27000 | 29000 | 31000 | 33000 | 5400 | New Bedford city | Massachusetts | 1 |
| MA | 2500546575 | 25 | 5 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Bristol County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | North Attleborough town | Massachusetts | 1 |
| MA | 2500549970 | 25 | 5 | METRO39300MM1120 | Taunton-Mansfield-Norton, MA HUD Metro FMR Area | Bristol County | 111900 | 22100 | 25250 | 28400 | 31550 | 34100 | 36600 | 39150 | 41650 | 1120 | Norton town | Massachusetts | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA | 2500556060 | 25 | 5 | METRO39300MM1200 | Easton-Raynham, MA HUD Metro FMR Area | Bristol County | 121300 | 25500 | 29150 | 32800 | 36400 | 39350 | 42250 | 45150 | 48050 | 1200 | Raynham town | Massachusetts | 1 |
| MA | 2500556375 | 25 | 5 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Bristol County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Rehoboth town | Massachusetts | 1 |
| MA | 2500560645 | 25 | 5 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Bristol County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Seekonk town | Massachusetts | 1 |
| MA | 2500562430 | 25 | 5 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Bristol County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Somerset town | Massachusetts | 1 |
| MA | 2500568750 | 25 | 5 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Bristol County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Swansea town | Massachusetts | 1 |
| MA | 2500569170 | 25 | 5 | METRO39300MM1120 | Taunton-Mansfield-Norton, MA HUD Metro FMR Area | Bristol County | 111900 | 22100 | 25250 | 28400 | 31550 | 34100 | 36600 | 39150 | 41650 | 1120 | Taunton city | Massachusetts | 1 |
| MA | 2500577570 | 25 | 5 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Bristol County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Westport town | Massachusetts | 1 |
| MA | 2500701585 | 25 | 7 | NCNTY25007N25007 | Dukes County, MA | Dukes County | 104800 | 22050 | 25200 | 28350 | 31450 | 34000 | 36500 | 39000 | 41550 | 9999 | Aquinnah town | Massachusetts | 0 |
| MA | 2500713800 | 25 | 7 | NCNTY25007N25007 | Dukes County, MA | Dukes County | 104800 | 22050 | 25200 | 28350 | 31450 | 34000 | 36500 | 39000 | 41550 | 9999 | Chilmark town | Massachusetts | 0 |
| MA | 2500721150 | 25 | 7 | NCNTY25007N25007 | Dukes County, MA | Dukes County | 104800 | 22050 | 25200 | 28350 | 31450 | 34000 | 36500 | 39000 | 41550 | 9999 | Edgartown town | Massachusetts | 0 |
| MA | 2500726325 | 25 | 7 | NCNTY25007N25007 | Dukes County, MA | Dukes County | 104800 | 22050 | 25200 | 28350 | 31450 | 34000 | 36500 | 39000 | 41550 | 9999 | Gosnold town | Massachusetts | 0 |
| MA | 2500750390 | 25 | 7 | NCNTY25007N25007 | Dukes County, MA | Dukes County | 104800 | 22050 | 25200 | 28350 | 31450 | 34000 | 36500 | 39000 | 41550 | 9999 | Oak Bluffs town | Massachusetts | 0 |
| MA | 2500769940 | 25 | 7 | NCNTY25007N25007 | Dukes County, MA | Dukes County | 104800 | 22050 | 25200 | 28350 | 31450 | 34000 | 36500 | 39000 | 41550 | 9999 | Tisbury town | Massachusetts | 0 |
| MA | 2500778235 | 25 | 7 | NCNTY25007N25007 | Dukes County, MA | Dukes County | 104800 | 22050 | 25200 | 28350 | 31450 | 34000 | 36500 | 39000 | 41550 | 9999 | West Tisbury town | Massachusetts | 0 |
| MA | 2500901260 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Amesbury Town city | Massachusetts | 1 |
| MA | 2500901465 | 25 | 9 | METRO14460MM4160 | Lawrence, MA-NH HUD Metro FMR Area | Essex County | 98000 | 20600 | 23550 | 26500 | 29400 | 31800 | 34150 | 36500 | 38850 | 4160 | Andover town | Massachusetts | 1 |
| MA | 2500905595 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Beverly city | Massachusetts | 1 |
| MA | 2500907420 | 25 | 9 | METRO14460MM4160 | Lawrence, MA-NH HUD Metro FMR Area | Essex County | 98000 | 20600 | 23550 | 26500 | 29400 | 31800 | 34150 | 36500 | 38850 | 4160 | Boxford town | Massachusetts | 1 |
| MA | 2500916250 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Danvers town | Massachusetts | 1 |
| MA | 2500921850 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Essex town | Massachusetts | 1 |
| MA | 2500925625 | 25 | 9 | METRO14460MM4160 | Lawrence, MA-NH HUD Metro FMR Area | Essex County | 98000 | 20600 | 23550 | 26500 | 29400 | 31800 | 34150 | 36500 | 38850 | 4160 | Georgetown town | Massachusetts | 1 |
| MA | 2500926150 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Gloucester city | Massachusetts | 1 |
| MA | 2500927620 | 25 | 9 | METRO14460MM4160 | Lawrence, MA-NH HUD Metro FMR Area | Essex County | 98000 | 20600 | 23550 | 26500 | 29400 | 31800 | 34150 | 36500 | 38850 | 4160 | Groveland town | Massachusetts | 1 |
| MA | 2500927900 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Hamilton town | Massachusetts | 1 |
| MA | 2500929405 | 25 | 9 | METRO14460MM4160 | Lawrence, MA-NH HUD Metro FMR Area | Essex County | 98000 | 20600 | 23550 | 26500 | 29400 | 31800 | 34150 | 36500 | 38850 | 4160 | Haverhill city | Massachusetts | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA | 2500932310 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Ipswich town | Massachusetts | 1 |
| MA | 2500934550 | 25 | 9 | METRO14460MM4160 | Lawrence, MA-NH HUD Metro FMR Area | Essex County | 98000 | 20600 | 23550 | 26500 | 29400 | 31800 | 34150 | 36500 | 38850 | 4160 | Lawrence city | Massachusetts | 1 |
| MA | 2500937490 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Lynn city | Massachusetts | 1 |
| MA | 2500937560 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Lynnfield town | Massachusetts | 1 |
| MA | 2500937995 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Manchester-by-the-Sea town | Massachusetts | 1 |
| MA | 2500938400 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Marblehead town | Massachusetts | 1 |
| MA | 2500940430 | 25 | 9 | METRO14460MM4160 | Lawrence, MA-NH HUD Metro FMR Area | Essex County | 98000 | 20600 | 23550 | 26500 | 29400 | 31800 | 34150 | 36500 | 38850 | 4160 | Merrimac town | Massachusetts | 1 |
| MA | 2500940710 | 25 | 9 | METRO14460MM4160 | Lawrence, MA-NH HUD Metro FMR Area | Essex County | 98000 | 20600 | 23550 | 26500 | 29400 | 31800 | 34150 | 36500 | 38850 | 4160 | Methuen city | Massachusetts | 1 |
| MA | 2500941095 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Middleton town | Massachusetts | 1 |
| MA | 2500943580 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Nahant town | Massachusetts | 1 |
| MA | 2500945175 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Newbury town | Massachusetts | 1 |
| MA | 2500945245 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Newburyport city | Massachusetts | 1 |
| MA | 2500946365 | 25 | 9 | METRO14460MM4160 | Lawrence, MA-NH HUD Metro FMR Area | Essex County | 98000 | 20600 | 23550 | 26500 | 29400 | 31800 | 34150 | 36500 | 38850 | 4160 | North Andover town | Massachusetts | 1 |
| MA | 2500952490 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Peabody city | Massachusetts | 1 |
| MA | 2500957880 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Rockport town | Massachusetts | 1 |
| MA | 2500958405 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Rowley town | Massachusetts | 1 |
| MA | 2500959105 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Salem city | Massachusetts | 1 |
| MA | 2500959245 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Salisbury town | Massachusetts | 1 |
| MA | 2500960015 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Saugus town | Massachusetts | 1 |
| MA | 2500968645 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Swampscott town | Massachusetts | 1 |
| MA | 2500970150 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Topsfield town | Massachusetts | 1 |
| MA | 2500974595 | 25 | 9 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Essex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Wenham town | Massachusetts | 1 |
| MA | 2500977150 | 25 | 9 | METRO14460MM4160 | Lawrence, MA-NH HUD Metro FMR Area | Essex County | 98000 | 20600 | 23550 | 26500 | 29400 | 31800 | 34150 | 36500 | 38850 | 4160 | West Newbury town | Massachusetts | 1 |
| MA | 2501102095 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Ashfield town | Massachusetts | 0 |
| MA | 2501105560 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Bernardston town | Massachusetts | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA | 2501109595 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Buckland town | Massachusetts | 0 |
| MA | 2501112505 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Charlemont town | Massachusetts | 0 |
| MA | 2501114885 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Colrain town | Massachusetts | 0 |
| MA | 2501115200 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Conway town | Massachusetts | 0 |
| MA | 2501116670 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Deerfield town | Massachusetts | 0 |
| MA | 2501121780 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Erving town | Massachusetts | 0 |
| MA | 2501125730 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Gill town | Massachusetts | 0 |
| MA | 2501127100 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Greenfield Town city | Massachusetts | 0 |
| MA | 2501129475 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Hawley town | Massachusetts | 0 |
| MA | 2501129650 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Heath town | Massachusetts | 0 |
| MA | 2501135180 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Leverett town | Massachusetts | 0 |
| MA | 2501135285 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Leyden town | Massachusetts | 0 |
| MA | 2501142040 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Monroe town | Massachusetts | 0 |
| MA | 2501142285 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Montague town | Massachusetts | 0 |
| MA | 2501145490 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | New Salem town | Massachusetts | 0 |
| MA | 2501147835 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Northfield town | Massachusetts | 0 |
| MA | 2501151265 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Orange town | Massachusetts | 0 |
| MA | 2501158335 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Rowe town | Massachusetts | 0 |
| MA | 2501161135 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Shelburne town | Massachusetts | 0 |
| MA | 2501161905 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Shutesbury town | Massachusetts | 0 |
| MA | 2501168400 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Sunderland town | Massachusetts | 0 |
| MA | 2501173265 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Warwick town | Massachusetts | 0 |
| MA | 2501174525 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Wendell town | Massachusetts | 0 |
| MA | 2501179110 | 25 | 11 | NCNTY25011N25011 | Franklin County, MA HUD Nonmetro FMR Area | Franklin County | 80000 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Whately town | Massachusetts | 0 |
| MA | 2501300840 | 25 | 13 | METRO44140M44140 | Springfield, MA MSA | Hampden County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Agawam Town city | Massachusetts | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA | 2501306085 | 25 | 13 | METRO44140M44140 | Springfield, MA MSA | Hampden County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Blandford town | Massachusetts | 1 |
| MA | 2501308470 | 25 | 13 | METRO44140M44140 | Springfield, MA MSA | Hampden County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Brimfield town | Massachusetts | 1 |
| MA | 2501313485 | 25 | 13 | METRO44140M44140 | Springfield, MA MSA | Hampden County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Chester town | Massachusetts | 1 |
| MA | 2501313660 | 25 | 13 | METRO44140M44140 | Springfield, MA MSA | Hampden County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Chicopee city | Massachusetts | 1 |
| MA | 2501319645 | 25 | 13 | METRO44140M44140 | Springfield, MA MSA | Hampden County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | East Longmeadow town | Massachusetts | 1 |
| MA | 2501326675 | 25 | 13 | METRO44140M44140 | Springfield, MA MSA | Hampden County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Granville town | Massachusetts | 1 |
| MA | 2501328075 | 25 | 13 | METRO44140M44140 | Springfield, MA MSA | Hampden County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Hampden town | Massachusetts | 1 |
| MA | 2501330665 | 25 | 13 | METRO44140M44140 | Springfield, MA MSA | Hampden County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9240 | Holland town | Massachusetts | 1 |
| MA | 2501330840 | 25 | 13 | METRO44140M44140 | Springfield, MA MSA | Hampden County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Holyoke city | Massachusetts | 1 |
| MA | 2501336300 | 25 | 13 | METRO44140M44140 | Springfield, MA MSA | Hampden County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Longmeadow town | Massachusetts | 1 |
| MA | 2501337175 | 25 | 13 | METRO44140M44140 | Springfield, MA MSA | Hampden County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Ludlow town | Massachusetts | 1 |
| MA | 2501342145 | 25 | 13 | METRO44140M44140 | Springfield, MA MSA | Hampden County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Monson town | Massachusetts | 1 |
| MA | 2501342530 | 25 | 13 | METRO44140M44140 | Springfield, MA MSA | Hampden County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Montgomery town | Massachusetts | 1 |
| MA | 2501352144 | 25 | 13 | METRO44140M44140 | Springfield, MA MSA | Hampden County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Palmer Town city | Massachusetts | 1 |
| MA | 2501358650 | 25 | 13 | METRO44140M44140 | Springfield, MA MSA | Hampden County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Russell town | Massachusetts | 1 |
| MA | 2501365825 | 25 | 13 | METRO44140M44140 | Springfield, MA MSA | Hampden County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Southwick town | Massachusetts | 1 |
| MA | 2501367000 | 25 | 13 | METRO44140M44140 | Springfield, MA MSA | Hampden County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Springfield city | Massachusetts | 1 |
| MA | 2501370045 | 25 | 13 | METRO44140M44140 | Springfield, MA MSA | Hampden County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Tolland town | Massachusetts | 1 |
| MA | 2501372390 | 25 | 13 | METRO44140M44140 | Springfield, MA MSA | Hampden County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Wales town | Massachusetts | 1 |
| MA | 2501376030 | 25 | 13 | METRO44140M44140 | Springfield, MA MSA | Hampden County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Westfield city | Massachusetts | 1 |
| MA | 2501377890 | 25 | 13 | METRO44140M44140 | Springfield, MA MSA | Hampden County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | West Springfield Town city | Massachusetts | 1 |
| MA | 2501379740 | 25 | 13 | METRO44140M44140 | Springfield, MA MSA | Hampden County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Wilbraham town | Massachusetts | 1 |
| MA | 2501501325 | 25 | 15 | METRO44140M44140 | Springfield, MA MSA | Hampshire County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Amherst town | Massachusetts | 1 |
| MA | 2501504825 | 25 | 15 | METRO44140M44140 | Springfield, MA MSA | Hampshire County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Belchertown town | Massachusetts | 1 |
| MA | 2501513590 | 25 | 15 | METRO44140M44140 | Springfield, MA MSA | Hampshire County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Chesterfield town | Massachusetts | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA | 2501516040 | 25 | 15 | METRO44140M44140 | Springfield, MA MSA | Hampshire County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Cummington town | Massachusetts | 1 |
| MA | 2501519370 | 25 | 15 | METRO44140M44140 | Springfield, MA MSA | Hampshire County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Easthampton Town city | Massachusetts | 1 |
| MA | 2501526290 | 25 | 15 | METRO44140M44140 | Springfield, MA MSA | Hampshire County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Goshen town | Massachusetts | 1 |
| MA | 2501526535 | 25 | 15 | METRO44140M44140 | Springfield, MA MSA | Hampshire County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Granby town | Massachusetts | 1 |
| MA | 2501527690 | 25 | 15 | METRO44140M44140 | Springfield, MA MSA | Hampshire County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Hadley town | Massachusetts | 1 |
| MA | 2501529265 | 25 | 15 | METRO44140M44140 | Springfield, MA MSA | Hampshire County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Hatfield town | Massachusetts | 1 |
| MA | 2501531785 | 25 | 15 | METRO44140M44140 | Springfield, MA MSA | Hampshire County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Huntington town | Massachusetts | 1 |
| MA | 2501540990 | 25 | 15 | METRO44140M44140 | Springfield, MA MSA | Hampshire County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Middlefield town | Massachusetts | 1 |
| MA | 2501546330 | 25 | 15 | METRO44140M44140 | Springfield, MA MSA | Hampshire County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Northampton city | Massachusetts | 1 |
| MA | 2501552560 | 25 | 15 | METRO44140M44140 | Springfield, MA MSA | Hampshire County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Pelham town | Massachusetts | 1 |
| MA | 2501554030 | 25 | 15 | METRO44140M44140 | Springfield, MA MSA | Hampshire County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Plainfield town | Massachusetts | 1 |
| MA | 2501562745 | 25 | 15 | METRO44140M44140 | Springfield, MA MSA | Hampshire County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Southampton town | Massachusetts | 1 |
| MA | 2501564145 | 25 | 15 | METRO44140M44140 | Springfield, MA MSA | Hampshire County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | South Hadley town | Massachusetts | 1 |
| MA | 2501572880 | 25 | 15 | METRO44140M44140 | Springfield, MA MSA | Hampshire County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Ware town | Massachusetts | 1 |
| MA | 2501576380 | 25 | 15 | METRO44140M44140 | Springfield, MA MSA | Hampshire County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Westhampton town | Massachusetts | 1 |
| MA | 2501579915 | 25 | 15 | METRO44140M44140 | Springfield, MA MSA | Hampshire County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 8000 | Williamsburg town | Massachusetts | 1 |
| MA | 2501582175 | 25 | 15 | METRO44140M44140 | Springfield, MA MSA | Hampshire County | 77200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Worthington town | Massachusetts | 1 |
| MA | 2501700380 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Acton town | Massachusetts | 1 |
| MA | 2501701605 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Arlington town | Massachusetts | 1 |
| MA | 2501701955 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 2600 | Ashby town | Massachusetts | 1 |
| MA | 2501702130 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Ashland town | Massachusetts | 1 |
| MA | 2501703005 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Ayer town | Massachusetts | 1 |
| MA | 2501704615 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Bedford town | Massachusetts | 1 |
| MA | 2501705070 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Belmont town | Massachusetts | 1 |
| MA | 2501705805 | 25 | 17 | METRO14460MM4560 | Lowell, MA HUD Metro FMR Area | Middlesex County | 108000 | 22700 | 25950 | 29200 | 32400 | 35000 | 37600 | 40200 | 42800 | 4560 | Billerica town | Massachusetts | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA | 2501707350 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Boxborough town | Massachusetts | 1 |
| MA | 2501709840 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Burlington town | Massachusetts | 1 |
| MA | 2501711000 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Cambridge city | Massachusetts | 1 |
| MA | 2501711525 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Carlisle town | Massachusetts | 1 |
| MA | 2501713135 | 25 | 17 | METRO14460MM4560 | Lowell, MA HUD Metro FMR Area | Middlesex County | 108000 | 22700 | 25950 | 29200 | 32400 | 35000 | 37600 | 40200 | 42800 | 4560 | Chelmsford town | Massachusetts | 1 |
| MA | 2501715060 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Concord town | Massachusetts | 1 |
| MA | 2501717475 | 25 | 17 | METRO14460MM4560 | Lowell, MA HUD Metro FMR Area | Middlesex County | 108000 | 22700 | 25950 | 29200 | 32400 | 35000 | 37600 | 40200 | 42800 | 4560 | Dracut town | Massachusetts | 1 |
| MA | 2501717825 | 25 | 17 | METRO14460MM4560 | Lowell, MA HUD Metro FMR Area | Middlesex County | 108000 | 22700 | 25950 | 29200 | 32400 | 35000 | 37600 | 40200 | 42800 | 4560 | Dunstable town | Massachusetts | 1 |
| MA | 2501721990 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Everett city | Massachusetts | 1 |
| MA | 2501724925 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Framingham town | Massachusetts | 1 |
| MA | 2501727480 | 25 | 17 | METRO14460MM4560 | Lowell, MA HUD Metro FMR Area | Middlesex County | 108000 | 22700 | 25950 | 29200 | 32400 | 35000 | 37600 | 40200 | 42800 | 4560 | Groton town | Massachusetts | 1 |
| MA | 2501730700 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Holliston town | Massachusetts | 1 |
| MA | 2501731085 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Hopkinton town | Massachusetts | 1 |
| MA | 2501731540 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Hudson town | Massachusetts | 1 |
| MA | 2501735215 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Lexington town | Massachusetts | 1 |
| MA | 2501735425 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Lincoln town | Massachusetts | 1 |
| MA | 2501735950 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Littleton town | Massachusetts | 1 |
| MA | 2501737000 | 25 | 17 | METRO14460MM4560 | Lowell, MA HUD Metro FMR Area | Middlesex County | 108000 | 22700 | 25950 | 29200 | 32400 | 35000 | 37600 | 40200 | 42800 | 4560 | Lowell city | Massachusetts | 1 |
| MA | 2501737875 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Malden city | Massachusetts | 1 |
| MA | 2501738715 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Marlborough city | Massachusetts | 1 |
| MA | 2501739625 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Maynard town | Massachusetts | 1 |
| MA | 2501739835 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Medford city | Massachusetts | 1 |
| MA | 2501740115 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Melrose city | Massachusetts | 1 |
| MA | 2501743895 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Natick town | Massachusetts | 1 |
| MA | 2501745560 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Newton city | Massachusetts | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA | 2501748955 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | North Reading town | Massachusetts | 1 |
| MA | 2501752805 | 25 | 17 | METRO14460MM4560 | Lowell, MA HUD Metro FMR Area | Middlesex County | 108000 | 22700 | 25950 | 29200 | 32400 | 35000 | 37600 | 40200 | 42800 | 4560 | Pepperell town | Massachusetts | 1 |
| MA | 2501756130 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Reading town | Massachusetts | 1 |
| MA | 2501761380 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Sherborn town | Massachusetts | 1 |
| MA | 2501761590 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Shirley town | Massachusetts | 1 |
| MA | 2501762535 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Somerville city | Massachusetts | 1 |
| MA | 2501767665 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Stoneham town | Massachusetts | 1 |
| MA | 2501768050 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Stow town | Massachusetts | 1 |
| MA | 2501768260 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Sudbury town | Massachusetts | 1 |
| MA | 2501769415 | 25 | 17 | METRO14460MM4560 | Lowell, MA HUD Metro FMR Area | Middlesex County | 108000 | 22700 | 25950 | 29200 | 32400 | 35000 | 37600 | 40200 | 42800 | 4560 | Tewksbury town | Massachusetts | 1 |
| MA | 2501770360 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Townsend town | Massachusetts | 1 |
| MA | 2501771025 | 25 | 17 | METRO14460MM4560 | Lowell, MA HUD Metro FMR Area | Middlesex County | 108000 | 22700 | 25950 | 29200 | 32400 | 35000 | 37600 | 40200 | 42800 | 4560 | Tyngsborough town | Massachusetts | 1 |
| MA | 2501772215 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Wakefield town | Massachusetts | 1 |
| MA | 2501772600 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Waltham city | Massachusetts | 1 |
| MA | 2501773440 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Watertown city | Massachusetts | 1 |
| MA | 2501773790 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Wayland town | Massachusetts | 1 |
| MA | 2501776135 | 25 | 17 | METRO14460MM4560 | Lowell, MA HUD Metro FMR Area | Middlesex County | 108000 | 22700 | 25950 | 29200 | 32400 | 35000 | 37600 | 40200 | 42800 | 4560 | Westford town | Massachusetts | 1 |
| MA | 2501777255 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Weston town | Massachusetts | 1 |
| MA | 2501780230 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Wilmington town | Massachusetts | 1 |
| MA | 2501780510 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Winchester town | Massachusetts | 1 |
| MA | 2501781035 | 25 | 17 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Middlesex County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Woburn city | Massachusetts | 1 |
| MA | 2501943790 | 25 | 19 | NCNTY25019N25019 | Nantucket County, MA | Nantucket County | 116700 | 24500 | 28000 | 31500 | 35000 | 37800 | 40600 | 43400 | 46200 | 9999 | Nantucket town | Massachusetts | 0 |
| MA | 2502102935 | 25 | 21 | METRO14460MM1200 | Brockton, MA HUD Metro FMR Area | Norfolk County | 95200 | 20000 | 22850 | 25700 | 28550 | 30850 | 33150 | 35450 | 37700 | 1200 | Avon town | Massachusetts | 1 |
| MA | 2502104930 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Bellingham town | Massachusetts | 1 |
| MA | 2502107740 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Braintree Town city | Massachusetts | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA | 2502109175 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Brookline town | Massachusetts | 1 |
| MA | 2502111315 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Canton town | Massachusetts | 1 |
| MA | 2502114640 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Cohasset town | Massachusetts | 1 |
| MA | 2502116495 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Dedham town | Massachusetts | 1 |
| MA | 2502117405 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Dover town | Massachusetts | 1 |
| MA | 2502124820 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Foxborough town | Massachusetts | 1 |
| MA | 2502125172 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Franklin Town city | Massachusetts | 1 |
| MA | 2502130455 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Holbrook town | Massachusetts | 1 |
| MA | 2502139765 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Medfield town | Massachusetts | 1 |
| MA | 2502139975 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Medway town | Massachusetts | 1 |
| MA | 2502141515 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Millis town | Massachusetts | 1 |
| MA | 2502141690 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Milton town | Massachusetts | 1 |
| MA | 2502144105 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Needham town | Massachusetts | 1 |
| MA | 2502146050 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Norfolk town | Massachusetts | 1 |
| MA | 2502150250 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Norwood town | Massachusetts | 1 |
| MA | 2502154100 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Plainville town | Massachusetts | 1 |
| MA | 2502155745 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Quincy city | Massachusetts | 1 |
| MA | 2502155955 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Randolph town | Massachusetts | 1 |
| MA | 2502160785 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Sharon town | Massachusetts | 1 |
| MA | 2502167945 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Stoughton town | Massachusetts | 1 |
| MA | 2502172495 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Walpole town | Massachusetts | 1 |
| MA | 2502174175 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Wellesley town | Massachusetts | 1 |
| MA | 2502178690 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Westwood town | Massachusetts | 1 |
| MA | 2502178972 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Weymouth Town city | Massachusetts | 1 |
| MA | 2502182315 | 25 | 21 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Norfolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Wrentham town | Massachusetts | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA | 2502300170 | 25 | 23 | METRO14460MM1200 | Brockton, MA HUD Metro FMR Area | Plymouth County | 95200 | 20000 | 22850 | 25700 | 28550 | 30850 | 33150 | 35450 | 37700 | 1200 | Abington town | Massachusetts | 1 |
| MA | 2502308085 | 25 | 23 | METRO14460MM1200 | Brockton, MA HUD Metro FMR Area | Plymouth County | 95200 | 20000 | 22850 | 25700 | 28550 | 30850 | 33150 | 35450 | 37700 | 1200 | Bridgewater town | Massachusetts | 1 |
| MA | 2502309000 | 25 | 23 | METRO14460MM1200 | Brockton, MA HUD Metro FMR Area | Plymouth County | 95200 | 20000 | 22850 | 25700 | 28550 | 30850 | 33150 | 35450 | 37700 | 1200 | Brockton city | Massachusetts | 1 |
| MA | 2502311665 | 25 | 23 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Plymouth County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Carver town | Massachusetts | 1 |
| MA | 2502317895 | 25 | 23 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Plymouth County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Duxbury town | Massachusetts | 1 |
| MA | 2502318455 | 25 | 23 | METRO14460MM1200 | Brockton, MA HUD Metro FMR Area | Plymouth County | 95200 | 20000 | 22850 | 25700 | 28550 | 30850 | 33150 | 35450 | 37700 | 1200 | East Bridgewater town | Massachusetts | 1 |
| MA | 2502327795 | 25 | 23 | METRO14460MM1200 | Brockton, MA HUD Metro FMR Area | Plymouth County | 95200 | 20000 | 22850 | 25700 | 28550 | 30850 | 33150 | 35450 | 37700 | 1200 | Halifax town | Massachusetts | 1 |
| MA | 2502328285 | 25 | 23 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Plymouth County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Hanover town | Massachusetts | 1 |
| MA | 2502328495 | 25 | 23 | METRO14460MM1200 | Brockton, MA HUD Metro FMR Area | Plymouth County | 95200 | 20000 | 22850 | 25700 | 28550 | 30850 | 33150 | 35450 | 37700 | 1200 | Hanson town | Massachusetts | 1 |
| MA | 2502330210 | 25 | 23 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Plymouth County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Hingham town | Massachusetts | 1 |
| MA | 2502331645 | 25 | 23 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Plymouth County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Hull town | Massachusetts | 1 |
| MA | 2502333220 | 25 | 23 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Plymouth County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Kingston town | Massachusetts | 1 |
| MA | 2502333920 | 25 | 23 | METRO14460MM1200 | Brockton, MA HUD Metro FMR Area | Plymouth County | 95200 | 20000 | 22850 | 25700 | 28550 | 30850 | 33150 | 35450 | 37700 | 1200 | Lakeville town | Massachusetts | 1 |
| MA | 2502338540 | 25 | 23 | METRO14460MM1200 | Brockton, MA HUD Metro FMR Area | Plymouth County | 95200 | 20000 | 22850 | 25700 | 28550 | 30850 | 33150 | 35450 | 37700 | 5400 | Marion town | Massachusetts | 1 |
| MA | 2502338855 | 25 | 23 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Plymouth County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Marshfield town | Massachusetts | 1 |
| MA | 2502339450 | 25 | 23 | METRO14460MM1200 | Brockton, MA HUD Metro FMR Area | Plymouth County | 95200 | 20000 | 22850 | 25700 | 28550 | 30850 | 33150 | 35450 | 37700 | 5400 | Mattapoisett town | Massachusetts | 1 |
| MA | 2502340850 | 25 | 23 | METRO14460MM1200 | Brockton, MA HUD Metro FMR Area | Plymouth County | 95200 | 20000 | 22850 | 25700 | 28550 | 30850 | 33150 | 35450 | 37700 | 1200 | Middleborough town | Massachusetts | 1 |
| MA | 2502350145 | 25 | 23 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Plymouth County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Norwell town | Massachusetts | 1 |
| MA | 2502352630 | 25 | 23 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Plymouth County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Pembroke town | Massachusetts | 1 |
| MA | 2502354310 | 25 | 23 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Plymouth County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Plymouth town | Massachusetts | 1 |
| MA | 2502354415 | 25 | 23 | METRO14460MM1200 | Brockton, MA HUD Metro FMR Area | Plymouth County | 95200 | 20000 | 22850 | 25700 | 28550 | 30850 | 33150 | 35450 | 37700 | 1200 | Plympton town | Massachusetts | 1 |
| MA | 2502357600 | 25 | 23 | METRO14460MM1200 | Brockton, MA HUD Metro FMR Area | Plymouth County | 95200 | 20000 | 22850 | 25700 | 28550 | 30850 | 33150 | 35450 | 37700 | 5400 | Rochester town | Massachusetts | 1 |
| MA | 2502357775 | 25 | 23 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Plymouth County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Rockland town | Massachusetts | 1 |
| MA | 2502360330 | 25 | 23 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Plymouth County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Scituate town | Massachusetts | 1 |
| MA | 2502372985 | 25 | 23 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Plymouth County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Wareham town | Massachusetts | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA | 2502375260 | 25 | 23 | METRO14460MM1200 | Brockton, MA HUD Metro FMR Area | Plymouth County | 95200 | 20000 | 22850 | 25700 | 28550 | 30850 | 33150 | 35450 | 37700 | 1200 | West Bridgewater town | Massachusetts | 1 |
| MA | 2502379530 | 25 | 23 | METRO14460MM1200 | Brockton, MA HUD Metro FMR Area | Plymouth County | 95200 | 20000 | 22850 | 25700 | 28550 | 30850 | 33150 | 35450 | 37700 | 1200 | Whitman town | Massachusetts | 1 |
| MA | 2502507000 | 25 | 25 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Suffolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Boston city | Massachusetts | 1 |
| MA | 2502513205 | 25 | 25 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Suffolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Chelsea city | Massachusetts | 1 |
| MA | 2502556585 | 25 | 25 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Suffolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Revere city | Massachusetts | 1 |
| MA | 2502581005 | 25 | 25 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Suffolk County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Winthrop Town city | Massachusetts | 1 |
| MA | 2502701885 | 25 | 27 | METRO49340MM2600 | Fitchburg-Leominster, MA HUD Metro FMR Area | Worcester County | 83200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 2600 | Ashburnham town | Massachusetts | 1 |
| MA | 2502702480 | 25 | 27 | METRO49340N25027 | Western Worcester County, MA HUD Metro FMR Area | Worcester County | 88400 | 18550 | 21200 | 23850 | 26500 | 28650 | 30750 | 32900 | 35000 | 9999 | Athol town | Massachusetts | 1 |
| MA | 2502702760 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Auburn town | Massachusetts | 1 |
| MA | 2502703740 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Barre town | Massachusetts | 1 |
| MA | 2502705490 | 25 | 27 | METRO49340MM1120 | Eastern Worcester County, MA HUD Metro FMR Area | Worcester County | 111600 | 23450 | 26800 | 30150 | 33500 | 36200 | 38900 | 41550 | 44250 | 1120 | Berlin town | Massachusetts | 1 |
| MA | 2502706015 | 25 | 27 | METRO49340MM1120 | Eastern Worcester County, MA HUD Metro FMR Area | Worcester County | 111600 | 23450 | 26800 | 30150 | 33500 | 36200 | 38900 | 41550 | 44250 | 1120 | Blackstone town | Massachusetts | 1 |
| MA | 2502706365 | 25 | 27 | METRO49340MM1120 | Eastern Worcester County, MA HUD Metro FMR Area | Worcester County | 111600 | 23450 | 26800 | 30150 | 33500 | 36200 | 38900 | 41550 | 44250 | 1120 | Bolton town | Massachusetts | 1 |
| MA | 2502707525 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Boylston town | Massachusetts | 1 |
| MA | 2502709105 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Brookfield town | Massachusetts | 1 |
| MA | 2502712715 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Charlton town | Massachusetts | 1 |
| MA | 2502714395 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Clinton town | Massachusetts | 1 |
| MA | 2502717300 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Douglas town | Massachusetts | 1 |
| MA | 2502717685 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Dudley town | Massachusetts | 1 |
| MA | 2502718560 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | East Brookfield town | Massachusetts | 1 |
| MA | 2502723875 | 25 | 27 | METRO49340MM2600 | Fitchburg-Leominster, MA HUD Metro FMR Area | Worcester County | 83200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 2600 | Fitchburg city | Massachusetts | 1 |
| MA | 2502725485 | 25 | 27 | METRO49340MM2600 | Fitchburg-Leominster, MA HUD Metro FMR Area | Worcester County | 83200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 2600 | Gardner city | Massachusetts | 1 |
| MA | 2502726430 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Grafton town | Massachusetts | 1 |
| MA | 2502728740 | 25 | 27 | METRO49340N25027 | Western Worcester County, MA HUD Metro FMR Area | Worcester County | 88400 | 18550 | 21200 | 23850 | 26500 | 28650 | 30750 | 32900 | 35000 | 9999 | Hardwick town | Massachusetts | 1 |
| MA | 2502728950 | 25 | 27 | METRO49340MM1120 | Eastern Worcester County, MA HUD Metro FMR Area | Worcester County | 111600 | 23450 | 26800 | 30150 | 33500 | 36200 | 38900 | 41550 | 44250 | 1120 | Harvard town | Massachusetts | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA | 2502730560 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Holden town | Massachusetts | 1 |
| MA | 2502730945 | 25 | 27 | METRO49340MM1120 | Eastern Worcester County, MA HUD Metro FMR Area | Worcester County | 111600 | 23450 | 26800 | 30150 | 33500 | 36200 | 38900 | 41550 | 44250 | 1120 | Hopedale town | Massachusetts | 1 |
| MA | 2502731435 | 25 | 27 | METRO49340N25027 | Western Worcester County, MA HUD Metro FMR Area | Worcester County | 88400 | 18550 | 21200 | 23850 | 26500 | 28650 | 30750 | 32900 | 35000 | 9999 | Hubbardston town | Massachusetts | 1 |
| MA | 2502734165 | 25 | 27 | METRO49340MM1120 | Eastern Worcester County, MA HUD Metro FMR Area | Worcester County | 111600 | 23450 | 26800 | 30150 | 33500 | 36200 | 38900 | 41550 | 44250 | 1120 | Lancaster town | Massachusetts | 1 |
| MA | 2502734795 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Leicester town | Massachusetts | 1 |
| MA | 2502735075 | 25 | 27 | METRO49340MM2600 | Fitchburg-Leominster, MA HUD Metro FMR Area | Worcester County | 83200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 2600 | Leominster city | Massachusetts | 1 |
| MA | 2502737420 | 25 | 27 | METRO49340MM2600 | Fitchburg-Leominster, MA HUD Metro FMR Area | Worcester County | 83200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 2600 | Lunenburg town | Massachusetts | 1 |
| MA | 2502740255 | 25 | 27 | METRO49340MM1120 | Eastern Worcester County, MA HUD Metro FMR Area | Worcester County | 111600 | 23450 | 26800 | 30150 | 33500 | 36200 | 38900 | 41550 | 44250 | 1120 | Mendon town | Massachusetts | 1 |
| MA | 2502741165 | 25 | 27 | METRO49340MM1120 | Eastern Worcester County, MA HUD Metro FMR Area | Worcester County | 111600 | 23450 | 26800 | 30150 | 33500 | 36200 | 38900 | 41550 | 44250 | 1120 | Milford town | Massachusetts | 1 |
| MA | 2502741340 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Millbury town | Massachusetts | 1 |
| MA | 2502741585 | 25 | 27 | METRO49340MM1120 | Eastern Worcester County, MA HUD Metro FMR Area | Worcester County | 111600 | 23450 | 26800 | 30150 | 33500 | 36200 | 38900 | 41550 | 44250 | 1120 | Millville town | Massachusetts | 1 |
| MA | 2502745105 | 25 | 27 | METRO49340N25027 | Western Worcester County, MA HUD Metro FMR Area | Worcester County | 88400 | 18550 | 21200 | 23850 | 26500 | 28650 | 30750 | 32900 | 35000 | 9999 | New Braintree town | Massachusetts | 1 |
| MA | 2502746820 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Northborough town | Massachusetts | 1 |
| MA | 2502746925 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Northbridge town | Massachusetts | 1 |
| MA | 2502747135 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | North Brookfield town | Massachusetts | 1 |
| MA | 2502750670 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Oakham town | Massachusetts | 1 |
| MA | 2502751825 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Oxford town | Massachusetts | 1 |
| MA | 2502752420 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Paxton town | Massachusetts | 1 |
| MA | 2502753120 | 25 | 27 | METRO49340N25027 | Western Worcester County, MA HUD Metro FMR Area | Worcester County | 88400 | 18550 | 21200 | 23850 | 26500 | 28650 | 30750 | 32900 | 35000 | 9999 | Petersham town | Massachusetts | 1 |
| MA | 2502753225 | 25 | 27 | METRO49340N25027 | Western Worcester County, MA HUD Metro FMR Area | Worcester County | 88400 | 18550 | 21200 | 23850 | 26500 | 28650 | 30750 | 32900 | 35000 | 9999 | Phillipston town | Massachusetts | 1 |
| MA | 2502755395 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Princeton town | Massachusetts | 1 |
| MA | 2502758580 | 25 | 27 | METRO49340N25027 | Western Worcester County, MA HUD Metro FMR Area | Worcester County | 88400 | 18550 | 21200 | 23850 | 26500 | 28650 | 30750 | 32900 | 35000 | 9999 | Royalston town | Massachusetts | 1 |
| MA | 2502758825 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Rutland town | Massachusetts | 1 |
| MA | 2502761800 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Shrewsbury town | Massachusetts | 1 |
| MA | 2502763165 | 25 | 27 | METRO49340MM1120 | Eastern Worcester County, MA HUD Metro FMR Area | Worcester County | 111600 | 23450 | 26800 | 30150 | 33500 | 36200 | 38900 | 41550 | 44250 | 1120 | Southborough town | Massachusetts | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA | 2502763345 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Southbridge Town city | Massachusetts | 1 |
| MA | 2502766105 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Spencer town | Massachusetts | 1 |
| MA | 2502767385 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Sterling town | Massachusetts | 1 |
| MA | 2502768155 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Sturbridge town | Massachusetts | 1 |
| MA | 2502768610 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Sutton town | Massachusetts | 1 |
| MA | 2502769275 | 25 | 27 | METRO49340MM2600 | Fitchburg-Leominster, MA HUD Metro FMR Area | Worcester County | 83200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 2600 | Templeton town | Massachusetts | 1 |
| MA | 2502771480 | 25 | 27 | METRO49340MM1120 | Eastern Worcester County, MA HUD Metro FMR Area | Worcester County | 111600 | 23450 | 26800 | 30150 | 33500 | 36200 | 38900 | 41550 | 44250 | 1120 | Upton town | Massachusetts | 1 |
| MA | 2502771620 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Uxbridge town | Massachusetts | 1 |
| MA | 2502773090 | 25 | 27 | METRO49340N25027 | Western Worcester County, MA HUD Metro FMR Area | Worcester County | 88400 | 18550 | 21200 | 23850 | 26500 | 28650 | 30750 | 32900 | 35000 | 9999 | Warren town | Massachusetts | 1 |
| MA | 2502773895 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Webster town | Massachusetts | 1 |
| MA | 2502775015 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Westborough town | Massachusetts | 1 |
| MA | 2502775155 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | West Boylston town | Massachusetts | 1 |
| MA | 2502775400 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | West Brookfield town | Massachusetts | 1 |
| MA | 2502777010 | 25 | 27 | METRO49340MM2600 | Fitchburg-Leominster, MA HUD Metro FMR Area | Worcester County | 83200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 2600 | Westminster town | Massachusetts | 1 |
| MA | 2502780405 | 25 | 27 | METRO49340MM2600 | Fitchburg-Leominster, MA HUD Metro FMR Area | Worcester County | 83200 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 2600 | Winchendon town | Massachusetts | 1 |
| MA | 2502782000 | 25 | 27 | METRO49340M49340 | Worcester, MA HUD Metro FMR Area | Worcester County | 98200 | 20650 | 23600 | 26550 | 29450 | 31850 | 34200 | 36550 | 38900 | 9240 | Worcester city | Massachusetts | 1 |
| MI | 2600199999 | 26 | 1 | NCNTY26001N26001 | Alcona County, MI | Alcona County | 52200 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Alcona County | Michigan | 0 |
| MI | 2600399999 | 26 | 3 | NCNTY26003N26003 | Alger County, MI | Alger County | 60000 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Alger County | Michigan | 0 |
| MI | 2600599999 | 26 | 5 | NCNTY26005N26005 | Allegan County, MI | Allegan County | 78700 | 16350 | 18700 | 21050 | 23350 | 25250 | 27100 | 29000 | 30850 | 3000 | Allegan County | Michigan | 0 |
| MI | 2600799999 | 26 | 7 | NCNTY26007N26007 | Alpena County, MI | Alpena County | 56800 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Alpena County | Michigan | 0 |
| MI | 2600999999 | 26 | 9 | NCNTY26009N26009 | Antrim County, MI | Antrim County | 64500 | 13550 | 15500 | 17450 | 19350 | 20900 | 22450 | 24000 | 25550 | 9999 | Antrim County | Michigan | 0 |
| MI | 2601199999 | 26 | 11 | NCNTY26011N26011 | Arenac County, MI | Arenac County | 52700 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Arenac County | Michigan | 0 |
| MI | 2601399999 | 26 | 13 | NCNTY26013N26013 | Baraga County, MI | Baraga County | 55700 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Baraga County | Michigan | 0 |
| MI | 2601599999 | 26 | 15 | METRO24340N26015 | Barry County, MI HUD Metro FMR Area | Barry County | 72000 | 15150 | 17300 | 19450 | 21600 | 23350 | 25100 | 26800 | 28550 | 9999 | Barry County | Michigan | 1 |
| MI | 2601799999 | 26 | 17 | METRO13020M13020 | Bay City, MI MSA | Bay County | 59500 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 6960 | Bay County | Michigan | 1 |
| MI | 2601999999 | 26 | 19 | NCNTY26019N26019 | Benzie County, MI | Benzie County | 69400 | 14500 | 16550 | 18600 | 20650 | 22350 | 24000 | 25650 | 27300 | 9999 | Benzie County | Michigan | 0 |
| MI | 2602199999 | 26 | 21 | METRO35660M35660 | Niles-Benton Harbor, MI MSA | Berrien County | 61000 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 870 | Berrien County | Michigan | 1 |
| MI | 2602399999 | 26 | 23 | NCNTY26023N26023 | Branch County, MI | Branch County | 61100 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Branch County | Michigan | 0 |
| MI | 2602599999 | 26 | 25 | METRO12980M12980 | Battle Creek, MI MSA | Calhoun County | 61100 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 3720 | Calhoun County | Michigan | 1 |
| MI | 2602799999 | 26 | 27 | METRO43780N26027 | Cass County, MI HUD Metro FMR Area | Cass County | 65900 | 13850 | 15800 | 17800 | 19750 | 21350 | 22950 | 24500 | 26100 | 9999 | Cass County | Michigan | 1 |
| MI | 2602999999 | 26 | 29 | NCNTY26029N26029 | Charlevoix County, MI | Charlevoix County | 68400 | 14350 | 16400 | 18450 | 20500 | 22150 | 23800 | 25450 | 27100 | 9999 | Charlevoix County | Michigan | 0 |
| MI | 2603199999 | 26 | 31 | NCNTY26031N26031 | Cheboygan County, MI | Cheboygan County | 55600 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Cheboygan County | Michigan | 0 |
| MI | 2603399999 | 26 | 33 | NCNTY26033N26033 | Chippewa County, MI | Chippewa County | 56900 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Chippewa County | Michigan | 0 |
| MI | 2603599999 | 26 | 35 | NCNTY26035N26035 | Clare County, MI | Clare County | 48000 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Clare County | Michigan | 0 |
| MI | 2603799999 | 26 | 37 | METRO29620M29620 | Lansing-East Lansing, MI MSA | Clinton County | 80700 | 16850 | 19250 | 21650 | 24050 | 26000 | 27900 | 29850 | 31750 | 4040 | Clinton County | Michigan | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MI | 2603999999 | 26 | 39 | NCNTY26039N26039 | Crawford County, MI | Crawford County | 54900 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Crawford County | Michigan | 0 |
| MI | 2604199999 | 26 | 41 | NCNTY26041N26041 | Delta County, MI | Delta County | 60300 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Delta County | Michigan | 0 |
| MI | 2604399999 | 26 | 43 | NCNTY26043N26043 | Dickinson County, MI | Dickinson County | 59800 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Dickinson County | Michigan | 0 |
| MI | 2604599999 | 26 | 45 | METRO29620M29620 | Lansing-East Lansing, MI MSA | Eaton County | 80700 | 16850 | 19250 | 21650 | 24050 | 26000 | 27900 | 29850 | 31750 | 4040 | Eaton County | Michigan | 1 |
| MI | 2604799999 | 26 | 47 | NCNTY26047N26047 | Emmet County, MI | Emmet County | 70600 | 14850 | 17000 | 19100 | 21200 | 22900 | 24600 | 26300 | 28000 | 9999 | Emmet County | Michigan | 0 |
| MI | 2604999999 | 26 | 49 | METRO22420M22420 | Flint, MI MSA | Genesee County | 62400 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 2640 | Genesee County | Michigan | 1 |
| MI | 2605199999 | 26 | 51 | NCNTY26051N26051 | Gladwin County, MI | Gladwin County | 53800 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Gladwin County | Michigan | 0 |
| MI | 2605399999 | 26 | 53 | NCNTY26053N26053 | Gogebic County, MI | Gogebic County | 54500 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Gogebic County | Michigan | 0 |
| MI | 2605599999 | 26 | 55 | NCNTY26055N26055 | Grand Traverse County, MI | Grand Traverse County | 81000 | 17050 | 19450 | 21900 | 24300 | 26250 | 28200 | 30150 | 32100 | 9999 | Grand Traverse County | Michigan | 0 |
| MI | 2605799999 | 26 | 57 | NCNTY26057N26057 | Gratiot County, MI | Gratiot County | 55200 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Gratiot County | Michigan | 0 |
| MI | 2605999999 | 26 | 59 | NCNTY26059N26059 | Hillsdale County, MI | Hillsdale County | 60800 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Hillsdale County | Michigan | 0 |
| MI | 2606199999 | 26 | 61 | NCNTY26061N26061 | Houghton County, MI | Houghton County | 62400 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Houghton County | Michigan | 0 |
| MI | 2606399999 | 26 | 63 | NCNTY26063N26063 | Huron County, MI | Huron County | 60500 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Huron County | Michigan | 0 |
| MI | 2606599999 | 26 | 65 | METRO29620M29620 | Lansing-East Lansing, MI MSA | Ingham County | 80700 | 16850 | 19250 | 21650 | 24050 | 26000 | 27900 | 29850 | 31750 | 4040 | Ingham County | Michigan | 1 |
| MI | 2606799999 | 26 | 67 | NCNTY26067N26067 | Ionia County, MI | Ionia County | 65100 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Ionia County | Michigan | 0 |
| MI | 2606999999 | 26 | 69 | NCNTY26069N26069 | Iosco County, MI | Iosco County | 52800 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Iosco County | Michigan | 0 |
| MI | 2607199999 | 26 | 71 | NCNTY26071N26071 | Iron County, MI | Iron County | 55600 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Iron County | Michigan | 0 |
| MI | 2607399999 | 26 | 73 | NCNTY26073N26073 | Isabella County, MI | Isabella County | 66200 | 13850 | 15800 | 17800 | 19750 | 21350 | 22950 | 24500 | 26100 | 9999 | Isabella County | Michigan | 0 |
| MI | 2607599999 | 26 | 75 | METRO27100M27100 | Jackson, MI MSA | Jackson County | 66400 | 13950 | 15950 | 17950 | 19900 | 21500 | 23100 | 24700 | 26300 | 3520 | Jackson County | Michigan | 1 |
| MI | 2607799999 | 26 | 77 | METRO28020M28020 | Kalamazoo-Portage, MI MSA | Kalamazoo County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 3720 | Kalamazoo County | Michigan | 1 |
| MI | 2607999999 | 26 | 79 | NCNTY26079N26079 | Kalkaska County, MI | Kalkaska County | 53000 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Kalkaska County | Michigan | 0 |
| MI | 2608199999 | 26 | 81 | METRO24340M24340 | Grand Rapids-Wyoming, MI HUD Metro FMR Area | Kent County | 80200 | 16850 | 19250 | 21650 | 24050 | 26000 | 27900 | 29850 | 31750 | 3000 | Kent County | Michigan | 1 |
| MI | 2608399999 | 26 | 83 | NCNTY26083N26083 | Keweenaw County, MI | Keweenaw County | 55800 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Keweenaw County | Michigan | 0 |
| MI | 2608599999 | 26 | 85 | NCNTY26085N26085 | Lake County, MI | Lake County | 46100 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Lake County | Michigan | 0 |
| MI | 2608799999 | 26 | 87 | METRO19820M19820 | Detroit-Warren-Livonia, MI HUD Metro FMR Area | Lapeer County | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 2160 | Lapeer County | Michigan | 1 |
| MI | 2608999999 | 26 | 89 | NCNTY26089N26089 | Leelanau County, MI | Leelanau County | 78600 | 16550 | 18900 | 21250 | 23600 | 25500 | 27400 | 29300 | 31200 | 9999 | Leelanau County | Michigan | 0 |
| MI | 2609199999 | 26 | 91 | NCNTY26091N26091 | Lenawee County, MI | Lenawee County | 70300 | 14750 | 16850 | 18950 | 21050 | 22750 | 24450 | 26150 | 27800 | 440 | Lenawee County | Michigan | 0 |
| MI | 2609399999 | 26 | 93 | METRO19820MM0440 | Livingston County, MI HUD Metro FMR Area | Livingston County | 101700 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 440 | Livingston County | Michigan | 1 |
| MI | 2609599999 | 26 | 95 | NCNTY26095N26095 | Luce County, MI | Luce County | 54400 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Luce County | Michigan | 0 |
| MI | 2609799999 | 26 | 97 | NCNTY26097N26097 | Mackinac County, MI | Mackinac County | 54500 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Mackinac County | Michigan | 0 |
| MI | 2609999999 | 26 | 99 | METRO19820M19820 | Detroit-Warren-Livonia, MI HUD Metro FMR Area | Macomb County | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 2160 | Macomb County | Michigan | 1 |
| MI | 2610199999 | 26 | 101 | NCNTY26101N26101 | Manistee County, MI | Manistee County | 58100 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Manistee County | Michigan | 0 |
| MI | 2610399999 | 26 | 103 | NCNTY26103N26103 | Marquette County, MI | Marquette County | 63300 | 13850 | 15800 | 17800 | 19750 | 21350 | 22950 | 24500 | 26100 | 9999 | Marquette County | Michigan | 0 |
| MI | 2610599999 | 26 | 105 | NCNTY26105N26105 | Mason County, MI | Mason County | 59100 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Mason County | Michigan | 0 |
| MI | 2610799999 | 26 | 107 | NCNTY26107N26107 | Mecosta County, MI | Mecosta County | 59500 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Mecosta County | Michigan | 0 |
| MI | 2610999999 | 26 | 109 | NCNTY26109N26109 | Menominee County, MI | Menominee County | 58400 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Menominee County | Michigan | 0 |
| MI | 2611199999 | 26 | 111 | METRO33220M33220 | Midland, MI MSA | Midland County | 82200 | 16950 | 19350 | 21750 | 24150 | 26100 | 28050 | 29950 | 31900 | 6960 | Midland County | Michigan | 1 |
| MI | 2611399999 | 26 | 113 | NCNTY26113N26113 | Missaukee County, MI | Missaukee County | 53400 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Missaukee County | Michigan | 0 |
| MI | 2611599999 | 26 | 115 | METRO33780M33780 | Monroe, MI MSA | Monroe County | 80600 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 2160 | Monroe County | Michigan | 1 |
| MI | 2611799999 | 26 | 117 | METRO24340N26117 | Montcalm County, MI HUD Metro FMR Area | Montcalm County | 55700 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Montcalm County | Michigan | 1 |
| MI | 2611999999 | 26 | 119 | NCNTY26119N26119 | Montmorency County, MI | Montmorency County | 48400 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Montmorency County | Michigan | 0 |
| MI | 2612199999 | 26 | 121 | METRO34740M34740 | Muskegon, MI MSA | Muskegon County | 62900 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 3000 | Muskegon County | Michigan | 1 |
| MI | 2612399999 | 26 | 123 | NCNTY26123N26123 | Newaygo County, MI | Newaygo County | 57000 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Newaygo County | Michigan | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MI | 2612599999 | 26 | 125 | METRO19820M19820 | Detroit-Warren-Livonia, MI HUD Metro FMR Area | Oakland County | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 2160 | Oakland County | Michigan | 1 |
| MI | 2612799999 | 26 | 127 | NCNTY26127N26127 | Oceana County, MI | Oceana County | 54100 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Oceana County | Michigan | 0 |
| MI | 2612999999 | 26 | 129 | NCNTY26129N26129 | Ogemaw County, MI | Ogemaw County | 50100 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Ogemaw County | Michigan | 0 |
| MI | 2613199999 | 26 | 131 | NCNTY26131N26131 | Ontonagon County, MI | Ontonagon County | 49800 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Ontonagon County | Michigan | 0 |
| MI | 2613399999 | 26 | 133 | NCNTY26133N26133 | Osceola County, MI | Osceola County | 52500 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Osceola County | Michigan | 0 |
| MI | 2613599999 | 26 | 135 | NCNTY26135N26135 | Oscoda County, MI | Oscoda County | 49700 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Oscoda County | Michigan | 0 |
| MI | 2613799999 | 26 | 137 | NCNTY26137N26137 | Otsego County, MI | Otsego County | 63100 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Otsego County | Michigan | 0 |
| MI | 2613999999 | 26 | 139 | METRO24340M26100 | Holland-Grand Haven, MI HUD Metro FMR Area | Ottawa County | 83600 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 3000 | Ottawa County | Michigan | 1 |
| MI | 2614199999 | 26 | 141 | NCNTY26141N26141 | Presque Isle County, MI | Presque Isle County | 55000 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Presque Isle County | Michigan | 0 |
| MI | 2614399999 | 26 | 143 | NCNTY26143N26143 | Roscommon County, MI | Roscommon County | 47400 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Roscommon County | Michigan | 0 |
| MI | 2614599999 | 26 | 145 | METRO40980M40980 | Saginaw, MI MSA | Saginaw County | 62900 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 6960 | Saginaw County | Michigan | 1 |
| MI | 2614799999 | 26 | 147 | METRO19820M19820 | Detroit-Warren-Livonia, MI HUD Metro FMR Area | St. Clair County | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 2160 | St. Clair County | Michigan | 1 |
| MI | 2614999999 | 26 | 149 | NCNTY26149N26149 | St. Joseph County, MI | St. Joseph County | 60100 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | St. Joseph County | Michigan | 0 |
| MI | 2615199999 | 26 | 151 | NCNTY26151N26151 | Sanilac County, MI | Sanilac County | 56600 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Sanilac County | Michigan | 0 |
| MI | 2615399999 | 26 | 153 | NCNTY26153N26153 | Schoolcraft County, MI | Schoolcraft County | 53300 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Schoolcraft County | Michigan | 0 |
| MI | 2615599999 | 26 | 155 | NCNTY26155N26155 | Shiawassee County, MI | Shiawassee County | 71100 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Shiawassee County | Michigan | 0 |
| MI | 2615799999 | 26 | 157 | NCNTY26157N26157 | Tuscola County, MI | Tuscola County | 58400 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Tuscola County | Michigan | 0 |
| MI | 2615999999 | 26 | 159 | METRO28020M28020 | Kalamazoo-Portage, MI MSA | Van Buren County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 3720 | Van Buren County | Michigan | 1 |
| MI | 2616199999 | 26 | 161 | METRO11460M11460 | Ann Arbor, MI MSA | Washtenaw County | 101500 | 21350 | 24400 | 27450 | 30450 | 32900 | 35350 | 37800 | 40200 | 440 | Washtenaw County | Michigan | 1 |
| MI | 2616399999 | 26 | 163 | METRO19820M19820 | Detroit-Warren-Livonia, MI HUD Metro FMR Area | Wayne County | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 2160 | Wayne County | Michigan | 1 |
| MI | 2616599999 | 26 | 165 | NCNTY26165N26165 | Wexford County, MI | Wexford County | 52900 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Wexford County | Michigan | 0 |
| MN | 2700199999 | 27 | 1 | NCNTY27001N27001 | Aitkin County, MN | Aitkin County | 59200 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Aitkin County | Minnesota | 0 |
| MN | 2700399999 | 27 | 3 | METRO33460M33460 | Minneapolis-St. Paul-Bloomington, MN-WI HUD Metro FMR Area | Anoka County | 103400 | 21700 | 24800 | 27900 | 31000 | 33500 | 36000 | 38450 | 40950 | 5120 | Anoka County | Minnesota | 1 |
| MN | 2700599999 | 27 | 5 | NCNTY27005N27005 | Becker County, MN | Becker County | 71900 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Becker County | Minnesota | 0 |
| MN | 2700799999 | 27 | 7 | NCNTY27007N27007 | Beltrami County, MN | Beltrami County | 60900 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Beltrami County | Minnesota | 0 |
| MN | 2700999999 | 27 | 9 | METRO41060M41060 | St. Cloud, MN MSA | Benton County | 81200 | 17050 | 19500 | 21950 | 24350 | 26300 | 28250 | 30200 | 32150 | 6980 | Benton County | Minnesota | 1 |
| MN | 2701199999 | 27 | 11 | NCNTY27011N27011 | Big Stone County, MN | Big Stone County | 70200 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Big Stone County | Minnesota | 0 |
| MN | 2701399999 | 27 | 13 | METRO31860M31860 | Mankato-North Mankato, MN MSA | Blue Earth County | 86200 | 17800 | 20350 | 22900 | 25400 | 27450 | 29500 | 31500 | 33550 | 9999 | Blue Earth County | Minnesota | 1 |
| MN | 2701599999 | 27 | 15 | NCNTY27015N27015 | Brown County, MN | Brown County | 76400 | 16050 | 18350 | 20650 | 22900 | 24750 | 26600 | 28400 | 30250 | 9999 | Brown County | Minnesota | 0 |
| MN | 2701799999 | 27 | 17 | METRO20260M20260 | Duluth, MN-WI MSA | Carlton County | 76800 | 16150 | 18450 | 20750 | 23050 | 24900 | 26750 | 28600 | 30450 | 9999 | Carlton County | Minnesota | 1 |
| MN | 2701999999 | 27 | 19 | METRO33460M33460 | Minneapolis-St. Paul-Bloomington, MN-WI HUD Metro FMR Area | Carver County | 103400 | 21700 | 24800 | 27900 | 31000 | 33500 | 36000 | 38450 | 40950 | 5120 | Carver County | Minnesota | 1 |
| MN | 2702199999 | 27 | 21 | NCNTY27021N27021 | Cass County, MN | Cass County | 61500 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Cass County | Minnesota | 0 |
| MN | 2702399999 | 27 | 23 | NCNTY27023N27023 | Chippewa County, MN | Chippewa County | 73300 | 15400 | 17600 | 19800 | 22000 | 23800 | 25550 | 27300 | 29050 | 9999 | Chippewa County | Minnesota | 0 |
| MN | 2702599999 | 27 | 25 | METRO33460M33460 | Minneapolis-St. Paul-Bloomington, MN-WI HUD Metro FMR Area | Chisago County | 103400 | 21700 | 24800 | 27900 | 31000 | 33500 | 36000 | 38450 | 40950 | 5120 | Chisago County | Minnesota | 1 |
| MN | 2702799999 | 27 | 27 | METRO22020M22020 | Fargo, ND-MN MSA | Clay County | 89400 | 18800 | 21450 | 24150 | 26800 | 28950 | 31100 | 33250 | 35400 | 2520 | Clay County | Minnesota | 1 |
| MN | 2702999999 | 27 | 29 | NCNTY27029N27029 | Clearwater County, MN | Clearwater County | 61600 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Clearwater County | Minnesota | 0 |
| MN | 2703199999 | 27 | 31 | NCNTY27031N27031 | Cook County, MN | Cook County | 65100 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Cook County | Minnesota | 0 |
| MN | 2703399999 | 27 | 33 | NCNTY27033N27033 | Cottonwood County, MN | Cottonwood County | 67200 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Cottonwood County | Minnesota | 0 |
| MN | 2703599999 | 27 | 35 | NCNTY27035N27035 | Crow Wing County, MN | Crow Wing County | 69600 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Crow Wing County | Minnesota | 0 |
| MN | 2703799999 | 27 | 37 | METRO33460M33460 | Minneapolis-St. Paul-Bloomington, MN-WI HUD Metro FMR Area | Dakota County | 103400 | 21700 | 24800 | 27900 | 31000 | 33500 | 36000 | 38450 | 40950 | 5120 | Dakota County | Minnesota | 1 |
| MN | 2703999999 | 27 | 39 | METRO40340M40340 | Rochester, MN HUD Metro FMR Area | Dodge County | 103000 | 21250 | 24300 | 27350 | 30350 | 32800 | 35250 | 37650 | 40100 | 9999 | Dodge County | Minnesota | 1 |
| MN | 2704199999 | 27 | 41 | NCNTY27041N27041 | Douglas County, MN | Douglas County | 79400 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Douglas County | Minnesota | 0 |
| MN | 2704399999 | 27 | 43 | NCNTY27043N27043 | Faribault County, MN | Faribault County | 67200 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Faribault County | Minnesota | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MN | 2704599999 | 27 | 45 | METRO40340N27045 | Fillmore County, MN HUD Metro FMR Area | Fillmore County | 75900 | 15950 | 18200 | 20500 | 22750 | 24600 | 26400 | 28250 | 30050 | 9999 | Fillmore County | Minnesota | 1 |
| MN | 2704799999 | 27 | 47 | NCNTY27047N27047 | Freeborn County, MN | Freeborn County | 66000 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Freeborn County | Minnesota | 0 |
| MN | 2704999999 | 27 | 49 | NCNTY27049N27049 | Goodhue County, MN | Goodhue County | 86800 | 18250 | 20850 | 23450 | 26050 | 28150 | 30250 | 32350 | 34400 | 9999 | Goodhue County | Minnesota | 0 |
| MN | 2705199999 | 27 | 51 | NCNTY27051N27051 | Grant County, MN | Grant County | 65900 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Grant County | Minnesota | 0 |
| MN | 2705399999 | 27 | 53 | METRO33460M33460 | Minneapolis-St. Paul-Bloomington, MN-WI HUD Metro FMR Area | Hennepin County | 103400 | 21700 | 24800 | 27900 | 31000 | 33500 | 36000 | 38450 | 40950 | 5120 | Hennepin County | Minnesota | 1 |
| MN | 2705599999 | 27 | 55 | METRO29100M29100 | La Crosse-Onalaska, WI-MN MSA | Houston County | 76800 | 16150 | 18450 | 20750 | 23050 | 24900 | 26750 | 28600 | 30450 | 3870 | Houston County | Minnesota | 1 |
| MN | 2705799999 | 27 | 57 | NCNTY27057N27057 | Hubbard County, MN | Hubbard County | 68800 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Hubbard County | Minnesota | 0 |
| MN | 2705999999 | 27 | 59 | METRO33460M33460 | Minneapolis-St. Paul-Bloomington, MN-WI HUD Metro FMR Area | Isanti County | 103400 | 21700 | 24800 | 27900 | 31000 | 33500 | 36000 | 38450 | 40950 | 5120 | Isanti County | Minnesota | 1 |
| MN | 2706199999 | 27 | 61 | NCNTY27061N27061 | Itasca County, MN | Itasca County | 65000 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Itasca County | Minnesota | 0 |
| MN | 2706399999 | 27 | 63 | NCNTY27063N27063 | Jackson County, MN | Jackson County | 74900 | 15750 | 18000 | 20250 | 22450 | 24250 | 26050 | 27850 | 29650 | 9999 | Jackson County | Minnesota | 0 |
| MN | 2706599999 | 27 | 65 | NCNTY27065N27065 | Kanabec County, MN | Kanabec County | 64400 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Kanabec County | Minnesota | 0 |
| MN | 2706799999 | 27 | 67 | NCNTY27067N27067 | Kandiyohi County, MN | Kandiyohi County | 73400 | 15400 | 17600 | 19800 | 22000 | 23800 | 25550 | 27300 | 29050 | 9999 | Kandiyohi County | Minnesota | 0 |
| MN | 2706999999 | 27 | 69 | NCNTY27069N27069 | Kittson County, MN | Kittson County | 73100 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Kittson County | Minnesota | 0 |
| MN | 2707199999 | 27 | 71 | NCNTY27071N27071 | Koochiching County, MN | Koochiching County | 65300 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Koochiching County | Minnesota | 0 |
| MN | 2707399999 | 27 | 73 | NCNTY27073N27073 | Lac qui Parle County, MN | Lac qui Parle County | 66100 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Lac qui Parle County | Minnesota | 0 |
| MN | 2707599999 | 27 | 75 | NCNTY27075N27075 | Lake County, MN | Lake County | 73900 | 15550 | 17750 | 19950 | 22150 | 23950 | 25700 | 27500 | 29250 | 9999 | Lake County | Minnesota | 0 |
| MN | 2707799999 | 27 | 77 | NCNTY27077N27077 | Lake of the Woods County, MN | Lake of the Woods County | 70900 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Lake of the Woods County | Minnesota | 0 |
| MN | 2707999999 | 27 | 79 | METRO33460N27079 | Le Sueur County, MN HUD Metro FMR Area | Le Sueur County | 84700 | 17800 | 20350 | 22900 | 25400 | 27450 | 29500 | 31500 | 33550 | 9999 | Le Sueur County | Minnesota | 1 |
| MN | 2708199999 | 27 | 81 | NCNTY27081N27081 | Lincoln County, MN | Lincoln County | 71700 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Lincoln County | Minnesota | 0 |
| MN | 2708399999 | 27 | 83 | NCNTY27083N27083 | Lyon County, MN | Lyon County | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 9999 | Lyon County | Minnesota | 0 |
| MN | 2708599999 | 27 | 85 | NCNTY27085N27085 | McLeod County, MN | McLeod County | 76400 | 16050 | 18350 | 20650 | 22900 | 24750 | 26600 | 28400 | 30250 | 9999 | McLeod County | Minnesota | 0 |
| MN | 2708799999 | 27 | 87 | NCNTY27087N27087 | Mahnomen County, MN | Mahnomen County | 55200 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Mahnomen County | Minnesota | 0 |
| MN | 2708999999 | 27 | 89 | NCNTY27089N27089 | Marshall County, MN | Marshall County | 76000 | 16000 | 18250 | 20550 | 22800 | 24650 | 26450 | 28300 | 30100 | 9999 | Marshall County | Minnesota | 0 |
| MN | 2709199999 | 27 | 91 | NCNTY27091N27091 | Martin County, MN | Martin County | 70900 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Martin County | Minnesota | 0 |
| MN | 2709399999 | 27 | 93 | NCNTY27093N27093 | Meeker County, MN | Meeker County | 76700 | 16100 | 18400 | 20700 | 23000 | 24850 | 26700 | 28550 | 30400 | 9999 | Meeker County | Minnesota | 0 |
| MN | 2709599999 | 27 | 95 | METRO33460N27095 | Mille Lacs County, MN HUD Metro FMR Area | Mille Lacs County | 65200 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Mille Lacs County | Minnesota | 1 |
| MN | 2709799999 | 27 | 97 | NCNTY27097N27097 | Morrison County, MN | Morrison County | 70400 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Morrison County | Minnesota | 0 |
| MN | 2709999999 | 27 | 99 | NCNTY27099N27099 | Mower County, MN | Mower County | 73700 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Mower County | Minnesota | 0 |
| MN | 2710199999 | 27 | 101 | NCNTY27101N27101 | Murray County, MN | Murray County | 77500 | 16300 | 18600 | 20950 | 23250 | 25150 | 27000 | 28850 | 30700 | 9999 | Murray County | Minnesota | 0 |
| MN | 2710399999 | 27 | 103 | METRO31860M31860 | Mankato-North Mankato, MN MSA | Nicollet County | 86200 | 17800 | 20350 | 22900 | 25400 | 27450 | 29500 | 31500 | 33550 | 9999 | Nicollet County | Minnesota | 1 |
| MN | 2710599999 | 27 | 105 | NCNTY27105N27105 | Nobles County, MN | Nobles County | 68000 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Nobles County | Minnesota | 0 |
| MN | 2710799999 | 27 | 107 | NCNTY27107N27107 | Norman County, MN | Norman County | 67900 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Norman County | Minnesota | 0 |
| MN | 2710999999 | 27 | 109 | METRO40340M40340 | Rochester, MN HUD Metro FMR Area | Olmsted County | 103000 | 21250 | 24300 | 27350 | 30350 | 32800 | 35250 | 37650 | 40100 | 6820 | Olmsted County | Minnesota | 1 |
| MN | 2711199999 | 27 | 111 | NCNTY27111N27111 | Otter Tail County, MN | Otter Tail County | 72400 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Otter Tail County | Minnesota | 0 |
| MN | 2711399999 | 27 | 113 | NCNTY27113N27113 | Pennington County, MN | Pennington County | 73300 | 15400 | 17600 | 19800 | 22000 | 23800 | 25550 | 27300 | 29050 | 9999 | Pennington County | Minnesota | 0 |
| MN | 2711599999 | 27 | 115 | NCNTY27115N27115 | Pine County, MN | Pine County | 62300 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Pine County | Minnesota | 0 |
| MN | 2711799999 | 27 | 117 | NCNTY27117N27117 | Pipestone County, MN | Pipestone County | 65800 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Pipestone County | Minnesota | 0 |
| MN | 2711999999 | 27 | 119 | METRO24220M24220 | Grand Forks, ND-MN MSA | Polk County | 89200 | 18550 | 21200 | 23850 | 26500 | 28650 | 30750 | 32900 | 35000 | 2985 | Polk County | Minnesota | 1 |
| MN | 2712199999 | 27 | 121 | NCNTY27121N27121 | Pope County, MN | Pope County | 77400 | 16250 | 18600 | 20900 | 23200 | 25100 | 26950 | 28800 | 30650 | 9999 | Pope County | Minnesota | 0 |
| MN | 2712399999 | 27 | 123 | METRO33460M33460 | Minneapolis-St. Paul-Bloomington, MN-WI HUD Metro FMR Area | Ramsey County | 103400 | 21700 | 24800 | 27900 | 31000 | 33500 | 36000 | 38450 | 40950 | 5120 | Ramsey County | Minnesota | 1 |
| MN | 2712599999 | 27 | 125 | NCNTY27125N27125 | Red Lake County, MN | Red Lake County | 77500 | 16300 | 18600 | 20950 | 23250 | 25150 | 27000 | 28850 | 30700 | 9999 | Red Lake County | Minnesota | 0 |
| MN | 2712799999 | 27 | 127 | NCNTY27127N27127 | Redwood County, MN | Redwood County | 69800 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Redwood County | Minnesota | 0 |
| MN | 2712999999 | 27 | 129 | NCNTY27129N27129 | Renville County, MN | Renville County | 73300 | 15400 | 17600 | 19800 | 22000 | 23800 | 25550 | 27300 | 29050 | 9999 | Renville County | Minnesota | 0 |
| MN | 2713199999 | 27 | 131 | NCNTY27131N27131 | Rice County, MN | Rice County | 82400 | 17300 | 19800 | 22250 | 24700 | 26700 | 28700 | 30650 | 32650 | 9999 | Rice County | Minnesota | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MN | 2713399999 | 27 | 133 | NCNTY27133N27133 | Rock County, MN | Rock County | 70300 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Rock County | Minnesota | 0 |
| MN | 2713599999 | 27 | 135 | NCNTY27135N27135 | Roseau County, MN | Roseau County | 72300 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Roseau County | Minnesota | 0 |
| MN | 2713799999 | 27 | 137 | METRO20260M20260 | Duluth, MN-WI MSA | St. Louis County | 76800 | 16150 | 18450 | 20750 | 23050 | 24900 | 26750 | 28600 | 30450 | 2240 | St. Louis County | Minnesota | 1 |
| MN | 2713999999 | 27 | 139 | METRO33460M33460 | Minneapolis-St. Paul-Bloomington, MN-WI HUD Metro FMR Area | Scott County | 103400 | 21700 | 24800 | 27900 | 31000 | 33500 | 36000 | 38450 | 40950 | 5120 | Scott County | Minnesota | 1 |
| MN | 2714199999 | 27 | 141 | METRO33460M33460 | Minneapolis-St. Paul-Bloomington, MN-WI HUD Metro FMR Area | Sherburne County | 103400 | 21700 | 24800 | 27900 | 31000 | 33500 | 36000 | 38450 | 40950 | 5120 | Sherburne County | Minnesota | 1 |
| MN | 2714399999 | 27 | 143 | METRO33460N27143 | Sibley County, MN HUD Metro FMR Area | Sibley County | 74800 | 15750 | 18000 | 20250 | 22450 | 24250 | 26050 | 27850 | 29650 | 9999 | Sibley County | Minnesota | 1 |
| MN | 2714599999 | 27 | 145 | METRO41060M41060 | St. Cloud, MN MSA | Stearns County | 81200 | 17050 | 19500 | 21950 | 24350 | 26300 | 28250 | 30200 | 32150 | 6980 | Stearns County | Minnesota | 1 |
| MN | 2714799999 | 27 | 147 | NCNTY27147N27147 | Steele County, MN | Steele County | 80900 | 17000 | 19400 | 21850 | 24250 | 26200 | 28150 | 30100 | 32050 | 9999 | Steele County | Minnesota | 0 |
| MN | 2714999999 | 27 | 149 | NCNTY27149N27149 | Stevens County, MN | Stevens County | 85000 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Stevens County | Minnesota | 0 |
| MN | 2715199999 | 27 | 151 | NCNTY27151N27151 | Swift County, MN | Swift County | 66600 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Swift County | Minnesota | 0 |
| MN | 2715399999 | 27 | 153 | NCNTY27153N27153 | Todd County, MN | Todd County | 63200 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Todd County | Minnesota | 0 |
| MN | 2715599999 | 27 | 155 | NCNTY27155N27155 | Traverse County, MN | Traverse County | 66800 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Traverse County | Minnesota | 0 |
| MN | 2715799999 | 27 | 157 | METRO40340N27157 | Wabasha County, MN HUD Metro FMR Area | Wabasha County | 77600 | 16350 | 18650 | 21000 | 23300 | 25200 | 27050 | 28900 | 30800 | 9999 | Wabasha County | Minnesota | 1 |
| MN | 2715999999 | 27 | 159 | NCNTY27159N27159 | Wadena County, MN | Wadena County | 59000 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Wadena County | Minnesota | 0 |
| MN | 2716199999 | 27 | 161 | NCNTY27161N27161 | Waseca County, MN | Waseca County | 75200 | 15800 | 18050 | 20300 | 22550 | 24400 | 26200 | 28000 | 29800 | 9999 | Waseca County | Minnesota | 0 |
| MN | 2716399999 | 27 | 163 | METRO33460M33460 | Minneapolis-St. Paul-Bloomington, MN-WI HUD Metro FMR Area | Washington County | 103400 | 21700 | 24800 | 27900 | 31000 | 33500 | 36000 | 38450 | 40950 | 5120 | Washington County | Minnesota | 1 |
| MN | 2716599999 | 27 | 165 | NCNTY27165N27165 | Watonwan County, MN | Watonwan County | 66800 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Watonwan County | Minnesota | 0 |
| MN | 2716799999 | 27 | 167 | NCNTY27167N27167 | Wilkin County, MN | Wilkin County | 71000 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Wilkin County | Minnesota | 0 |
| MN | 2716999999 | 27 | 169 | NCNTY27169N27169 | Winona County, MN | Winona County | 77500 | 16300 | 18600 | 20950 | 23250 | 25150 | 27000 | 28850 | 30700 | 9999 | Winona County | Minnesota | 0 |
| MN | 2717199999 | 27 | 171 | METRO33460M33460 | Minneapolis-St. Paul-Bloomington, MN-WI HUD Metro FMR Area | Wright County | 103400 | 21700 | 24800 | 27900 | 31000 | 33500 | 36000 | 38450 | 40950 | 5120 | Wright County | Minnesota | 1 |
| MN | 2717399999 | 27 | 173 | NCNTY27173N27173 | Yellow Medicine County, MN | Yellow Medicine County | 70400 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Yellow Medicine County | Minnesota | 0 |
| MS | 2800199999 | 28 | 1 | NCNTY28001N28001 | Adams County, MS | Adams County | 37200 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Adams County | Mississippi | 0 |
| MS | 2800399999 | 28 | 3 | NCNTY28003N28003 | Alcorn County, MS | Alcorn County | 49200 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Alcorn County | Mississippi | 0 |
| MS | 2800599999 | 28 | 5 | NCNTY28005N28005 | Amite County, MS | Amite County | 46100 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Amite County | Mississippi | 0 |
| MS | 2800799999 | 28 | 7 | NCNTY28007N28007 | Attala County, MS | Attala County | 47400 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Attala County | Mississippi | 0 |
| MS | 2800999999 | 28 | 9 | METRO32820N28009 | Benton County, MS HUD Metro FMR Area | Benton County | 48600 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Benton County | Mississippi | 1 |
| MS | 2801199999 | 28 | 11 | NCNTY28011N28011 | Bolivar County, MS | Bolivar County | 38500 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Bolivar County | Mississippi | 0 |
| MS | 2801399999 | 28 | 13 | NCNTY28013N28013 | Calhoun County, MS | Calhoun County | 45900 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Calhoun County | Mississippi | 0 |
| MS | 2801599999 | 28 | 15 | NCNTY28015N28015 | Carroll County, MS | Carroll County | 60900 | 12650 | 14450 | 16250 | 18050 | 19500 | 20950 | 22400 | 23850 | 9999 | Carroll County | Mississippi | 0 |
| MS | 2801799999 | 28 | 17 | NCNTY28017N28017 | Chickasaw County, MS | Chickasaw County | 47000 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Chickasaw County | Mississippi | 0 |
| MS | 2801999999 | 28 | 19 | NCNTY28019N28019 | Choctaw County, MS | Choctaw County | 52600 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Choctaw County | Mississippi | 0 |
| MS | 2802199999 | 28 | 21 | NCNTY28021N28021 | Claiborne County, MS | Claiborne County | 29600 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Claiborne County | Mississippi | 0 |
| MS | 2802399999 | 28 | 23 | NCNTY28023N28023 | Clarke County, MS | Clarke County | 54100 | 11350 | 12950 | 14550 | 16150 | 17450 | 18750 | 20050 | 21350 | 9999 | Clarke County | Mississippi | 0 |
| MS | 2802599999 | 28 | 25 | NCNTY28025N28025 | Clay County, MS | Clay County | 44800 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Clay County | Mississippi | 0 |
| MS | 2802799999 | 28 | 27 | NCNTY28027N28027 | Coahoma County, MS | Coahoma County | 35300 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Coahoma County | Mississippi | 0 |
| MS | 2802999999 | 28 | 29 | METRO27140M27140 | Jackson, MS HUD Metro FMR Area | Copiah County | 70900 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Copiah County | Mississippi | 1 |
| MS | 2803199999 | 28 | 31 | NCNTY28031N28031 | Covington County, MS | Covington County | 46600 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Covington County | Mississippi | 0 |
| MS | 2803399999 | 28 | 33 | METRO32820M32820 | Memphis, TN-MS-AR HUD Metro FMR Area | DeSoto County | 67900 | 14250 | 16300 | 18350 | 20350 | 22000 | 23650 | 25250 | 26900 | 4920 | DeSoto County | Mississippi | 1 |
| MS | 2803599999 | 28 | 35 | METRO25620M25620 | Hattiesburg, MS MSA | Forrest County | 62600 | 13200 | 15050 | 16950 | 18800 | 20350 | 21850 | 23350 | 24850 | 3285 | Forrest County | Mississippi | 1 |
| MS | 2803799999 | 28 | 37 | NCNTY28037N28037 | Franklin County, MS | Franklin County | 57000 | 12000 | 13700 | 15400 | 17100 | 18500 | 19850 | 21250 | 22600 | 9999 | Franklin County | Mississippi | 0 |
| MS | 2803999999 | 28 | 39 | NCNTY28039N28039 | George County, MS | George County | 60700 | 12750 | 14600 | 16400 | 18200 | 19700 | 21150 | 22600 | 24050 | 9999 | George County | Mississippi | 0 |
| MS | 2804199999 | 28 | 41 | NCNTY28041N28041 | Greene County, MS | Greene County | 64100 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Greene County | Mississippi | 0 |
| MS | 2804399999 | 28 | 43 | NCNTY28043N28043 | Grenada County, MS | Grenada County | 45700 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Grenada County | Mississippi | 0 |
| MS | 2804599999 | 28 | 45 | METRO25060M25060 | Gulfport-Biloxi, MS HUD Metro FMR Area | Hancock County | 60900 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 920 | Hancock County | Mississippi | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MS | 2804799999 | 28 | 47 | METRO25060M25060 | Gulfport-Biloxi, MS HUD Metro FMR Area | Harrison County | 60900 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 920 | Harrison County | Mississippi | 1 |
| MS | 2804999999 | 28 | 49 | METRO27140M27140 | Jackson, MS HUD Metro FMR Area | Hinds County | 70900 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 3560 | Hinds County | Mississippi | 1 |
| MS | 2805199999 | 28 | 51 | NCNTY28051N28051 | Holmes County, MS | Holmes County | 26200 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Holmes County | Mississippi | 0 |
| MS | 2805399999 | 28 | 53 | NCNTY28053N28053 | Humphreys County, MS | Humphreys County | 33300 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Humphreys County | Mississippi | 0 |
| MS | 2805599999 | 28 | 55 | NCNTY28055N28055 | Issaquena County, MS | Issaquena County | 32200 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Issaquena County | Mississippi | 0 |
| MS | 2805799999 | 28 | 57 | NCNTY28057N28057 | Itawamba County, MS | Itawamba County | 52800 | 11100 | 12700 | 14300 | 15850 | 17150 | 18400 | 19700 | 20950 | 9999 | Itawamba County | Mississippi | 0 |
| MS | 2805999999 | 28 | 59 | METRO25060M37700 | Pascagoula, MS HUD Metro FMR Area | Jackson County | 69100 | 14550 | 16600 | 18700 | 20750 | 22450 | 24100 | 25750 | 27400 | 920 | Jackson County | Mississippi | 1 |
| MS | 2806199999 | 28 | 61 | NCNTY28061N28061 | Jasper County, MS | Jasper County | 46500 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Jasper County | Mississippi | 0 |
| MS | 2806399999 | 28 | 63 | NCNTY28063N28063 | Jefferson County, MS | Jefferson County | 32200 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Jefferson County | Mississippi | 0 |
| MS | 2806599999 | 28 | 65 | NCNTY28065N28065 | Jefferson Davis County, MS | Jefferson Davis County | 34100 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Jefferson Davis County | Mississippi | 0 |
| MS | 2806799999 | 28 | 67 | NCNTY28067N28067 | Jones County, MS | Jones County | 48400 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Jones County | Mississippi | 0 |
| MS | 2806999999 | 28 | 69 | NCNTY28069N28069 | Kemper County, MS | Kemper County | 39900 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Kemper County | Mississippi | 0 |
| MS | 2807199999 | 28 | 71 | NCNTY28071N28071 | Lafayette County, MS | Lafayette County | 72400 | 15200 | 17400 | 19550 | 21700 | 23450 | 25200 | 26950 | 28650 | 9999 | Lafayette County | Mississippi | 0 |
| MS | 2807399999 | 28 | 73 | METRO25620M25620 | Hattiesburg, MS MSA | Lamar County | 62600 | 13200 | 15050 | 16950 | 18800 | 20350 | 21850 | 23350 | 24850 | 3285 | Lamar County | Mississippi | 1 |
| MS | 2807599999 | 28 | 75 | NCNTY28075N28075 | Lauderdale County, MS | Lauderdale County | 63200 | 11750 | 13400 | 15100 | 16750 | 18100 | 19450 | 20800 | 22150 | 9999 | Lauderdale County | Mississippi | 0 |
| MS | 2807799999 | 28 | 77 | NCNTY28077N28077 | Lawrence County, MS | Lawrence County | 56400 | 11300 | 12900 | 14500 | 16100 | 17400 | 18700 | 20000 | 21300 | 9999 | Lawrence County | Mississippi | 0 |
| MS | 2807999999 | 28 | 79 | NCNTY28079N28079 | Leake County, MS | Leake County | 49400 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Leake County | Mississippi | 0 |
| MS | 2808199999 | 28 | 81 | NCNTY28081N28081 | Lee County, MS | Lee County | 71800 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Lee County | Mississippi | 0 |
| MS | 2808399999 | 28 | 83 | NCNTY28083N28083 | Leflore County, MS | Leflore County | 32200 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Leflore County | Mississippi | 0 |
| MS | 2808599999 | 28 | 85 | NCNTY28085N28085 | Lincoln County, MS | Lincoln County | 50400 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Lincoln County | Mississippi | 0 |
| MS | 2808799999 | 28 | 87 | NCNTY28087N28087 | Lowndes County, MS | Lowndes County | 58300 | 12250 | 14000 | 15750 | 17500 | 18900 | 20300 | 21700 | 23100 | 9999 | Lowndes County | Mississippi | 0 |
| MS | 2808999999 | 28 | 89 | METRO27140M27140 | Jackson, MS HUD Metro FMR Area | Madison County | 70900 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 3560 | Madison County | Mississippi | 1 |
| MS | 2809199999 | 28 | 91 | NCNTY28091N28091 | Marion County, MS | Marion County | 41900 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Marion County | Mississippi | 0 |
| MS | 2809399999 | 28 | 93 | METRO32820N28093 | Marshall County, MS HUD Metro FMR Area | Marshall County | 53800 | 11200 | 12800 | 14400 | 16000 | 17300 | 18600 | 19850 | 21150 | 9999 | Marshall County | Mississippi | 1 |
| MS | 2809599999 | 28 | 95 | NCNTY28095N28095 | Monroe County, MS | Monroe County | 54600 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 9999 | Monroe County | Mississippi | 0 |
| MS | 2809799999 | 28 | 97 | NCNTY28097N28097 | Montgomery County, MS | Montgomery County | 44700 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Montgomery County | Mississippi | 0 |
| MS | 2809999999 | 28 | 99 | NCNTY28099N28099 | Neshoba County, MS | Neshoba County | 50900 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Neshoba County | Mississippi | 0 |
| MS | 2810199999 | 28 | 101 | NCNTY28101N28101 | Newton County, MS | Newton County | 49500 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Newton County | Mississippi | 0 |
| MS | 2810399999 | 28 | 103 | NCNTY28103N28103 | Noxubee County, MS | Noxubee County | 46600 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Noxubee County | Mississippi | 0 |
| MS | 2810599999 | 28 | 105 | NCNTY28105N28105 | Oktibbeha County, MS | Oktibbeha County | 61800 | 13000 | 14850 | 16700 | 18550 | 20050 | 21550 | 23050 | 24500 | 9999 | Oktibbeha County | Mississippi | 0 |
| MS | 2810799999 | 28 | 107 | NCNTY28107N28107 | Panola County, MS | Panola County | 44500 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Panola County | Mississippi | 0 |
| MS | 2810999999 | 28 | 109 | NCNTY28109N28109 | Pearl River County, MS | Pearl River County | 60300 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Pearl River County | Mississippi | 0 |
| MS | 2811199999 | 28 | 111 | METRO25620M25620 | Hattiesburg, MS MSA | Perry County | 62600 | 13200 | 15050 | 16950 | 18800 | 20350 | 21850 | 23350 | 24850 | 9999 | Perry County | Mississippi | 1 |
| MS | 2811399999 | 28 | 113 | NCNTY28113N28113 | Pike County, MS | Pike County | 43300 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Pike County | Mississippi | 0 |
| MS | 2811599999 | 28 | 115 | NCNTY28115N28115 | Pontotoc County, MS | Pontotoc County | 53900 | 11350 | 12950 | 14550 | 16150 | 17450 | 18750 | 20050 | 21350 | 9999 | Pontotoc County | Mississippi | 0 |
| MS | 2811799999 | 28 | 117 | NCNTY28117N28117 | Prentiss County, MS | Prentiss County | 47000 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Prentiss County | Mississippi | 0 |
| MS | 2811999999 | 28 | 119 | NCNTY28119N28119 | Quitman County, MS | Quitman County | 37100 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Quitman County | Mississippi | 0 |
| MS | 2812199999 | 28 | 121 | METRO27140M27140 | Jackson, MS HUD Metro FMR Area | Rankin County | 70900 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 3560 | Rankin County | Mississippi | 1 |
| MS | 2812399999 | 28 | 123 | NCNTY28123N28123 | Scott County, MS | Scott County | 43300 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Scott County | Mississippi | 0 |
| MS | 2812599999 | 28 | 125 | NCNTY28125N28125 | Sharkey County, MS | Sharkey County | 43300 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Sharkey County | Mississippi | 0 |
| MS | 2812799999 | 28 | 127 | METRO27140N28127 | Simpson County, MS HUD Metro FMR Area | Simpson County | 44900 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Simpson County | Mississippi | 1 |
| MS | 2812999999 | 28 | 129 | NCNTY28129N28129 | Smith County, MS | Smith County | 54500 | 11450 | 13100 | 14750 | 16350 | 17700 | 19000 | 20300 | 21600 | 9999 | Smith County | Mississippi | 0 |
| MS | 2813199999 | 28 | 131 | NCNTY28131N28131 | Stone County, MS | Stone County | 59000 | 12400 | 14200 | 15950 | 17700 | 19150 | 20550 | 21950 | 23400 | 9999 | Stone County | Mississippi | 0 |
| MS | 2813399999 | 28 | 133 | NCNTY28133N28133 | Sunflower County, MS | Sunflower County | 37600 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Sunflower County | Mississippi | 0 |
| MS | 2813599999 | 28 | 135 | NCNTY28135N28135 | Tallahatchie County, MS | Tallahatchie County | 42200 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Tallahatchie County | Mississippi | 0 |
| MS | 2813799999 | 28 | 137 | METRO32820N28137 | Tate County, MS HUD Metro FMR Area | Tate County | 62100 | 13100 | 14950 | 16800 | 18650 | 20150 | 21650 | 23150 | 24650 | 9999 | Tate County | Mississippi | 1 |
| MS | 2813999999 | 28 | 139 | NCNTY28139N28139 | Tippah County, MS | Tippah County | 51300 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Tippah County | Mississippi | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MS | 2814199999 | 28 | 141 | NCNTY28141N28141 | Tishomingo County, MS | Tishomingo County | 47400 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Tishomingo County | Mississippi | 0 |
| MS | 2814399999 | 28 | 143 | METRO32820N28143 | Tunica County, MS HUD Metro FMR Area | Tunica County | 39300 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Tunica County | Mississippi | 1 |
| MS | 2814599999 | 28 | 145 | NCNTY28145N28145 | Union County, MS | Union County | 51200 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Union County | Mississippi | 0 |
| MS | 2814799999 | 28 | 147 | NCNTY28147N28147 | Walthall County, MS | Walthall County | 43000 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Walthall County | Mississippi | 0 |
| MS | 2814999999 | 28 | 149 | NCNTY28149N28149 | Warren County, MS | Warren County | 54900 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Warren County | Mississippi | 0 |
| MS | 2815199999 | 28 | 151 | NCNTY28151N28151 | Washington County, MS | Washington County | 40700 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Washington County | Mississippi | 0 |
| MS | 2815399999 | 28 | 153 | NCNTY28153N28153 | Wayne County, MS | Wayne County | 53800 | 11350 | 12950 | 14550 | 16150 | 17450 | 18750 | 20050 | 21350 | 9999 | Wayne County | Mississippi | 0 |
| MS | 2815599999 | 28 | 155 | NCNTY28155N28155 | Webster County, MS | Webster County | 52600 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Webster County | Mississippi | 0 |
| MS | 2815799999 | 28 | 157 | NCNTY28157N28157 | Wilkinson County, MS | Wilkinson County | 33600 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Wilkinson County | Mississippi | 0 |
| MS | 2815999999 | 28 | 159 | NCNTY28159N28159 | Winston County, MS | Winston County | 46100 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Winston County | Mississippi | 0 |
| MS | 2816199999 | 28 | 161 | NCNTY28161N28161 | Yalobusha County, MS | Yalobusha County | 48200 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Yalobusha County | Mississippi | 0 |
| MS | 2816399999 | 28 | 163 | METRO27140N28163 | Yazoo County, MS HUD Metro FMR Area | Yazoo County | 39900 | 11100 | 12650 | 14250 | 15800 | 17100 | 18350 | 19600 | 20900 | 9999 | Yazoo County | Mississippi | 1 |
| MO | 2900199999 | 29 | 1 | NCNTY29001N29001 | Adair County, MO | Adair County | 65000 | 13650 | 15600 | 17550 | 19500 | 21100 | 22650 | 24200 | 25750 | 9999 | Adair County | Missouri | 0 |
| MO | 2900399999 | 29 | 3 | METRO41140M41140 | St. Joseph, MO-KS MSA | Andrew County | 63600 | 13400 | 15300 | 17200 | 19100 | 20650 | 22200 | 23700 | 25250 | 7000 | Andrew County | Missouri | 1 |
| MO | 2900599999 | 29 | 5 | NCNTY29005N29005 | Atchison County, MO | Atchison County | 63900 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Atchison County | Missouri | 0 |
| MO | 2900799999 | 29 | 7 | NCNTY29007N29007 | Audrain County, MO | Audrain County | 58600 | 12350 | 14100 | 15850 | 17600 | 19050 | 20450 | 21850 | 23250 | 9999 | Audrain County | Missouri | 0 |
| MO | 2900999999 | 29 | 9 | NCNTY29009N29009 | Barry County, MO | Barry County | 54400 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Barry County | Missouri | 0 |
| MO | 2901199999 | 29 | 11 | NCNTY29011N29011 | Barton County, MO | Barton County | 54200 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Barton County | Missouri | 0 |
| MO | 2901399999 | 29 | 13 | METRO28140N29013 | Bates County, MO HUD Metro FMR Area | Bates County | 63700 | 13300 | 15200 | 17100 | 18950 | 20500 | 22000 | 23500 | 25050 | 9999 | Bates County | Missouri | 1 |
| MO | 2901599999 | 29 | 15 | NCNTY29015N29015 | Benton County, MO | Benton County | 45300 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Benton County | Missouri | 0 |
| MO | 2901799999 | 29 | 17 | METRO16020M16020 | Cape Girardeau, MO-IL MSA | Bollinger County | 67000 | 14100 | 16100 | 18100 | 20100 | 21750 | 23350 | 24950 | 26550 | 9999 | Bollinger County | Missouri | 1 |
| MO | 2901999999 | 29 | 19 | METRO17860M17860 | Columbia, MO MSA | Boone County | 77900 | 16350 | 18700 | 21050 | 23350 | 25250 | 27100 | 29000 | 30850 | 1740 | Boone County | Missouri | 1 |
| MO | 2902199999 | 29 | 21 | METRO41140M41140 | St. Joseph, MO-KS MSA | Buchanan County | 63600 | 13400 | 15300 | 17200 | 19100 | 20650 | 22200 | 23700 | 25250 | 7000 | Buchanan County | Missouri | 1 |
| MO | 2902399999 | 29 | 23 | NCNTY29023N29023 | Butler County, MO | Butler County | 49400 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Butler County | Missouri | 0 |
| MO | 2902599999 | 29 | 25 | METRO28140M28140 | Kansas City, MO-KS HUD Metro FMR Area | Caldwell County | 86000 | 18100 | 20650 | 23250 | 25800 | 27900 | 29950 | 32000 | 34100 | 9999 | Caldwell County | Missouri | 1 |
| MO | 2902799999 | 29 | 27 | METRO27620N29027 | Callaway County, MO HUD Metro FMR Area | Callaway County | 69500 | 14600 | 16700 | 18800 | 20850 | 22550 | 24200 | 25900 | 27550 | 9999 | Callaway County | Missouri | 1 |
| MO | 2902999999 | 29 | 29 | NCNTY29029N29029 | Camden County, MO | Camden County | 63000 | 13250 | 15150 | 17050 | 18900 | 20450 | 21950 | 23450 | 24950 | 9999 | Camden County | Missouri | 0 |
| MO | 2903199999 | 29 | 31 | METRO16020M16020 | Cape Girardeau, MO-IL MSA | Cape Girardeau County | 67000 | 14100 | 16100 | 18100 | 20100 | 21750 | 23350 | 24950 | 26550 | 9999 | Cape Girardeau County | Missouri | 1 |
| MO | 2903399999 | 29 | 33 | NCNTY29033N29033 | Carroll County, MO | Carroll County | 60700 | 12750 | 14600 | 16400 | 18200 | 19700 | 21150 | 22600 | 24050 | 9999 | Carroll County | Missouri | 0 |
| MO | 2903599999 | 29 | 35 | NCNTY29035N29035 | Carter County, MO | Carter County | 52800 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Carter County | Missouri | 0 |
| MO | 2903799999 | 29 | 37 | METRO28140M28140 | Kansas City, MO-KS HUD Metro FMR Area | Cass County | 86000 | 18100 | 20650 | 23250 | 25800 | 27900 | 29950 | 32000 | 34100 | 3760 | Cass County | Missouri | 1 |
| MO | 2903999999 | 29 | 39 | NCNTY29039N29039 | Cedar County, MO | Cedar County | 47100 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Cedar County | Missouri | 0 |
| MO | 2904199999 | 29 | 41 | NCNTY29041N29041 | Chariton County, MO | Chariton County | 56000 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Chariton County | Missouri | 0 |
| MO | 2904399999 | 29 | 43 | METRO44180M44180 | Springfield, MO HUD Metro FMR Area | Christian County | 65300 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 7920 | Christian County | Missouri | 1 |
| MO | 2904599999 | 29 | 45 | NCNTY29045N29045 | Clark County, MO | Clark County | 58000 | 12200 | 13950 | 15700 | 17400 | 18800 | 20200 | 21600 | 23000 | 9999 | Clark County | Missouri | 0 |
| MO | 2904799999 | 29 | 47 | METRO28140M28140 | Kansas City, MO-KS HUD Metro FMR Area | Clay County | 86000 | 18100 | 20650 | 23250 | 25800 | 27900 | 29950 | 32000 | 34100 | 3760 | Clay County | Missouri | 1 |
| MO | 2904999999 | 29 | 49 | METRO28140M28140 | Kansas City, MO-KS HUD Metro FMR Area | Clinton County | 86000 | 18100 | 20650 | 23250 | 25800 | 27900 | 29950 | 32000 | 34100 | 3760 | Clinton County | Missouri | 1 |
| MO | 2905199999 | 29 | 51 | METRO27620M27620 | Jefferson City, MO HUD Metro FMR Area | Cole County | 75500 | 15900 | 18150 | 20400 | 22650 | 24500 | 26300 | 28100 | 29900 | 9999 | Cole County | Missouri | 1 |
| MO | 2905399999 | 29 | 53 | NCNTY29053N29053 | Cooper County, MO | Cooper County | 67100 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 9999 | Cooper County | Missouri | 0 |
| MO | 2905599999 | 29 | 55 | NCNTY29055N29055 | Crawford County, MO | Crawford County | 52300 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Crawford County | Missouri | 0 |
| MO | 2905699999 | 29 | 55 | METRO41180M41180 | St. Louis, MO-IL HUD Metro FMR Area | Sullivan part | 82900 | 17400 | 19900 | 22400 | 24850 | 26850 | 28850 | 30850 | 32850 | 7040 | Sullivan city part of Crawford County | Missouri | 1 |
| MO | 2905799999 | 29 | 57 | NCNTY29057N29057 | Dade County, MO | Dade County | 48700 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Dade County | Missouri | 0 |
| MO | 2905999999 | 29 | 59 | METRO44180N29059 | Dallas County, MO HUD Metro FMR Area | Dallas County | 49500 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Dallas County | Missouri | 1 |
| MO | 2906199999 | 29 | 61 | NCNTY29061N29061 | Daviess County, MO | Daviess County | 63200 | 12900 | 14750 | 16600 | 18400 | 19900 | 21350 | 22850 | 24300 | 9999 | Daviess County | Missouri | 0 |
| MO | 2906399999 | 29 | 63 | METRO41140M41140 | St. Joseph, MO-KS MSA | DeKalb County | 63600 | 13400 | 15300 | 17200 | 19100 | 20650 | 22200 | 23700 | 25250 | 9999 | DeKalb County | Missouri | 1 |
| MO | 2906599999 | 29 | 65 | NCNTY29065N29065 | Dent County, MO | Dent County | 51500 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Dent County | Missouri | 0 |
| MO | 2906799999 | 29 | 67 | NCNTY29067N29067 | Douglas County, MO | Douglas County | 41700 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Douglas County | Missouri | 0 |
| MO | 2906999999 | 29 | 69 | NCNTY29069N29069 | Dunklin County, MO | Dunklin County | 42800 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Dunklin County | Missouri | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MO | 2907199999 | 29 | 71 | METRO41180M41180 | St. Louis, MO-IL HUD Metro FMR Area | Franklin County | 82900 | 17400 | 19900 | 22400 | 24850 | 26850 | 28850 | 30850 | 32850 | 7040 | Franklin County | Missouri | 1 |
| MO | 2907399999 | 29 | 73 | NCNTY29073N29073 | Gasconade County, MO | Gasconade County | 63500 | 13350 | 15250 | 17150 | 19050 | 20600 | 22100 | 23650 | 25150 | 9999 | Gasconade County | Missouri | 0 |
| MO | 2907599999 | 29 | 75 | NCNTY29075N29075 | Gentry County, MO | Gentry County | 58500 | 12300 | 14050 | 15800 | 17550 | 19000 | 20400 | 21800 | 23200 | 9999 | Gentry County | Missouri | 0 |
| MO | 2907799999 | 29 | 77 | METRO44180M44180 | Springfield, MO HUD Metro FMR Area | Greene County | 65300 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 7920 | Greene County | Missouri | 1 |
| MO | 2907999999 | 29 | 79 | NCNTY29079N29079 | Grundy County, MO | Grundy County | 62500 | 13150 | 15000 | 16900 | 18750 | 20250 | 21750 | 23250 | 24750 | 9999 | Grundy County | Missouri | 0 |
| MO | 2908199999 | 29 | 81 | NCNTY29081N29081 | Harrison County, MO | Harrison County | 55800 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Harrison County | Missouri | 0 |
| MO | 2908399999 | 29 | 83 | NCNTY29083N29083 | Henry County, MO | Henry County | 57000 | 12000 | 13700 | 15400 | 17100 | 18500 | 19850 | 21250 | 22600 | 9999 | Henry County | Missouri | 0 |
| MO | 2908599999 | 29 | 85 | NCNTY29085N29085 | Hickory County, MO | Hickory County | 46000 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Hickory County | Missouri | 0 |
| MO | 2908799999 | 29 | 87 | NCNTY29087N29087 | Holt County, MO | Holt County | 59700 | 12550 | 14350 | 16150 | 17900 | 19350 | 20800 | 22200 | 23650 | 9999 | Holt County | Missouri | 0 |
| MO | 2908999999 | 29 | 89 | NCNTY29089N29089 | Howard County, MO | Howard County | 65200 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Howard County | Missouri | 0 |
| MO | 2909199999 | 29 | 91 | NCNTY29091N29091 | Howell County, MO | Howell County | 46600 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Howell County | Missouri | 0 |
| MO | 2909399999 | 29 | 93 | NCNTY29093N29093 | Iron County, MO | Iron County | 48200 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Iron County | Missouri | 0 |
| MO | 2909599999 | 29 | 95 | METRO28140M28140 | Kansas City, MO-KS HUD Metro FMR Area | Jackson County | 86000 | 18100 | 20650 | 23250 | 25800 | 27900 | 29950 | 32000 | 34100 | 3760 | Jackson County | Missouri | 1 |
| MO | 2909799999 | 29 | 97 | METRO27900M27900 | Joplin, MO MSA | Jasper County | 63300 | 13200 | 15100 | 17000 | 18850 | 20400 | 21900 | 23400 | 24900 | 3710 | Jasper County | Missouri | 1 |
| MO | 2909999999 | 29 | 99 | METRO41180M41180 | St. Louis, MO-IL HUD Metro FMR Area | Jefferson County | 82900 | 17400 | 19900 | 22400 | 24850 | 26850 | 28850 | 30850 | 32850 | 7040 | Jefferson County | Missouri | 1 |
| MO | 2910199999 | 29 | 101 | NCNTY29101N29101 | Johnson County, MO | Johnson County | 66800 | 14050 | 16050 | 18050 | 20050 | 21700 | 23300 | 24900 | 26500 | 9999 | Johnson County | Missouri | 0 |
| MO | 2910399999 | 29 | 103 | NCNTY29103N29103 | Knox County, MO | Knox County | 53500 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Knox County | Missouri | 0 |
| MO | 2910599999 | 29 | 105 | NCNTY29105N29105 | Laclede County, MO | Laclede County | 53900 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Laclede County | Missouri | 0 |
| MO | 2910799999 | 29 | 107 | METRO28140M28140 | Kansas City, MO-KS HUD Metro FMR Area | Lafayette County | 86000 | 18100 | 20650 | 23250 | 25800 | 27900 | 29950 | 32000 | 34100 | 3760 | Lafayette County | Missouri | 1 |
| MO | 2910999999 | 29 | 109 | NCNTY29109N29109 | Lawrence County, MO | Lawrence County | 52800 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Lawrence County | Missouri | 0 |
| MO | 2911199999 | 29 | 111 | NCNTY29111N29111 | Lewis County, MO | Lewis County | 61700 | 12950 | 14800 | 16650 | 18500 | 20000 | 21500 | 22950 | 24450 | 9999 | Lewis County | Missouri | 0 |
| MO | 2911399999 | 29 | 113 | METRO41180M41180 | St. Louis, MO-IL HUD Metro FMR Area | Lincoln County | 82900 | 17400 | 19900 | 22400 | 24850 | 26850 | 28850 | 30850 | 32850 | 7040 | Lincoln County | Missouri | 1 |
| MO | 2911599999 | 29 | 115 | NCNTY29115N29115 | Linn County, MO | Linn County | 53100 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Linn County | Missouri | 0 |
| MO | 2911799999 | 29 | 117 | NCNTY29117N29117 | Livingston County, MO | Livingston County | 62800 | 13200 | 15100 | 17000 | 18850 | 20400 | 21900 | 23400 | 24900 | 9999 | Livingston County | Missouri | 0 |
| MO | 2911999999 | 29 | 119 | METRO22220N29119 | McDonald County, MO HUD Metro FMR Area | McDonald County | 48200 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | McDonald County | Missouri | 1 |
| MO | 2912199999 | 29 | 121 | NCNTY29121N29121 | Macon County, MO | Macon County | 54700 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Macon County | Missouri | 0 |
| MO | 2912399999 | 29 | 123 | NCNTY29123N29123 | Madison County, MO | Madison County | 53900 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Madison County | Missouri | 0 |
| MO | 2912599999 | 29 | 125 | NCNTY29125N29125 | Maries County, MO | Maries County | 59000 | 12400 | 14200 | 15950 | 17700 | 19150 | 20550 | 21950 | 23400 | 9999 | Maries County | Missouri | 0 |
| MO | 2912799999 | 29 | 127 | NCNTY29127N29127 | Marion County, MO | Marion County | 59600 | 12550 | 14350 | 16150 | 17900 | 19350 | 20800 | 22200 | 23650 | 9999 | Marion County | Missouri | 0 |
| MO | 2912999999 | 29 | 129 | NCNTY29129N29129 | Mercer County, MO | Mercer County | 54900 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Mercer County | Missouri | 0 |
| MO | 2913199999 | 29 | 131 | NCNTY29131N29131 | Miller County, MO | Miller County | 54600 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Miller County | Missouri | 0 |
| MO | 2913399999 | 29 | 133 | NCNTY29133N29133 | Mississippi County, MO | Mississippi County | 37900 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Mississippi County | Missouri | 0 |
| MO | 2913599999 | 29 | 135 | METRO27620N29135 | Moniteau County, MO HUD Metro FMR Area | Moniteau County | 64000 | 13450 | 15400 | 17300 | 19200 | 20750 | 22300 | 23850 | 25350 | 9999 | Moniteau County | Missouri | 1 |
| MO | 2913799999 | 29 | 137 | NCNTY29137N29137 | Monroe County, MO | Monroe County | 57900 | 12150 | 13900 | 15650 | 17350 | 18750 | 20150 | 21550 | 22950 | 9999 | Monroe County | Missouri | 0 |
| MO | 2913999999 | 29 | 139 | NCNTY29139N29139 | Montgomery County, MO | Montgomery County | 55400 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Montgomery County | Missouri | 0 |
| MO | 2914199999 | 29 | 141 | NCNTY29141N29141 | Morgan County, MO | Morgan County | 48700 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Morgan County | Missouri | 0 |
| MO | 2914399999 | 29 | 143 | NCNTY29143N29143 | New Madrid County, MO | New Madrid County | 44500 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | New Madrid County | Missouri | 0 |
| MO | 2914599999 | 29 | 145 | METRO27900M27900 | Joplin, MO MSA | Newton County | 63300 | 13200 | 15100 | 17000 | 18850 | 20400 | 21900 | 23400 | 24900 | 3710 | Newton County | Missouri | 1 |
| MO | 2914799999 | 29 | 147 | NCNTY29147N29147 | Nodaway County, MO | Nodaway County | 63100 | 13300 | 15200 | 17100 | 18950 | 20500 | 22000 | 23500 | 25050 | 9999 | Nodaway County | Missouri | 0 |
| MO | 2914999999 | 29 | 149 | NCNTY29149N29149 | Oregon County, MO | Oregon County | 44200 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Oregon County | Missouri | 0 |
| MO | 2915199999 | 29 | 151 | METRO27620M27620 | Jefferson City, MO HUD Metro FMR Area | Osage County | 75500 | 15900 | 18150 | 20400 | 22650 | 24500 | 26300 | 28100 | 29900 | 9999 | Osage County | Missouri | 1 |
| MO | 2915399999 | 29 | 153 | NCNTY29153N29153 | Ozark County, MO | Ozark County | 43900 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Ozark County | Missouri | 0 |
| MO | 2915599999 | 29 | 155 | NCNTY29155N29155 | Pemiscot County, MO | Pemiscot County | 46700 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Pemiscot County | Missouri | 0 |
| MO | 2915799999 | 29 | 157 | NCNTY29157N29157 | Perry County, MO | Perry County | 72000 | 15150 | 17300 | 19450 | 21600 | 23350 | 25100 | 26800 | 28550 | 9999 | Perry County | Missouri | 0 |
| MO | 2915999999 | 29 | 159 | NCNTY29159N29159 | Pettis County, MO | Pettis County | 55100 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Pettis County | Missouri | 0 |
| MO | 2916199999 | 29 | 161 | NCNTY29161N29161 | Phelps County, MO | Phelps County | 61900 | 13000 | 14850 | 16700 | 18550 | 20050 | 21550 | 23050 | 24500 | 9999 | Phelps County | Missouri | 0 |
| MO | 2916399999 | 29 | 163 | NCNTY29163N29163 | Pike County, MO | Pike County | 60200 | 12650 | 14450 | 16250 | 18050 | 19500 | 20950 | 22400 | 23850 | 9999 | Pike County | Missouri | 0 |
| MO | 2916599999 | 29 | 165 | METRO28140M28140 | Kansas City, MO-KS HUD Metro FMR Area | Platte County | 86000 | 18100 | 20650 | 23250 | 25800 | 27900 | 29950 | 32000 | 34100 | 3760 | Platte County | Missouri | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MO | 2916799999 | 29 | 167 | METRO44180N29167 | Polk County, MO HUD Metro FMR Area | Polk County | 55200 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Polk County | Missouri | 1 |
| MO | 2916999999 | 29 | 169 | NCNTY29169N29169 | Pulaski County, MO | Pulaski County | 65400 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Pulaski County | Missouri | 0 |
| MO | 2917199999 | 29 | 171 | NCNTY29171N29171 | Putnam County, MO | Putnam County | 47700 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Putnam County | Missouri | 0 |
| MO | 2917399999 | 29 | 173 | NCNTY29173N29173 | Ralls County, MO | Ralls County | 64000 | 13450 | 15400 | 17300 | 19200 | 20750 | 22300 | 23850 | 25350 | 9999 | Ralls County | Missouri | 0 |
| MO | 2917599999 | 29 | 175 | NCNTY29175N29175 | Randolph County, MO | Randolph County | 63000 | 13000 | 14850 | 16700 | 18550 | 20050 | 21550 | 23050 | 24500 | 9999 | Randolph County | Missouri | 0 |
| MO | 2917799999 | 29 | 177 | METRO28140M28140 | Kansas City, MO-KS HUD Metro FMR Area | Ray County | 86000 | 18100 | 20650 | 23250 | 25800 | 27900 | 29950 | 32000 | 34100 | 3760 | Ray County | Missouri | 1 |
| MO | 2917999999 | 29 | 179 | NCNTY29179N29179 | Reynolds County, MO | Reynolds County | 53900 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Reynolds County | Missouri | 0 |
| MO | 2918199999 | 29 | 181 | NCNTY29181N29181 | Ripley County, MO | Ripley County | 44200 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Ripley County | Missouri | 0 |
| MO | 2918399999 | 29 | 183 | METRO41180M41180 | St. Louis, MO-IL HUD Metro FMR Area | St. Charles County | 82900 | 17400 | 19900 | 22400 | 24850 | 26850 | 28850 | 30850 | 32850 | 7040 | St. Charles County | Missouri | 1 |
| MO | 2918599999 | 29 | 185 | NCNTY29185N29185 | St. Clair County, MO | St. Clair County | 48100 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | St. Clair County | Missouri | 0 |
| MO | 2918699999 | 29 | 186 | NCNTY29186N29186 | Ste. Genevieve County, MO | Ste. Genevieve County | 62700 | 13200 | 15050 | 16950 | 18800 | 20350 | 21850 | 23350 | 24850 | 9999 | Ste. Genevieve County | Missouri | 0 |
| MO | 2918799999 | 29 | 187 | NCNTY29187N29187 | St. Francois County, MO | St. Francois County | 60200 | 12650 | 14450 | 16250 | 18050 | 19500 | 20950 | 22400 | 23850 | 9999 | St. Francois County | Missouri | 0 |
| MO | 2918999999 | 29 | 189 | METRO41180M41180 | St. Louis, MO-IL HUD Metro FMR Area | St. Louis County | 82900 | 17400 | 19900 | 22400 | 24850 | 26850 | 28850 | 30850 | 32850 | 7040 | St. Louis County | Missouri | 1 |
| MO | 2919599999 | 29 | 195 | NCNTY29195N29195 | Saline County, MO | Saline County | 55600 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Saline County | Missouri | 0 |
| MO | 2919799999 | 29 | 197 | NCNTY29197N29197 | Schuyler County, MO | Schuyler County | 51900 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Schuyler County | Missouri | 0 |
| MO | 2919999999 | 29 | 199 | NCNTY29199N29199 | Scotland County, MO | Scotland County | 62700 | 13200 | 15050 | 16950 | 18800 | 20350 | 21850 | 23350 | 24850 | 9999 | Scotland County | Missouri | 0 |
| MO | 2920199999 | 29 | 201 | NCNTY29201N29201 | Scott County, MO | Scott County | 53400 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Scott County | Missouri | 0 |
| MO | 2920399999 | 29 | 203 | NCNTY29203N29203 | Shannon County, MO | Shannon County | 46500 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Shannon County | Missouri | 0 |
| MO | 2920599999 | 29 | 205 | NCNTY29205N29205 | Shelby County, MO | Shelby County | 59600 | 12550 | 14350 | 16150 | 17900 | 19350 | 20800 | 22200 | 23650 | 9999 | Shelby County | Missouri | 0 |
| MO | 2920799999 | 29 | 207 | NCNTY29207N29207 | Stoddard County, MO | Stoddard County | 52300 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Stoddard County | Missouri | 0 |
| MO | 2920999999 | 29 | 209 | NCNTY29209N29209 | Stone County, MO | Stone County | 55800 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Stone County | Missouri | 0 |
| MO | 2921199999 | 29 | 211 | NCNTY29211N29211 | Sullivan County, MO | Sullivan County | 54500 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Sullivan County | Missouri | 0 |
| MO | 2921399999 | 29 | 213 | NCNTY29213N29213 | Taney County, MO | Taney County | 51800 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Taney County | Missouri | 0 |
| MO | 2921599999 | 29 | 215 | NCNTY29215N29215 | Texas County, MO | Texas County | 48800 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Texas County | Missouri | 0 |
| MO | 2921799999 | 29 | 217 | NCNTY29217N29217 | Vernon County, MO | Vernon County | 52800 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Vernon County | Missouri | 0 |
| MO | 2921999999 | 29 | 219 | METRO41180M41180 | St. Louis, MO-IL HUD Metro FMR Area | Warren County | 82900 | 17400 | 19900 | 22400 | 24850 | 26850 | 28850 | 30850 | 32850 | 7040 | Warren County | Missouri | 1 |
| MO | 2922199999 | 29 | 221 | NCNTY29221N29221 | Washington County, MO | Washington County | 44600 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Washington County | Missouri | 0 |
| MO | 2922399999 | 29 | 223 | NCNTY29223N29223 | Wayne County, MO | Wayne County | 43900 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Wayne County | Missouri | 0 |
| MO | 2922599999 | 29 | 225 | METRO44180M44180 | Springfield, MO HUD Metro FMR Area | Webster County | 65300 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 7920 | Webster County | Missouri | 1 |
| MO | 2922799999 | 29 | 227 | NCNTY29227N29227 | Worth County, MO | Worth County | 58000 | 12200 | 13950 | 15700 | 17400 | 18800 | 20200 | 21600 | 23000 | 9999 | Worth County | Missouri | 0 |
| MO | 2922999999 | 29 | 229 | NCNTY29229N29229 | Wright County, MO | Wright County | 42600 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Wright County | Missouri | 0 |
| MO | 2951099999 | 29 | 510 | METRO41180M41180 | St. Louis, MO-IL HUD Metro FMR Area | St. Louis city | 82900 | 17400 | 19900 | 22400 | 24850 | 26850 | 28850 | 30850 | 32850 | 7040 | St. Louis city | Missouri | 1 |
| MT | 3000199999 | 30 | 1 | NCNTY30001N30001 | Beaverhead County, MT | Beaverhead County | 69300 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Beaverhead County | Montana | 0 |
| MT | 3000399999 | 30 | 3 | NCNTY30003N30003 | Big Horn County, MT | Big Horn County | 55300 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Big Horn County | Montana | 0 |
| MT | 3000599999 | 30 | 5 | NCNTY30005N30005 | Blaine County, MT | Blaine County | 46200 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Blaine County | Montana | 0 |
| MT | 3000799999 | 30 | 7 | NCNTY30007N30007 | Broadwater County, MT | Broadwater County | 70800 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Broadwater County | Montana | 0 |
| MT | 3000999999 | 30 | 9 | METRO13740M13740 | Billings, MT HUD Metro FMR Area | Carbon County | 76600 | 16100 | 18400 | 20700 | 23000 | 24850 | 26700 | 28550 | 30400 | 9999 | Carbon County | Montana | 1 |
| MT | 3001199999 | 30 | 11 | NCNTY30011N30011 | Carter County, MT | Carter County | 65400 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Carter County | Montana | 0 |
| MT | 3001399999 | 30 | 13 | METRO24500M24500 | Great Falls, MT MSA | Cascade County | 67400 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 3040 | Cascade County | Montana | 1 |
| MT | 3001599999 | 30 | 15 | NCNTY30015N30015 | Chouteau County, MT | Chouteau County | 53400 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Chouteau County | Montana | 0 |
| MT | 3001799999 | 30 | 17 | NCNTY30017N30017 | Custer County, MT | Custer County | 76500 | 16100 | 18400 | 20700 | 22950 | 24800 | 26650 | 28500 | 30300 | 9999 | Custer County | Montana | 0 |
| MT | 3001999999 | 30 | 19 | NCNTY30019N30019 | Daniels County, MT | Daniels County | 75800 | 15950 | 18200 | 20500 | 22750 | 24600 | 26400 | 28250 | 30050 | 9999 | Daniels County | Montana | 0 |
| MT | 3002199999 | 30 | 21 | NCNTY30021N30021 | Dawson County, MT | Dawson County | 72600 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Dawson County | Montana | 0 |
| MT | 3002399999 | 30 | 23 | NCNTY30023N30023 | Deer Lodge County, MT | Deer Lodge County | 60100 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Deer Lodge County | Montana | 0 |
| MT | 3002599999 | 30 | 25 | NCNTY30025N30025 | Fallon County, MT | Fallon County | 77100 | 16250 | 18550 | 20850 | 23150 | 25050 | 26900 | 28750 | 30600 | 9999 | Fallon County | Montana | 0 |
| MT | 3002799999 | 30 | 27 | NCNTY30027N30027 | Fergus County, MT | Fergus County | 57800 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Fergus County | Montana | 0 |
| MT | 3002999999 | 30 | 29 | NCNTY30029N30029 | Flathead County, MT | Flathead County | 73800 | 15550 | 17750 | 19950 | 22150 | 23950 | 25700 | 27500 | 29250 | 9999 | Flathead County | Montana | 0 |
| MT | 3003199999 | 30 | 31 | NCNTY30031N30031 | Gallatin County, MT | Gallatin County | 90400 | 19000 | 21700 | 24400 | 27100 | 29300 | 31450 | 33650 | 35800 | 9999 | Gallatin County | Montana | 0 |
| MT | 3003399999 | 30 | 33 | NCNTY30033N30033 | Garfield County, MT | Garfield County | 68400 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Garfield County | Montana | 0 |
| MT | 3003599999 | 30 | 35 | NCNTY30035N30035 | Glacier County, MT | Glacier County | 46300 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Glacier County | Montana | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MT | 3003799999 | 30 | 37 | METRO13740N30037 | Golden Valley County, MT HUD Metro FMR Area | Golden Valley County | 76500 | 16100 | 18400 | 20700 | 22950 | 24800 | 26650 | 28500 | 30300 | 9999 | Golden Valley County | Montana | 1 |
| MT | 3003999999 | 30 | 39 | NCNTY30039N30039 | Granite County, MT | Granite County | 59400 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Granite County | Montana | 0 |
| MT | 3004199999 | 30 | 41 | NCNTY30041N30041 | Hill County, MT | Hill County | 57300 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Hill County | Montana | 0 |
| MT | 3004399999 | 30 | 43 | NCNTY30043N30043 | Jefferson County, MT | Jefferson County | 82800 | 17400 | 19900 | 22400 | 24850 | 26850 | 28850 | 30850 | 32850 | 9999 | Jefferson County | Montana | 0 |
| MT | 3004599999 | 30 | 45 | NCNTY30045N30045 | Judith Basin County, MT | Judith Basin County | 62200 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Judith Basin County | Montana | 0 |
| MT | 3004799999 | 30 | 47 | NCNTY30047N30047 | Lake County, MT | Lake County | 58300 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Lake County | Montana | 0 |
| MT | 3004999999 | 30 | 49 | NCNTY30049N30049 | Lewis and Clark County, MT | Lewis and Clark County | 83800 | 17650 | 20150 | 22650 | 25150 | 27200 | 29200 | 31200 | 33200 | 9999 | Lewis and Clark County | Montana | 0 |
| MT | 3005199999 | 30 | 51 | NCNTY30051N30051 | Liberty County, MT | Liberty County | 67700 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Liberty County | Montana | 0 |
| MT | 3005399999 | 30 | 53 | NCNTY30053N30053 | Lincoln County, MT | Lincoln County | 49900 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Lincoln County | Montana | 0 |
| MT | 3005599999 | 30 | 55 | NCNTY30055N30055 | McCone County, MT | McCone County | 69700 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | McCone County | Montana | 0 |
| MT | 3005799999 | 30 | 57 | NCNTY30057N30057 | Madison County, MT | Madison County | 65000 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Madison County | Montana | 0 |
| MT | 3005999999 | 30 | 59 | NCNTY30059N30059 | Meagher County, MT | Meagher County | 49300 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Meagher County | Montana | 0 |
| MT | 3006199999 | 30 | 61 | NCNTY30061N30061 | Mineral County, MT | Mineral County | 58400 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Mineral County | Montana | 0 |
| MT | 3006399999 | 30 | 63 | METRO33540M33540 | Missoula, MT MSA | Missoula County | 84300 | 16650 | 19000 | 21400 | 23750 | 25650 | 27550 | 29450 | 31350 | 5140 | Missoula County | Montana | 1 |
| MT | 3006599999 | 30 | 65 | NCNTY30065N30065 | Musselshell County, MT | Musselshell County | 56100 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Musselshell County | Montana | 0 |
| MT | 3006799999 | 30 | 67 | NCNTY30067N30067 | Park County, MT | Park County | 71000 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Park County | Montana | 0 |
| MT | 3006999999 | 30 | 69 | NCNTY30069N30069 | Petroleum County, MT | Petroleum County | 62500 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Petroleum County | Montana | 0 |
| MT | 3007199999 | 30 | 71 | NCNTY30071N30071 | Phillips County, MT | Phillips County | 58900 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Phillips County | Montana | 0 |
| MT | 3007399999 | 30 | 73 | NCNTY30073N30073 | Pondera County, MT | Pondera County | 58400 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Pondera County | Montana | 0 |
| MT | 3007599999 | 30 | 75 | NCNTY30075N30075 | Powder River County, MT | Powder River County | 64000 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Powder River County | Montana | 0 |
| MT | 3007799999 | 30 | 77 | NCNTY30077N30077 | Powell County, MT | Powell County | 59000 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Powell County | Montana | 0 |
| MT | 3007999999 | 30 | 79 | NCNTY30079N30079 | Prairie County, MT | Prairie County | 59000 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Prairie County | Montana | 0 |
| MT | 3008199999 | 30 | 81 | NCNTY30081N30081 | Ravalli County, MT | Ravalli County | 62300 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Ravalli County | Montana | 0 |
| MT | 3008399999 | 30 | 83 | NCNTY30083N30083 | Richland County, MT | Richland County | 83000 | 17450 | 19950 | 22450 | 24900 | 26900 | 28900 | 30900 | 32900 | 9999 | Richland County | Montana | 0 |
| MT | 3008599999 | 30 | 85 | NCNTY30085N30085 | Roosevelt County, MT | Roosevelt County | 55600 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Roosevelt County | Montana | 0 |
| MT | 3008799999 | 30 | 87 | NCNTY30087N30087 | Rosebud County, MT | Rosebud County | 75000 | 15750 | 18000 | 20250 | 22500 | 24300 | 26100 | 27900 | 29700 | 9999 | Rosebud County | Montana | 0 |
| MT | 3008999999 | 30 | 89 | NCNTY30089N30089 | Sanders County, MT | Sanders County | 48000 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Sanders County | Montana | 0 |
| MT | 3009199999 | 30 | 91 | NCNTY30091N30091 | Sheridan County, MT | Sheridan County | 77500 | 16300 | 18600 | 20950 | 23250 | 25150 | 27000 | 28850 | 30700 | 9999 | Sheridan County | Montana | 0 |
| MT | 3009399999 | 30 | 93 | NCNTY30093N30093 | Silver Bow County, MT | Silver Bow County | 61700 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Silver Bow County | Montana | 0 |
| MT | 3009599999 | 30 | 95 | NCNTY30095N30095 | Stillwater County, MT | Stillwater County | 82500 | 17350 | 19800 | 22300 | 24750 | 26750 | 28750 | 30700 | 32700 | 9999 | Stillwater County | Montana | 0 |
| MT | 3009799999 | 30 | 97 | NCNTY30097N30097 | Sweet Grass County, MT | Sweet Grass County | 68600 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Sweet Grass County | Montana | 0 |
| MT | 3009999999 | 30 | 99 | NCNTY30099N30099 | Teton County, MT | Teton County | 66200 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Teton County | Montana | 0 |
| MT | 3010199999 | 30 | 101 | NCNTY30101N30101 | Toole County, MT | Toole County | 61500 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Toole County | Montana | 0 |
| MT | 3010399999 | 30 | 103 | NCNTY30103N30103 | Treasure County, MT | Treasure County | 52200 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Treasure County | Montana | 0 |
| MT | 3010599999 | 30 | 105 | NCNTY30105N30105 | Valley County, MT | Valley County | 69400 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Valley County | Montana | 0 |
| MT | 3010799999 | 30 | 107 | NCNTY30107N30107 | Wheatland County, MT | Wheatland County | 45500 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Wheatland County | Montana | 0 |
| MT | 3010999999 | 30 | 109 | NCNTY30109N30109 | Wibaux County, MT | Wibaux County | 63000 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Wibaux County | Montana | 0 |
| MT | 3011199999 | 30 | 111 | METRO13740M13740 | Billings, MT HUD Metro FMR Area | Yellowstone County | 76600 | 16100 | 18400 | 20700 | 23000 | 24850 | 26700 | 28550 | 30400 | 880 | Yellowstone County | Montana | 1 |
| NE | 3100199999 | 31 | 1 | NCNTY31001N31001 | Adams County, NE | Adams County | 72900 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 9999 | Adams County | Nebraska | 0 |
| NE | 3100399999 | 31 | 3 | NCNTY31003N31003 | Antelope County, NE | Antelope County | 62700 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Antelope County | Nebraska | 0 |
| NE | 3100599999 | 31 | 5 | NCNTY31005N31005 | Arthur County, NE | Arthur County | 65100 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Arthur County | Nebraska | 0 |
| NE | 3100799999 | 31 | 7 | NCNTY31007N31007 | Banner County, NE | Banner County | 69900 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Banner County | Nebraska | 0 |
| NE | 3100999999 | 31 | 9 | NCNTY31009N31009 | Blaine County, NE | Blaine County | 61700 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Blaine County | Nebraska | 0 |
| NE | 3101199999 | 31 | 11 | NCNTY31011N31011 | Boone County, NE | Boone County | 73200 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Boone County | Nebraska | 0 |
| NE | 3101399999 | 31 | 13 | NCNTY31013N31013 | Box Butte County, NE | Box Butte County | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 9999 | Box Butte County | Nebraska | 0 |
| NE | 3101599999 | 31 | 15 | NCNTY31015N31015 | Boyd County, NE | Boyd County | 67700 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Boyd County | Nebraska | 0 |
| NE | 3101799999 | 31 | 17 | NCNTY31017N31017 | Brown County, NE | Brown County | 55900 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Brown County | Nebraska | 0 |
| NE | 3101999999 | 31 | 19 | NCNTY31019N31019 | Buffalo County, NE | Buffalo County | 77800 | 16350 | 18700 | 21050 | 23350 | 25250 | 27100 | 29000 | 30850 | 9999 | Buffalo County | Nebraska | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NE | 3102199999 | 31 | 21 | NCNTY31021N31021 | Burt County, NE | Burt County | 67000 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Burt County | Nebraska | 0 |
| NE | 3102399999 | 31 | 23 | NCNTY31023N31023 | Butler County, NE | Butler County | 69800 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Butler County | Nebraska | 0 |
| NE | 3102599999 | 31 | 25 | METRO36540M36540 | Omaha-Council Bluffs, NE-IA HUD Metro FMR Area | Cass County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 5920 | Cass County | Nebraska | 1 |
| NE | 3102799999 | 31 | 27 | NCNTY31027N31027 | Cedar County, NE | Cedar County | 75600 | 15900 | 18200 | 20450 | 22700 | 24550 | 26350 | 28150 | 30000 | 9999 | Cedar County | Nebraska | 0 |
| NE | 3102999999 | 31 | 29 | NCNTY31029N31029 | Chase County, NE | Chase County | 66000 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Chase County | Nebraska | 0 |
| NE | 3103199999 | 31 | 31 | NCNTY31031N31031 | Cherry County, NE | Cherry County | 65500 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Cherry County | Nebraska | 0 |
| NE | 3103399999 | 31 | 33 | NCNTY31033N31033 | Cheyenne County, NE | Cheyenne County | 82200 | 17300 | 19750 | 22200 | 24650 | 26650 | 28600 | 30600 | 32550 | 9999 | Cheyenne County | Nebraska | 0 |
| NE | 3103599999 | 31 | 35 | NCNTY31035N31035 | Clay County, NE | Clay County | 68400 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Clay County | Nebraska | 0 |
| NE | 3103799999 | 31 | 37 | NCNTY31037N31037 | Colfax County, NE | Colfax County | 66800 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Colfax County | Nebraska | 0 |
| NE | 3103999999 | 31 | 39 | NCNTY31039N31039 | Cuming County, NE | Cuming County | 68400 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Cuming County | Nebraska | 0 |
| NE | 3104199999 | 31 | 41 | NCNTY31041N31041 | Custer County, NE | Custer County | 64000 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Custer County | Nebraska | 0 |
| NE | 3104399999 | 31 | 43 | METRO43580M43580 | Sioux City, IA-NE-SD HUD Metro FMR Area | Dakota County | 75200 | 15750 | 18000 | 20250 | 22500 | 24300 | 26100 | 27900 | 29700 | 7720 | Dakota County | Nebraska | 1 |
| NE | 3104599999 | 31 | 45 | NCNTY31045N31045 | Dawes County, NE | Dawes County | 67200 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Dawes County | Nebraska | 0 |
| NE | 3104799999 | 31 | 47 | NCNTY31047N31047 | Dawson County, NE | Dawson County | 63100 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Dawson County | Nebraska | 0 |
| NE | 3104999999 | 31 | 49 | NCNTY31049N31049 | Deuel County, NE | Deuel County | 63300 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Deuel County | Nebraska | 0 |
| NE | 3105199999 | 31 | 51 | METRO43580M43580 | Sioux City, IA-NE-SD HUD Metro FMR Area | Dixon County | 75200 | 15750 | 18000 | 20250 | 22500 | 24300 | 26100 | 27900 | 29700 | 9999 | Dixon County | Nebraska | 1 |
| NE | 3105399999 | 31 | 53 | NCNTY31053N31053 | Dodge County, NE | Dodge County | 64700 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Dodge County | Nebraska | 0 |
| NE | 3105599999 | 31 | 55 | METRO36540M36540 | Omaha-Council Bluffs, NE-IA HUD Metro FMR Area | Douglas County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 5920 | Douglas County | Nebraska | 1 |
| NE | 3105799999 | 31 | 57 | NCNTY31057N31057 | Dundy County, NE | Dundy County | 60200 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Dundy County | Nebraska | 0 |
| NE | 3105999999 | 31 | 59 | NCNTY31059N31059 | Fillmore County, NE | Fillmore County | 72600 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Fillmore County | Nebraska | 0 |
| NE | 3106199999 | 31 | 61 | NCNTY31061N31061 | Franklin County, NE | Franklin County | 64800 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Franklin County | Nebraska | 0 |
| NE | 3106399999 | 31 | 63 | NCNTY31063N31063 | Frontier County, NE | Frontier County | 65500 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Frontier County | Nebraska | 0 |
| NE | 3106599999 | 31 | 65 | NCNTY31065N31065 | Furnas County, NE | Furnas County | 64900 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Furnas County | Nebraska | 0 |
| NE | 3106799999 | 31 | 67 | NCNTY31067N31067 | Gage County, NE | Gage County | 71200 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Gage County | Nebraska | 0 |
| NE | 3106999999 | 31 | 69 | NCNTY31069N31069 | Garden County, NE | Garden County | 72200 | 15200 | 17350 | 19500 | 21650 | 23400 | 25150 | 26850 | 28600 | 9999 | Garden County | Nebraska | 0 |
| NE | 3107199999 | 31 | 71 | NCNTY31071N31071 | Garfield County, NE | Garfield County | 58800 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Garfield County | Nebraska | 0 |
| NE | 3107399999 | 31 | 73 | NCNTY31073N31073 | Gosper County, NE | Gosper County | 84800 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Gosper County | Nebraska | 0 |
| NE | 3107599999 | 31 | 75 | NCNTY31075N31075 | Grant County, NE | Grant County | 57900 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Grant County | Nebraska | 0 |
| NE | 3107799999 | 31 | 77 | NCNTY31077N31077 | Greeley County, NE | Greeley County | 63600 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Greeley County | Nebraska | 0 |
| NE | 3107999999 | 31 | 79 | METRO24260N31079 | Hall County, NE HUD Metro FMR Area | Hall County | 66300 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Hall County | Nebraska | 1 |
| NE | 3108199999 | 31 | 81 | METRO24260N31081 | Hamilton County, NE HUD Metro FMR Area | Hamilton County | 80200 | 16850 | 19250 | 21650 | 24050 | 26000 | 27900 | 29850 | 31750 | 9999 | Hamilton County | Nebraska | 1 |
| NE | 3108399999 | 31 | 83 | NCNTY31083N31083 | Harlan County, NE | Harlan County | 66900 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Harlan County | Nebraska | 0 |
| NE | 3108599999 | 31 | 85 | NCNTY31085N31085 | Hayes County, NE | Hayes County | 67100 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Hayes County | Nebraska | 0 |
| NE | 3108799999 | 31 | 87 | NCNTY31087N31087 | Hitchcock County, NE | Hitchcock County | 58200 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Hitchcock County | Nebraska | 0 |
| NE | 3108999999 | 31 | 89 | NCNTY31089N31089 | Holt County, NE | Holt County | 67900 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Holt County | Nebraska | 0 |
| NE | 3109199999 | 31 | 91 | NCNTY31091N31091 | Hooker County, NE | Hooker County | 56500 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Hooker County | Nebraska | 0 |
| NE | 3109399999 | 31 | 93 | METRO24260N31093 | Howard County, NE HUD Metro FMR Area | Howard County | 72700 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Howard County | Nebraska | 1 |
| NE | 3109599999 | 31 | 95 | NCNTY31095N31095 | Jefferson County, NE | Jefferson County | 58300 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Jefferson County | Nebraska | 0 |
| NE | 3109799999 | 31 | 97 | NCNTY31097N31097 | Johnson County, NE | Johnson County | 64100 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Johnson County | Nebraska | 0 |
| NE | 3109999999 | 31 | 99 | NCNTY31099N31099 | Kearney County, NE | Kearney County | 75900 | 15950 | 18200 | 20500 | 22750 | 24600 | 26400 | 28250 | 30050 | 9999 | Kearney County | Nebraska | 0 |
| NE | 3110199999 | 31 | 101 | NCNTY31101N31101 | Keith County, NE | Keith County | 61500 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Keith County | Nebraska | 0 |
| NE | 3110399999 | 31 | 103 | NCNTY31103N31103 | Keya Paha County, NE | Keya Paha County | 56300 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Keya Paha County | Nebraska | 0 |
| NE | 3110599999 | 31 | 105 | NCNTY31105N31105 | Kimball County, NE | Kimball County | 56600 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Kimball County | Nebraska | 0 |
| NE | 3110799999 | 31 | 107 | NCNTY31107N31107 | Knox County, NE | Knox County | 65100 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Knox County | Nebraska | 0 |
| NE | 3110999999 | 31 | 109 | METRO30700M30700 | Lincoln, NE HUD Metro FMR Area | Lancaster County | 82100 | 17300 | 19750 | 22200 | 24650 | 26650 | 28600 | 30600 | 32550 | 4360 | Lancaster County | Nebraska | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NE | 3111199999 | 31 | 111 | NCNTY31111N31111 | Lincoln County, NE | Lincoln County | 73500 | 15450 | 17650 | 19850 | 22050 | 23850 | 25600 | 27350 | 29150 | 9999 | Lincoln County | Nebraska | 0 |
| NE | 3111399999 | 31 | 113 | NCNTY31113N31113 | Logan County, NE | Logan County | 69100 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Logan County | Nebraska | 0 |
| NE | 3111599999 | 31 | 115 | NCNTY31115N31115 | Loup County, NE | Loup County | 68400 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Loup County | Nebraska | 0 |
| NE | 3111799999 | 31 | 117 | NCNTY31117N31117 | McPherson County, NE | McPherson County | 74300 | 15650 | 17850 | 20100 | 22300 | 24100 | 25900 | 27700 | 29450 | 9999 | McPherson County | Nebraska | 0 |
| NE | 3111999999 | 31 | 119 | NCNTY31119N31119 | Madison County, NE | Madison County | 67600 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Madison County | Nebraska | 0 |
| NE | 3112199999 | 31 | 121 | METRO24260N31121 | Merrick County, NE HUD Metro FMR Area | Merrick County | 69700 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Merrick County | Nebraska | 1 |
| NE | 3112399999 | 31 | 123 | NCNTY31123N31123 | Morrill County, NE | Morrill County | 58800 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Morrill County | Nebraska | 0 |
| NE | 3112599999 | 31 | 125 | NCNTY31125N31125 | Nance County, NE | Nance County | 65300 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Nance County | Nebraska | 0 |
| NE | 3112799999 | 31 | 127 | NCNTY31127N31127 | Nemaha County, NE | Nemaha County | 73700 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Nemaha County | Nebraska | 0 |
| NE | 3112999999 | 31 | 129 | NCNTY31129N31129 | Nuckolls County, NE | Nuckolls County | 58200 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Nuckolls County | Nebraska | 0 |
| NE | 3113199999 | 31 | 131 | NCNTY31131N31131 | Otoe County, NE | Otoe County | 73300 | 15400 | 17600 | 19800 | 22000 | 23800 | 25550 | 27300 | 29050 | 9999 | Otoe County | Nebraska | 0 |
| NE | 3113399999 | 31 | 133 | NCNTY31133N31133 | Pawnee County, NE | Pawnee County | 59900 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Pawnee County | Nebraska | 0 |
| NE | 3113599999 | 31 | 135 | NCNTY31135N31135 | Perkins County, NE | Perkins County | 73900 | 15550 | 17750 | 19950 | 22150 | 23950 | 25700 | 27500 | 29250 | 9999 | Perkins County | Nebraska | 0 |
| NE | 3113799999 | 31 | 137 | NCNTY31137N31137 | Phelps County, NE | Phelps County | 76800 | 16150 | 18450 | 20750 | 23050 | 24900 | 26750 | 28600 | 30450 | 9999 | Phelps County | Nebraska | 0 |
| NE | 3113999999 | 31 | 139 | NCNTY31139N31139 | Pierce County, NE | Pierce County | 74200 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Pierce County | Nebraska | 0 |
| NE | 3114199999 | 31 | 141 | NCNTY31141N31141 | Platte County, NE | Platte County | 78000 | 16400 | 18750 | 21100 | 23400 | 25300 | 27150 | 29050 | 30900 | 9999 | Platte County | Nebraska | 0 |
| NE | 3114399999 | 31 | 143 | NCNTY31143N31143 | Polk County, NE | Polk County | 81600 | 17150 | 19600 | 22050 | 24500 | 26500 | 28450 | 30400 | 32350 | 9999 | Polk County | Nebraska | 0 |
| NE | 3114599999 | 31 | 145 | NCNTY31145N31145 | Red Willow County, NE | Red Willow County | 64000 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Red Willow County | Nebraska | 0 |
| NE | 3114799999 | 31 | 147 | NCNTY31147N31147 | Richardson County, NE | Richardson County | 62500 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Richardson County | Nebraska | 0 |
| NE | 3114999999 | 31 | 149 | NCNTY31149N31149 | Rock County, NE | Rock County | 69300 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Rock County | Nebraska | 0 |
| NE | 3115199999 | 31 | 151 | NCNTY31151N31151 | Saline County, NE | Saline County | 66000 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Saline County | Nebraska | 0 |
| NE | 3115399999 | 31 | 153 | METRO36540M36540 | Omaha-Council Bluffs, NE-IA HUD Metro FMR Area | Sarpy County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 5920 | Sarpy County | Nebraska | 1 |
| NE | 3115599999 | 31 | 155 | METRO36540N31155 | Saunders County, NE HUD Metro FMR Area | Saunders County | 82800 | 17400 | 19900 | 22400 | 24850 | 26850 | 28850 | 30850 | 32850 | 9999 | Saunders County | Nebraska | 1 |
| NE | 3115799999 | 31 | 157 | NCNTY31157N31157 | Scotts Bluff County, NE | Scotts Bluff County | 62400 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Scotts Bluff County | Nebraska | 0 |
| NE | 3115999999 | 31 | 159 | METRO30700N31159 | Seward County, NE HUD Metro FMR Area | Seward County | 84600 | 17800 | 20350 | 22900 | 25400 | 27450 | 29500 | 31500 | 33550 | 9999 | Seward County | Nebraska | 1 |
| NE | 3116199999 | 31 | 161 | NCNTY31161N31161 | Sheridan County, NE | Sheridan County | 58300 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Sheridan County | Nebraska | 0 |
| NE | 3116399999 | 31 | 163 | NCNTY31163N31163 | Sherman County, NE | Sherman County | 69100 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Sherman County | Nebraska | 0 |
| NE | 3116599999 | 31 | 165 | NCNTY31165N31165 | Sioux County, NE | Sioux County | 62700 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Sioux County | Nebraska | 0 |
| NE | 3116799999 | 31 | 167 | NCNTY31167N31167 | Stanton County, NE | Stanton County | 73500 | 15450 | 17650 | 19850 | 22050 | 23850 | 25600 | 27350 | 29150 | 9999 | Stanton County | Nebraska | 0 |
| NE | 3116999999 | 31 | 169 | NCNTY31169N31169 | Thayer County, NE | Thayer County | 69500 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Thayer County | Nebraska | 0 |
| NE | 3117199999 | 31 | 171 | NCNTY31171N31171 | Thomas County, NE | Thomas County | 75700 | 15900 | 18200 | 20450 | 22700 | 24550 | 26350 | 28150 | 30000 | 9999 | Thomas County | Nebraska | 0 |
| NE | 3117399999 | 31 | 173 | NCNTY31173N31173 | Thurston County, NE | Thurston County | 53000 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Thurston County | Nebraska | 0 |
| NE | 3117599999 | 31 | 175 | NCNTY31175N31175 | Valley County, NE | Valley County | 69000 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Valley County | Nebraska | 0 |
| NE | 3117799999 | 31 | 177 | METRO36540M36540 | Omaha-Council Bluffs, NE-IA HUD Metro FMR Area | Washington County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 5920 | Washington County | Nebraska | 1 |
| NE | 3117999999 | 31 | 179 | NCNTY31179N31179 | Wayne County, NE | Wayne County | 75800 | 15950 | 18200 | 20500 | 22750 | 24600 | 26400 | 28250 | 30050 | 9999 | Wayne County | Nebraska | 0 |
| NE | 3118199999 | 31 | 181 | NCNTY31181N31181 | Webster County, NE | Webster County | 63200 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Webster County | Nebraska | 0 |
| NE | 3118399999 | 31 | 183 | NCNTY31183N31183 | Wheeler County, NE | Wheeler County | 64400 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Wheeler County | Nebraska | 0 |
| NE | 3118599999 | 31 | 185 | NCNTY31185N31185 | York County, NE | York County | 75200 | 15800 | 18050 | 20300 | 22550 | 24400 | 26200 | 28000 | 29800 | 9999 | York County | Nebraska | 0 |
| NV | 3200199999 | 32 | 1 | NCNTY32001N32001 | Churchill County, NV | Churchill County | 63300 | 15750 | 18000 | 20250 | 22500 | 24300 | 26100 | 27900 | 29700 | 9999 | Churchill County | Nevada | 0 |
| NV | 3200399999 | 32 | 3 | METRO29820M29820 | Las Vegas-Henderson-Paradise, NV MSA | Clark County | 70800 | 15750 | 18000 | 20250 | 22500 | 24300 | 26100 | 27900 | 29700 | 4120 | Clark County | Nevada | 1 |
| NV | 3200599999 | 32 | 5 | NCNTY32005N32005 | Douglas County, NV | Douglas County | 75400 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Douglas County | Nevada | 0 |
| NV | 3200799999 | 32 | 7 | NCNTY32007N32007 | Elko County, NV | Elko County | 91800 | 19300 | 22050 | 24800 | 27550 | 29800 | 32000 | 34200 | 36400 | 9999 | Elko County | Nevada | 0 |
| NV | 3200999999 | 32 | 9 | NCNTY32009N32009 | Esmeralda County, NV | Esmeralda County | 52500 | 15750 | 18000 | 20250 | 22500 | 24300 | 26100 | 27900 | 29700 | 9999 | Esmeralda County | Nevada | 0 |
| NV | 3201199999 | 32 | 11 | NCNTY32011N32011 | Eureka County, NV | Eureka County | 118600 | 21850 | 25000 | 28100 | 31200 | 33700 | 36200 | 38700 | 41200 | 9999 | Eureka County | Nevada | 0 |
| NV | 3201399999 | 32 | 13 | NCNTY32013N32013 | Humboldt County, NV | Humboldt County | 85900 | 17900 | 20450 | 23000 | 25550 | 27600 | 29650 | 31700 | 33750 | 9999 | Humboldt County | Nevada | 0 |
| NV | 3201599999 | 32 | 15 | NCNTY32015N32015 | Lander County, NV | Lander County | 97000 | 20400 | 23300 | 26200 | 29100 | 31450 | 33800 | 36100 | 38450 | 9999 | Lander County | Nevada | 0 |
| NV | 3201799999 | 32 | 17 | NCNTY32017N32017 | Lincoln County, NV | Lincoln County | 63300 | 15750 | 18000 | 20250 | 22500 | 24300 | 26100 | 27900 | 29700 | 9999 | Lincoln County | Nevada | 0 |
| NV | 3201999999 | 32 | 19 | NCNTY32019N32019 | Lyon County, NV | Lyon County | 64100 | 15750 | 18000 | 20250 | 22500 | 24300 | 26100 | 27900 | 29700 | 9999 | Lyon County | Nevada | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | 3202199999 | 32 | 21 | NCNTY32021N32021 | Mineral County, NV | Mineral County | 61900 | 15750 | 18000 | 20250 | 22500 | 24300 | 26100 | 27900 | 29700 | 9999 | Mineral County | Nevada | 0 |
| NV | 3202399999 | 32 | 23 | NCNTY32023N32023 | Nye County, NV | Nye County | 57300 | 15750 | 18000 | 20250 | 22500 | 24300 | 26100 | 27900 | 29700 | 4120 | Nye County | Nevada | 0 |
| NV | 3202799999 | 32 | 27 | NCNTY32027N32027 | Pershing County, NV | Pershing County | 64100 | 15750 | 18000 | 20250 | 22500 | 24300 | 26100 | 27900 | 29700 | 9999 | Pershing County | Nevada | 0 |
| NV | 3202999999 | 32 | 29 | METRO39900M39900 | Reno, NV MSA | Storey County | 79600 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 9999 | Storey County | Nevada | 1 |
| NV | 3203199999 | 32 | 31 | METRO39900M39900 | Reno, NV MSA | Washoe County | 79600 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 6720 | Washoe County | Nevada | 1 |
| NV | 3203399999 | 32 | 33 | NCNTY32033N32033 | White Pine County, NV | White Pine County | 73800 | 15750 | 18000 | 20250 | 22500 | 24300 | 26100 | 27900 | 29700 | 9999 | White Pine County | Nevada | 0 |
| NV | 3251099999 | 32 | 510 | METRO16180M16180 | Carson City, NV MSA | Carson City | 75400 | 15800 | 18050 | 20300 | 22550 | 24400 | 26200 | 28000 | 29800 | 9999 | Carson City | Nevada | 1 |
| NH | 3300101060 | 33 | 1 | NCNTY33001N33001 | Belknap County, NH | Belknap County | 82400 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Alton town | New Hampshire | 0 |
| NH | 3300103220 | 33 | 1 | NCNTY33001N33001 | Belknap County, NH | Belknap County | 82400 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Barnstead town | New Hampshire | 0 |
| NH | 3300104740 | 33 | 1 | NCNTY33001N33001 | Belknap County, NH | Belknap County | 82400 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Belmont town | New Hampshire | 0 |
| NH | 3300110660 | 33 | 1 | NCNTY33001N33001 | Belknap County, NH | Belknap County | 82400 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Center Harbor town | New Hampshire | 0 |
| NH | 3300128740 | 33 | 1 | NCNTY33001N33001 | Belknap County, NH | Belknap County | 82400 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Gilford town | New Hampshire | 0 |
| NH | 3300128980 | 33 | 1 | NCNTY33001N33001 | Belknap County, NH | Belknap County | 82400 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Gilmanton town | New Hampshire | 0 |
| NH | 3300140180 | 33 | 1 | NCNTY33001N33001 | Belknap County, NH | Belknap County | 82400 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Laconia city | New Hampshire | 0 |
| NH | 3300147140 | 33 | 1 | NCNTY33001N33001 | Belknap County, NH | Belknap County | 82400 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Meredith town | New Hampshire | 0 |
| NH | 3300151540 | 33 | 1 | NCNTY33001N33001 | Belknap County, NH | Belknap County | 82400 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | New Hampton town | New Hampshire | 0 |
| NH | 3300167300 | 33 | 1 | NCNTY33001N33001 | Belknap County, NH | Belknap County | 82400 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Sanbornton town | New Hampshire | 0 |
| NH | 3300177060 | 33 | 1 | NCNTY33001N33001 | Belknap County, NH | Belknap County | 82400 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Tilton town | New Hampshire | 0 |
| NH | 3300300420 | 33 | 3 | NCNTY33003N33003 | Carroll County, NH | Carroll County | 71900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Albany town | New Hampshire | 0 |
| NH | 3300303700 | 33 | 3 | NCNTY33003N33003 | Carroll County, NH | Carroll County | 71900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Bartlett town | New Hampshire | 0 |
| NH | 3300307940 | 33 | 3 | NCNTY33003N33003 | Carroll County, NH | Carroll County | 71900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Brookfield town | New Hampshire | 0 |
| NH | 3300311780 | 33 | 3 | NCNTY33003N33003 | Carroll County, NH | Carroll County | 71900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Chatham town | New Hampshire | 0 |
| NH | 3300314660 | 33 | 3 | NCNTY33003N33003 | Carroll County, NH | Carroll County | 71900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Conway town | New Hampshire | 0 |
| NH | 3300323380 | 33 | 3 | NCNTY33003N33003 | Carroll County, NH | Carroll County | 71900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Eaton town | New Hampshire | 0 |
| NH | 3300323620 | 33 | 3 | NCNTY33003N33003 | Carroll County, NH | Carroll County | 71900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Effingham town | New Hampshire | 0 |
| NH | 3300327700 | 33 | 3 | NCNTY33003N33003 | Carroll County, NH | Carroll County | 71900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Freedom town | New Hampshire | 0 |
| NH | 3300332500 | 33 | 3 | NCNTY33003N33003 | Carroll County, NH | Carroll County | 71900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Hale's location | New Hampshire | 0 |
| NH | 3300334500 | 33 | 3 | NCNTY33003N33003 | Carroll County, NH | Carroll County | 71900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Hart's Location town | New Hampshire | 0 |
| NH | 3300338260 | 33 | 3 | NCNTY33003N33003 | Carroll County, NH | Carroll County | 71900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Jackson town | New Hampshire | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NH | 3300345060 | 33 | 3 | NCNTY33003N33003 | Carroll County, NH | Carroll County | 71900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Madison town | New Hampshire | 0 |
| NH | 3300349380 | 33 | 3 | NCNTY33003N33003 | Carroll County, NH | Carroll County | 71900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Moultonborough town | New Hampshire | 0 |
| NH | 3300358740 | 33 | 3 | NCNTY33003N33003 | Carroll County, NH | Carroll County | 71900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Ossipee town | New Hampshire | 0 |
| NH | 3300367780 | 33 | 3 | NCNTY33003N33003 | Carroll County, NH | Carroll County | 71900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Sandwich town | New Hampshire | 0 |
| NH | 3300376100 | 33 | 3 | NCNTY33003N33003 | Carroll County, NH | Carroll County | 71900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Tamworth town | New Hampshire | 0 |
| NH | 3300377620 | 33 | 3 | NCNTY33003N33003 | Carroll County, NH | Carroll County | 71900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Tuftonboro town | New Hampshire | 0 |
| NH | 3300378180 | 33 | 3 | NCNTY33003N33003 | Carroll County, NH | Carroll County | 71900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Wakefield town | New Hampshire | 0 |
| NH | 3300386420 | 33 | 3 | NCNTY33003N33003 | Carroll County, NH | Carroll County | 71900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Wolfeboro town | New Hampshire | 0 |
| NH | 3300500820 | 33 | 5 | NCNTY33005N33005 | Cheshire County, NH | Cheshire County | 86500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Alstead town | New Hampshire | 0 |
| NH | 3300512260 | 33 | 5 | NCNTY33005N33005 | Cheshire County, NH | Cheshire County | 86500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Chesterfield town | New Hampshire | 0 |
| NH | 3300519140 | 33 | 5 | NCNTY33005N33005 | Cheshire County, NH | Cheshire County | 86500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Dublin town | New Hampshire | 0 |
| NH | 3300526500 | 33 | 5 | NCNTY33005N33005 | Cheshire County, NH | Cheshire County | 86500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Fitzwilliam town | New Hampshire | 0 |
| NH | 3300529220 | 33 | 5 | NCNTY33005N33005 | Cheshire County, NH | Cheshire County | 86500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Gilsum town | New Hampshire | 0 |
| NH | 3300534420 | 33 | 5 | NCNTY33005N33005 | Cheshire County, NH | Cheshire County | 86500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Harrisville town | New Hampshire | 0 |
| NH | 3300536660 | 33 | 5 | NCNTY33005N33005 | Cheshire County, NH | Cheshire County | 86500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Hinsdale town | New Hampshire | 0 |
| NH | 3300538500 | 33 | 5 | NCNTY33005N33005 | Cheshire County, NH | Cheshire County | 86500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Jaffrey town | New Hampshire | 0 |
| NH | 3300539300 | 33 | 5 | NCNTY33005N33005 | Cheshire County, NH | Cheshire County | 86500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Keene city | New Hampshire | 0 |
| NH | 3300545460 | 33 | 5 | NCNTY33005N33005 | Cheshire County, NH | Cheshire County | 86500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Marlborough town | New Hampshire | 0 |
| NH | 3300545700 | 33 | 5 | NCNTY33005N33005 | Cheshire County, NH | Cheshire County | 86500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Marlow town | New Hampshire | 0 |
| NH | 3300550580 | 33 | 5 | NCNTY33005N33005 | Cheshire County, NH | Cheshire County | 86500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Nelson town | New Hampshire | 0 |
| NH | 3300564420 | 33 | 5 | NCNTY33005N33005 | Cheshire County, NH | Cheshire County | 86500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Richmond town | New Hampshire | 0 |
| NH | 3300564580 | 33 | 5 | NCNTY33005N33005 | Cheshire County, NH | Cheshire County | 86500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Rindge town | New Hampshire | 0 |
| NH | 3300565700 | 33 | 5 | NCNTY33005N33005 | Cheshire County, NH | Cheshire County | 86500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Roxbury town | New Hampshire | 0 |
| NH | 3300573700 | 33 | 5 | NCNTY33005N33005 | Cheshire County, NH | Cheshire County | 86500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Stoddard town | New Hampshire | 0 |
| NH | 3300574900 | 33 | 5 | NCNTY33005N33005 | Cheshire County, NH | Cheshire County | 86500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Sullivan town | New Hampshire | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NH | 3300575300 | 33 | 5 | NCNTY33005N33005 | Cheshire County, NH | Cheshire County | 86500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Surry town | New Hampshire | 0 |
| NH | 3300575700 | 33 | 5 | NCNTY33005N33005 | Cheshire County, NH | Cheshire County | 86500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Swanzey town | New Hampshire | 0 |
| NH | 3300577380 | 33 | 5 | NCNTY33005N33005 | Cheshire County, NH | Cheshire County | 86500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Troy town | New Hampshire | 0 |
| NH | 3300578420 | 33 | 5 | NCNTY33005N33005 | Cheshire County, NH | Cheshire County | 86500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Walpole town | New Hampshire | 0 |
| NH | 3300582660 | 33 | 5 | NCNTY33005N33005 | Cheshire County, NH | Cheshire County | 86500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Westmoreland town | New Hampshire | 0 |
| NH | 3300585540 | 33 | 5 | NCNTY33005N33005 | Cheshire County, NH | Cheshire County | 86500 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 9999 | Winchester town | New Hampshire | 0 |
| NH | 3300702420 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Atkinson and Gilmanton Academy grant | New Hampshire | 0 |
| NH | 3300704100 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Beans grant | New Hampshire | 0 |
| NH | 3300704260 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Beans purchase | New Hampshire | 0 |
| NH | 3300705140 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Berlin city | New Hampshire | 0 |
| NH | 3300708420 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Cambridge township | New Hampshire | 0 |
| NH | 3300710100 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Carroll town | New Hampshire | 0 |
| NH | 3300711220 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Chandlers purchase | New Hampshire | 0 |
| NH | 3300713220 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Clarksville town | New Hampshire | 0 |
| NH | 3300713780 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Colebrook town | New Hampshire | 0 |
| NH | 3300713940 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Columbia town | New Hampshire | 0 |
| NH | 3300716100 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Crawfords purchase | New Hampshire | 0 |
| NH | 3300716660 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Cutts grant | New Hampshire | 0 |
| NH | 3300716820 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Dalton town | New Hampshire | 0 |
| NH | 3300718340 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Dixs grant | New Hampshire | 0 |
| NH | 3300718420 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Dixville township | New Hampshire | 0 |
| NH | 3300719300 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Dummer town | New Hampshire | 0 |
| NH | 3300725140 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Errol town | New Hampshire | 0 |
| NH | 3300725180 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Ervings location | New Hampshire | 0 |
| NH | 3300730260 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Gorham town | New Hampshire | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NH | 3300731780 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Greens grant | New Hampshire | 0 |
| NH | 3300732420 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Hadleys purchase | New Hampshire | 0 |
| NH | 3300738820 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Jefferson town | New Hampshire | 0 |
| NH | 3300739940 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Kilkenny township | New Hampshire | 0 |
| NH | 3300740420 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Lancaster town | New Hampshire | 0 |
| NH | 3300743620 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Low and Burbanks grant | New Hampshire | 0 |
| NH | 3300746020 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Martins location | New Hampshire | 0 |
| NH | 3300747860 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Milan town | New Hampshire | 0 |
| NH | 3300748260 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Millsfield township | New Hampshire | 0 |
| NH | 3300756100 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Northumberland town | New Hampshire | 0 |
| NH | 3300757860 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Odell township | New Hampshire | 0 |
| NH | 3300761620 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Pinkhams grant | New Hampshire | 0 |
| NH | 3300761780 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Pittsburg town | New Hampshire | 0 |
| NH | 3300763860 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Randolph town | New Hampshire | 0 |
| NH | 3300767860 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Sargents purchase | New Hampshire | 0 |
| NH | 3300768500 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Second College grant | New Hampshire | 0 |
| NH | 3300768980 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Shelburne town | New Hampshire | 0 |
| NH | 3300773060 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Stark town | New Hampshire | 0 |
| NH | 3300773380 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Stewartstown town | New Hampshire | 0 |
| NH | 3300774180 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Stratford town | New Hampshire | 0 |
| NH | 3300774500 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Success township | New Hampshire | 0 |
| NH | 3300776580 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Thompson and Meserves purchase | New Hampshire | 0 |
| NH | 3300780740 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Wentworth location | New Hampshire | 0 |
| NH | 3300784420 | 33 | 7 | NCNTY33007N33007 | Coos County, NH | Coos County | 61900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Whitefield town | New Hampshire | 0 |
| NH | 3300900580 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Alexandria town | New Hampshire | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NH | 3300902020 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Ashland town | New Hampshire | 0 |
| NH | 3300903940 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Bath town | New Hampshire | 0 |
| NH | 3300905060 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Benton town | New Hampshire | 0 |
| NH | 3300905460 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Bethlehem town | New Hampshire | 0 |
| NH | 3300907540 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Bridgewater town | New Hampshire | 0 |
| NH | 3300907700 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Bristol town | New Hampshire | 0 |
| NH | 3300908660 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Campton town | New Hampshire | 0 |
| NH | 3300908980 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Canaan town | New Hampshire | 0 |
| NH | 3300918740 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Dorchester town | New Hampshire | 0 |
| NH | 3300922020 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Easton town | New Hampshire | 0 |
| NH | 3300923860 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Ellsworth town | New Hampshire | 0 |
| NH | 3300924340 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Enfield town | New Hampshire | 0 |
| NH | 3300927300 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Franconia town | New Hampshire | 0 |
| NH | 3300930820 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Grafton town | New Hampshire | 0 |
| NH | 3300932180 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Groton town | New Hampshire | 0 |
| NH | 3300933860 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Hanover town | New Hampshire | 0 |
| NH | 3300934820 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Haverhill town | New Hampshire | 0 |
| NH | 3300935220 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Hebron town | New Hampshire | 0 |
| NH | 3300936900 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Holderness town | New Hampshire | 0 |
| NH | 3300940660 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Landaff town | New Hampshire | 0 |
| NH | 3300941300 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Lebanon city | New Hampshire | 0 |
| NH | 3300941860 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Lincoln town | New Hampshire | 0 |
| NH | 3300942020 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Lisbon town | New Hampshire | 0 |
| NH | 3300942580 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Littleton town | New Hampshire | 0 |
| NH | 3300942820 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Livermore town | New Hampshire | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NH | 3300944100 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Lyman town | New Hampshire | 0 |
| NH | 3300944260 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Lyme town | New Hampshire | 0 |
| NH | 3300948980 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Monroe town | New Hampshire | 0 |
| NH | 3300958340 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Orange town | New Hampshire | 0 |
| NH | 3300958500 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Orford town | New Hampshire | 0 |
| NH | 3300961060 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Piermont town | New Hampshire | 0 |
| NH | 3300962660 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Plymouth town | New Hampshire | 0 |
| NH | 3300965940 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Rumney town | New Hampshire | 0 |
| NH | 3300974740 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Sugar Hill town | New Hampshire | 0 |
| NH | 3300976740 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Thornton town | New Hampshire | 0 |
| NH | 3300978740 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Warren town | New Hampshire | 0 |
| NH | 3300979380 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Waterville Valley town | New Hampshire | 0 |
| NH | 3300980500 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Wentworth town | New Hampshire | 0 |
| NH | 3300987060 | 33 | 9 | NCNTY33009N33009 | Grafton County, NH | Grafton County | 92600 | 19500 | 22250 | 25050 | 27800 | 30050 | 32250 | 34500 | 36700 | 9999 | Woodstock town | New Hampshire | 0 |
| NH | 3301101300 | 33 | 11 | METRO31700MM5350 | Nashua, NH HUD Metro FMR Area | Hillsborough County | 113600 | 23350 | 26650 | 30000 | 33300 | 36000 | 38650 | 41300 | 44000 | 5350 | Amherst town | New Hampshire | 1 |
| NH | 3301101700 | 33 | 11 | METRO31700N33011 | Hillsborough County, NH (part) HUD Metro FMR Area | Hillsborough County | 94100 | 19800 | 22600 | 25450 | 28250 | 30550 | 32800 | 35050 | 37300 | 9999 | Antrim town | New Hampshire | 1 |
| NH | 3301104500 | 33 | 11 | METRO31700MM4760 | Manchester, NH HUD Metro FMR Area | Hillsborough County | 83600 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 4760 | Bedford town | New Hampshire | 1 |
| NH | 3301104900 | 33 | 11 | METRO31700N33011 | Hillsborough County, NH (part) HUD Metro FMR Area | Hillsborough County | 94100 | 19800 | 22600 | 25450 | 28250 | 30550 | 32800 | 35050 | 37300 | 9999 | Bennington town | New Hampshire | 1 |
| NH | 3301108100 | 33 | 11 | METRO31700MM5350 | Nashua, NH HUD Metro FMR Area | Hillsborough County | 113600 | 23350 | 26650 | 30000 | 33300 | 36000 | 38650 | 41300 | 44000 | 5350 | Brookline town | New Hampshire | 1 |
| NH | 3301117780 | 33 | 11 | METRO31700N33011 | Hillsborough County, NH (part) HUD Metro FMR Area | Hillsborough County | 94100 | 19800 | 22600 | 25450 | 28250 | 30550 | 32800 | 35050 | 37300 | 9999 | Deering town | New Hampshire | 1 |
| NH | 3301127140 | 33 | 11 | METRO31700N33011 | Hillsborough County, NH (part) HUD Metro FMR Area | Hillsborough County | 94100 | 19800 | 22600 | 25450 | 28250 | 30550 | 32800 | 35050 | 37300 | 9999 | Francestown town | New Hampshire | 1 |
| NH | 3301129860 | 33 | 11 | METRO31700MM4760 | Manchester, NH HUD Metro FMR Area | Hillsborough County | 83600 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 4760 | Goffstown town | New Hampshire | 1 |
| NH | 3301131540 | 33 | 11 | METRO31700N33011 | Hillsborough County, NH (part) HUD Metro FMR Area | Hillsborough County | 94100 | 19800 | 22600 | 25450 | 28250 | 30550 | 32800 | 35050 | 37300 | 9999 | Greenfield town | New Hampshire | 1 |
| NH | 3301131940 | 33 | 11 | METRO31700MM5350 | Nashua, NH HUD Metro FMR Area | Hillsborough County | 113600 | 23350 | 26650 | 30000 | 33300 | 36000 | 38650 | 41300 | 44000 | 5350 | Greenville town | New Hampshire | 1 |
| NH | 3301133700 | 33 | 11 | METRO31700N33011 | Hillsborough County, NH (part) HUD Metro FMR Area | Hillsborough County | 94100 | 19800 | 22600 | 25450 | 28250 | 30550 | 32800 | 35050 | 37300 | 9999 | Hancock town | New Hampshire | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NH | 3301136180 | 33 | 11 | METRO31700N33011 | Hillsborough County, NH (part) HUD Metro FMR Area | Hillsborough County | 94100 | 19800 | 22600 | 25450 | 28250 | 30550 | 32800 | 35050 | 37300 | 9999 | Hillsborough town | New Hampshire | 1 |
| NH | 3301137140 | 33 | 11 | METRO31700MM5350 | Nashua, NH HUD Metro FMR Area | Hillsborough County | 113600 | 23350 | 26650 | 30000 | 33300 | 36000 | 38650 | 41300 | 44000 | 5350 | Hollis town | New Hampshire | 1 |
| NH | 3301137940 | 33 | 11 | METRO31700MM5350 | Nashua, NH HUD Metro FMR Area | Hillsborough County | 113600 | 23350 | 26650 | 30000 | 33300 | 36000 | 38650 | 41300 | 44000 | 5350 | Hudson town | New Hampshire | 1 |
| NH | 3301142260 | 33 | 11 | METRO31700MM5350 | Nashua, NH HUD Metro FMR Area | Hillsborough County | 113600 | 23350 | 26650 | 30000 | 33300 | 36000 | 38650 | 41300 | 44000 | 5350 | Litchfield town | New Hampshire | 1 |
| NH | 3301144580 | 33 | 11 | METRO31700N33011 | Hillsborough County, NH (part) HUD Metro FMR Area | Hillsborough County | 94100 | 19800 | 22600 | 25450 | 28250 | 30550 | 32800 | 35050 | 37300 | 9999 | Lyndeborough town | New Hampshire | 1 |
| NH | 3301145140 | 33 | 11 | METRO31700MM4760 | Manchester, NH HUD Metro FMR Area | Hillsborough County | 83600 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 4760 | Manchester city | New Hampshire | 1 |
| NH | 3301146260 | 33 | 11 | METRO31700MM5350 | Nashua, NH HUD Metro FMR Area | Hillsborough County | 113600 | 23350 | 26650 | 30000 | 33300 | 36000 | 38650 | 41300 | 44000 | 5350 | Mason town | New Hampshire | 1 |
| NH | 3301147540 | 33 | 11 | METRO31700MM5350 | Nashua, NH HUD Metro FMR Area | Hillsborough County | 113600 | 23350 | 26650 | 30000 | 33300 | 36000 | 38650 | 41300 | 44000 | 5350 | Merrimack town | New Hampshire | 1 |
| NH | 3301148020 | 33 | 11 | METRO31700MM5350 | Nashua, NH HUD Metro FMR Area | Hillsborough County | 113600 | 23350 | 26650 | 30000 | 33300 | 36000 | 38650 | 41300 | 44000 | 5350 | Milford town | New Hampshire | 1 |
| NH | 3301149140 | 33 | 11 | METRO31700MM5350 | Nashua, NH HUD Metro FMR Area | Hillsborough County | 113600 | 23350 | 26650 | 30000 | 33300 | 36000 | 38650 | 41300 | 44000 | 5350 | Mont Vernon town | New Hampshire | 1 |
| NH | 3301150260 | 33 | 11 | METRO31700MM5350 | Nashua, NH HUD Metro FMR Area | Hillsborough County | 113600 | 23350 | 26650 | 30000 | 33300 | 36000 | 38650 | 41300 | 44000 | 5350 | Nashua city | New Hampshire | 1 |
| NH | 3301150740 | 33 | 11 | METRO31700N33011 | Hillsborough County, NH (part) HUD Metro FMR Area | Hillsborough County | 94100 | 19800 | 22600 | 25450 | 28250 | 30550 | 32800 | 35050 | 37300 | 9999 | New Boston town | New Hampshire | 1 |
| NH | 3301151940 | 33 | 11 | METRO31700MM5350 | Nashua, NH HUD Metro FMR Area | Hillsborough County | 113600 | 23350 | 26650 | 30000 | 33300 | 36000 | 38650 | 41300 | 44000 | 5350 | New Ipswich town | New Hampshire | 1 |
| NH | 3301159940 | 33 | 11 | METRO31700MM5350 | Nashua, NH HUD Metro FMR Area | Hillsborough County | 113600 | 23350 | 26650 | 30000 | 33300 | 36000 | 38650 | 41300 | 44000 | 4560 | Pelham town | New Hampshire | 1 |
| NH | 3301160580 | 33 | 11 | METRO31700N33011 | Hillsborough County, NH (part) HUD Metro FMR Area | Hillsborough County | 94100 | 19800 | 22600 | 25450 | 28250 | 30550 | 32800 | 35050 | 37300 | 9999 | Peterborough town | New Hampshire | 1 |
| NH | 3301168820 | 33 | 11 | METRO31700N33011 | Hillsborough County, NH (part) HUD Metro FMR Area | Hillsborough County | 94100 | 19800 | 22600 | 25450 | 28250 | 30550 | 32800 | 35050 | 37300 | 9999 | Sharon town | New Hampshire | 1 |
| NH | 3301176260 | 33 | 11 | METRO31700N33011 | Hillsborough County, NH (part) HUD Metro FMR Area | Hillsborough County | 94100 | 19800 | 22600 | 25450 | 28250 | 30550 | 32800 | 35050 | 37300 | 9999 | Temple town | New Hampshire | 1 |
| NH | 3301179780 | 33 | 11 | METRO31700MM4760 | Manchester, NH HUD Metro FMR Area | Hillsborough County | 83600 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 4760 | Weare town | New Hampshire | 1 |
| NH | 3301185220 | 33 | 11 | METRO31700MM5350 | Nashua, NH HUD Metro FMR Area | Hillsborough County | 113600 | 23350 | 26650 | 30000 | 33300 | 36000 | 38650 | 41300 | 44000 | 5350 | Wilton town | New Hampshire | 1 |
| NH | 3301185940 | 33 | 11 | METRO31700N33011 | Hillsborough County, NH (part) HUD Metro FMR Area | Hillsborough County | 94100 | 19800 | 22600 | 25450 | 28250 | 30550 | 32800 | 35050 | 37300 | 9999 | Windsor town | New Hampshire | 1 |
| NH | 3301300660 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 4760 | Allenstown town | New Hampshire | 0 |
| NH | 3301301460 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Andover town | New Hampshire | 0 |
| NH | 3301306260 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Boscawen town | New Hampshire | 0 |
| NH | 3301306500 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Bow town | New Hampshire | 0 |
| NH | 3301306980 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Bradford town | New Hampshire | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NH | 3301309860 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Canterbury town | New Hampshire | 0 |
| NH | 3301312420 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Chichester town | New Hampshire | 0 |
| NH | 3301314200 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Concord city | New Hampshire | 0 |
| NH | 3301316980 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Danbury town | New Hampshire | 0 |
| NH | 3301319460 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Dunbarton town | New Hampshire | 0 |
| NH | 3301324900 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Epsom town | New Hampshire | 0 |
| NH | 3301327380 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Franklin city | New Hampshire | 0 |
| NH | 3301335540 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Henniker town | New Hampshire | 0 |
| NH | 3301335860 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Hill town | New Hampshire | 0 |
| NH | 3301337300 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 4760 | Hooksett town | New Hampshire | 0 |
| NH | 3301337540 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Hopkinton town | New Hampshire | 0 |
| NH | 3301343380 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Loudon town | New Hampshire | 0 |
| NH | 3301350900 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Newbury town | New Hampshire | 0 |
| NH | 3301352100 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | New London town | New Hampshire | 0 |
| NH | 3301354260 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Northfield town | New Hampshire | 0 |
| NH | 3301360020 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Pembroke town | New Hampshire | 0 |
| NH | 3301361940 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Pittsfield town | New Hampshire | 0 |
| NH | 3301366980 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Salisbury town | New Hampshire | 0 |
| NH | 3301375460 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Sutton town | New Hampshire | 0 |
| NH | 3301378580 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Warner town | New Hampshire | 0 |
| NH | 3301380020 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Webster town | New Hampshire | 0 |
| NH | 3301384900 | 33 | 13 | NCNTY33013N33013 | Merrimack County, NH | Merrimack County | 89200 | 18750 | 21400 | 24100 | 26750 | 28900 | 31050 | 33200 | 35350 | 9999 | Wilmot town | New Hampshire | 0 |
| NH | 3301502340 | 33 | 15 | METRO14460MM4160 | Lawrence, MA-NH HUD Metro FMR Area | Rockingham County | 98000 | 20600 | 23550 | 26500 | 29400 | 31800 | 34150 | 36500 | 38850 | 4160 | Atkinson town | New Hampshire | 1 |
| NH | 3301502820 | 33 | 15 | METRO14460MM4760 | Western Rockingham County, NH HUD Metro FMR Area | Rockingham County | 112200 | 23600 | 26950 | 30300 | 33650 | 36350 | 39050 | 41750 | 44450 | 4760 | Auburn town | New Hampshire | 1 |
| NH | 3301507220 | 33 | 15 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Rockingham County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | Brentwood town | New Hampshire | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NH | 3301509300 | 33 | 15 | METRO14460MM4760 | Western Rockingham County, NH HUD Metro FMR Area | Rockingham County | 112200 | 23600 | 26950 | 30300 | 33650 | 36350 | 39050 | 41750 | 44450 | 4760 | Candia town | New Hampshire | 1 |
| NH | 3301512100 | 33 | 15 | METRO14460MM4160 | Lawrence, MA-NH HUD Metro FMR Area | Rockingham County | 98000 | 20600 | 23550 | 26500 | 29400 | 31800 | 34150 | 36500 | 38850 | 4160 | Chester town | New Hampshire | 1 |
| NH | 3301517140 | 33 | 15 | METRO14460MM4160 | Lawrence, MA-NH HUD Metro FMR Area | Rockingham County | 98000 | 20600 | 23550 | 26500 | 29400 | 31800 | 34150 | 36500 | 38850 | 4160 | Danville town | New Hampshire | 1 |
| NH | 3301517460 | 33 | 15 | METRO14460MM4760 | Western Rockingham County, NH HUD Metro FMR Area | Rockingham County | 112200 | 23600 | 26950 | 30300 | 33650 | 36350 | 39050 | 41750 | 44450 | 9999 | Deerfield town | New Hampshire | 1 |
| NH | 3301517940 | 33 | 15 | METRO14460MM4160 | Lawrence, MA-NH HUD Metro FMR Area | Rockingham County | 98000 | 20600 | 23550 | 26500 | 29400 | 31800 | 34150 | 36500 | 38850 | 4160 | Derry town | New Hampshire | 1 |
| NH | 3301521380 | 33 | 15 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Rockingham County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | East Kingston town | New Hampshire | 1 |
| NH | 3301524660 | 33 | 15 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Rockingham County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | Epping town | New Hampshire | 1 |
| NH | 3301525380 | 33 | 15 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Rockingham County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | Exeter town | New Hampshire | 1 |
| NH | 3301527940 | 33 | 15 | METRO14460MM4160 | Lawrence, MA-NH HUD Metro FMR Area | Rockingham County | 98000 | 20600 | 23550 | 26500 | 29400 | 31800 | 34150 | 36500 | 38850 | 4160 | Fremont town | New Hampshire | 1 |
| NH | 3301531700 | 33 | 15 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Rockingham County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | Greenland town | New Hampshire | 1 |
| NH | 3301532900 | 33 | 15 | METRO14460MM4160 | Lawrence, MA-NH HUD Metro FMR Area | Rockingham County | 98000 | 20600 | 23550 | 26500 | 29400 | 31800 | 34150 | 36500 | 38850 | 4160 | Hampstead town | New Hampshire | 1 |
| NH | 3301533060 | 33 | 15 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Rockingham County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | Hampton town | New Hampshire | 1 |
| NH | 3301533460 | 33 | 15 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Rockingham County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | Hampton Falls town | New Hampshire | 1 |
| NH | 3301539780 | 33 | 15 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Rockingham County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | Kensington town | New Hampshire | 1 |
| NH | 3301540100 | 33 | 15 | METRO14460MM4160 | Lawrence, MA-NH HUD Metro FMR Area | Rockingham County | 98000 | 20600 | 23550 | 26500 | 29400 | 31800 | 34150 | 36500 | 38850 | 4160 | Kingston town | New Hampshire | 1 |
| NH | 3301543220 | 33 | 15 | METRO14460MM4760 | Western Rockingham County, NH HUD Metro FMR Area | Rockingham County | 112200 | 23600 | 26950 | 30300 | 33650 | 36350 | 39050 | 41750 | 44450 | 4760 | Londonderry town | New Hampshire | 1 |
| NH | 3301550980 | 33 | 15 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Rockingham County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | New Castle town | New Hampshire | 1 |
| NH | 3301551380 | 33 | 15 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Rockingham County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | Newfields town | New Hampshire | 1 |
| NH | 3301551620 | 33 | 15 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Rockingham County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | Newington town | New Hampshire | 1 |
| NH | 3301552340 | 33 | 15 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Rockingham County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | Newmarket town | New Hampshire | 1 |
| NH | 3301552900 | 33 | 15 | METRO14460MM4160 | Lawrence, MA-NH HUD Metro FMR Area | Rockingham County | 98000 | 20600 | 23550 | 26500 | 29400 | 31800 | 34150 | 36500 | 38850 | 4160 | Newton town | New Hampshire | 1 |
| NH | 3301554580 | 33 | 15 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Rockingham County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | North Hampton town | New Hampshire | 1 |
| NH | 3301556820 | 33 | 15 | METRO14460MM4760 | Western Rockingham County, NH HUD Metro FMR Area | Rockingham County | 112200 | 23600 | 26950 | 30300 | 33650 | 36350 | 39050 | 41750 | 44450 | 9999 | Northwood town | New Hampshire | 1 |
| NH | 3301557460 | 33 | 15 | METRO14460MM4760 | Western Rockingham County, NH HUD Metro FMR Area | Rockingham County | 112200 | 23600 | 26950 | 30300 | 33650 | 36350 | 39050 | 41750 | 44450 | 9999 | Nottingham town | New Hampshire | 1 |
| NH | 3301562500 | 33 | 15 | METRO14460MM4160 | Lawrence, MA-NH HUD Metro FMR Area | Rockingham County | 98000 | 20600 | 23550 | 26500 | 29400 | 31800 | 34150 | 36500 | 38850 | 4160 | Plaistow town | New Hampshire | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NH | 3301562900 | 33 | 15 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Rockingham County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | Portsmouth city | New Hampshire | 1 |
| NH | 3301564020 | 33 | 15 | METRO14460MM4160 | Lawrence, MA-NH HUD Metro FMR Area | Rockingham County | 98000 | 20600 | 23550 | 26500 | 29400 | 31800 | 34150 | 36500 | 38850 | 4160 | Raymond town | New Hampshire | 1 |
| NH | 3301566180 | 33 | 15 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Rockingham County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | Rye town | New Hampshire | 1 |
| NH | 3301566660 | 33 | 15 | METRO14460MM4160 | Lawrence, MA-NH HUD Metro FMR Area | Rockingham County | 98000 | 20600 | 23550 | 26500 | 29400 | 31800 | 34150 | 36500 | 38850 | 4160 | Salem town | New Hampshire | 1 |
| NH | 3301567620 | 33 | 15 | METRO14460MM4160 | Lawrence, MA-NH HUD Metro FMR Area | Rockingham County | 98000 | 20600 | 23550 | 26500 | 29400 | 31800 | 34150 | 36500 | 38850 | 4160 | Sandown town | New Hampshire | 1 |
| NH | 3301568260 | 33 | 15 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Rockingham County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | Seabrook town | New Hampshire | 1 |
| NH | 3301571140 | 33 | 15 | METRO14460MM1120 | Boston-Cambridge-Quincy, MA-NH HUD Metro FMR Area | Rockingham County | 119000 | 26850 | 30700 | 34550 | 38350 | 41450 | 44500 | 47600 | 50650 | 1120 | South Hampton town | New Hampshire | 1 |
| NH | 3301574340 | 33 | 15 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Rockingham County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | Stratham town | New Hampshire | 1 |
| NH | 3301585780 | 33 | 15 | METRO14460MM4160 | Lawrence, MA-NH HUD Metro FMR Area | Rockingham County | 98000 | 20600 | 23550 | 26500 | 29400 | 31800 | 34150 | 36500 | 38850 | 4160 | Windham town | New Hampshire | 1 |
| NH | 3301703460 | 33 | 17 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Strafford County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | Barrington town | New Hampshire | 1 |
| NH | 3301718820 | 33 | 17 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Strafford County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | Dover city | New Hampshire | 1 |
| NH | 3301719700 | 33 | 17 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Strafford County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | Durham town | New Hampshire | 1 |
| NH | 3301726020 | 33 | 17 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Strafford County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | Farmington town | New Hampshire | 1 |
| NH | 3301741460 | 33 | 17 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Strafford County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | Lee town | New Hampshire | 1 |
| NH | 3301744820 | 33 | 17 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Strafford County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | Madbury town | New Hampshire | 1 |
| NH | 3301747700 | 33 | 17 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Strafford County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 9999 | Middleton town | New Hampshire | 1 |
| NH | 3301748660 | 33 | 17 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Strafford County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | Milton town | New Hampshire | 1 |
| NH | 3301751220 | 33 | 17 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Strafford County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 9999 | New Durham town | New Hampshire | 1 |
| NH | 3301765140 | 33 | 17 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Strafford County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | Rochester city | New Hampshire | 1 |
| NH | 3301765540 | 33 | 17 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Strafford County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | Rollinsford town | New Hampshire | 1 |
| NH | 3301769940 | 33 | 17 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Strafford County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 6450 | Somersworth city | New Hampshire | 1 |
| NH | 3301773860 | 33 | 17 | METRO14460MM6450 | Portsmouth-Rochester, NH HUD Metro FMR Area | Strafford County | 102800 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 9999 | Strafford town | New Hampshire | 1 |
| NH | 3301900260 | 33 | 19 | NCNTY33019N33019 | Sullivan County, NH | Sullivan County | 76900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Acworth town | New Hampshire | 0 |
| NH | 3301911380 | 33 | 19 | NCNTY33019N33019 | Sullivan County, NH | Sullivan County | 76900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Charlestown town | New Hampshire | 0 |
| NH | 3301912900 | 33 | 19 | NCNTY33019N33019 | Sullivan County, NH | Sullivan County | 76900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Claremont city | New Hampshire | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NH | 3301915060 | 33 | 19 | NCNTY33019N33019 | Sullivan County, NH | Sullivan County | 76900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Cornish town | New Hampshire | 0 |
| NH | 3301916340 | 33 | 19 | NCNTY33019N33019 | Sullivan County, NH | Sullivan County | 76900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Croydon town | New Hampshire | 0 |
| NH | 3301930500 | 33 | 19 | NCNTY33019N33019 | Sullivan County, NH | Sullivan County | 76900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Goshen town | New Hampshire | 0 |
| NH | 3301931220 | 33 | 19 | NCNTY33019N33019 | Sullivan County, NH | Sullivan County | 76900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Grantham town | New Hampshire | 0 |
| NH | 3301940900 | 33 | 19 | NCNTY33019N33019 | Sullivan County, NH | Sullivan County | 76900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Langdon town | New Hampshire | 0 |
| NH | 3301941700 | 33 | 19 | NCNTY33019N33019 | Sullivan County, NH | Sullivan County | 76900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Lempster town | New Hampshire | 0 |
| NH | 3301952580 | 33 | 19 | NCNTY33019N33019 | Sullivan County, NH | Sullivan County | 76900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Newport town | New Hampshire | 0 |
| NH | 3301962340 | 33 | 19 | NCNTY33019N33019 | Sullivan County, NH | Sullivan County | 76900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Plainfield town | New Hampshire | 0 |
| NH | 3301972740 | 33 | 19 | NCNTY33019N33019 | Sullivan County, NH | Sullivan County | 76900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Springfield town | New Hampshire | 0 |
| NH | 3301975060 | 33 | 19 | NCNTY33019N33019 | Sullivan County, NH | Sullivan County | 76900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Sunapee town | New Hampshire | 0 |
| NH | 3301977940 | 33 | 19 | NCNTY33019N33019 | Sullivan County, NH | Sullivan County | 76900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Unity town | New Hampshire | 0 |
| NH | 3301978980 | 33 | 19 | NCNTY33019N33019 | Sullivan County, NH | Sullivan County | 76900 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 9999 | Washington town | New Hampshire | 0 |
| NJ | 3400199999 | 34 | 1 | METRO12100M12100 | Atlantic City-Hammonton, NJ MSA | Atlantic County | 84300 | 17450 | 19950 | 22450 | 24900 | 26900 | 28900 | 30900 | 32900 | 560 | Atlantic County | New Jersey | 1 |
| NJ | 3400399999 | 34 | 3 | METRO35620MM0875 | Bergen-Passaic, NJ HUD Metro FMR Area | Bergen County | 104200 | 21900 | 25000 | 28150 | 31250 | 33750 | 36250 | 38750 | 41250 | 875 | Bergen County | New Jersey | 1 |
| NJ | 3400599999 | 34 | 5 | METRO37980M37980 | Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA | Burlington County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 6160 | Burlington County | New Jersey | 1 |
| NJ | 3400799999 | 34 | 7 | METRO37980M37980 | Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA | Camden County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 6160 | Camden County | New Jersey | 1 |
| NJ | 3400999999 | 34 | 9 | METRO36140M36140 | Ocean City, NJ MSA | Cape May County | 85800 | 18050 | 20600 | 23200 | 25750 | 27850 | 29900 | 31950 | 34000 | 560 | Cape May County | New Jersey | 1 |
| NJ | 3401199999 | 34 | 11 | METRO47220M47220 | Vineland-Bridgeton, NJ MSA | Cumberland County | 67700 | 15400 | 17600 | 19800 | 22000 | 23800 | 25550 | 27300 | 29050 | 8760 | Cumberland County | New Jersey | 1 |
| NJ | 3401399999 | 34 | 13 | METRO35620MM5640 | Newark, NJ HUD Metro FMR Area | Essex County | 106000 | 22300 | 25450 | 28650 | 31800 | 34350 | 36900 | 39450 | 42000 | 5640 | Essex County | New Jersey | 1 |
| NJ | 3401599999 | 34 | 15 | METRO37980M37980 | Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA | Gloucester County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 6160 | Gloucester County | New Jersey | 1 |
| NJ | 3401799999 | 34 | 17 | METRO35620MM3640 | Jersey City, NJ HUD Metro FMR Area | Hudson County | 76900 | 20750 | 23700 | 26650 | 29600 | 32000 | 34350 | 36750 | 39100 | 3640 | Hudson County | New Jersey | 1 |
| NJ | 3401999999 | 34 | 19 | METRO35620MM5015 | Middlesex-Somerset-Hunterdon, NJ HUD Metro FMR Area | Hunterdon County | 119500 | 25100 | 28700 | 32300 | 35850 | 38750 | 41600 | 44500 | 47350 | 5015 | Hunterdon County | New Jersey | 1 |
| NJ | 3402199999 | 34 | 21 | METRO45940M45940 | Trenton, NJ MSA | Mercer County | 108700 | 22850 | 26100 | 29350 | 32600 | 35250 | 37850 | 40450 | 43050 | 8480 | Mercer County | New Jersey | 1 |
| NJ | 3402399999 | 34 | 23 | METRO35620MM5015 | Middlesex-Somerset-Hunterdon, NJ HUD Metro FMR Area | Middlesex County | 119500 | 25100 | 28700 | 32300 | 35850 | 38750 | 41600 | 44500 | 47350 | 5015 | Middlesex County | New Jersey | 1 |
| NJ | 3402599999 | 34 | 25 | METRO35620MM5190 | Monmouth-Ocean, NJ HUD Metro FMR Area | Monmouth County | 109400 | 23000 | 26250 | 29550 | 32800 | 35450 | 38050 | 40700 | 43300 | 5190 | Monmouth County | New Jersey | 1 |
| NJ | 3402799999 | 34 | 27 | METRO35620MM5640 | Newark, NJ HUD Metro FMR Area | Morris County | 106000 | 22300 | 25450 | 28650 | 31800 | 34350 | 36900 | 39450 | 42000 | 5640 | Morris County | New Jersey | 1 |
| NJ | 3402999999 | 34 | 29 | METRO35620MM5190 | Monmouth-Ocean, NJ HUD Metro FMR Area | Ocean County | 109400 | 23000 | 26250 | 29550 | 32800 | 35450 | 38050 | 40700 | 43300 | 5190 | Ocean County | New Jersey | 1 |
| NJ | 3403199999 | 34 | 31 | METRO35620MM0875 | Bergen-Passaic, NJ HUD Metro FMR Area | Passaic County | 104200 | 21900 | 25000 | 28150 | 31250 | 33750 | 36250 | 38750 | 41250 | 875 | Passaic County | New Jersey | 1 |
| NJ | 3403399999 | 34 | 33 | METRO37980M37980 | Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA | Salem County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 6160 | Salem County | New Jersey | 1 |
| NJ | 3403599999 | 34 | 35 | METRO35620MM5015 | Middlesex-Somerset-Hunterdon, NJ HUD Metro FMR Area | Somerset County | 119500 | 25100 | 28700 | 32300 | 35850 | 38750 | 41600 | 44500 | 47350 | 5015 | Somerset County | New Jersey | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NJ | 3403799999 | 34 | 37 | METRO35620MM5640 | Newark, NJ HUD Metro FMR Area | Sussex County | 106000 | 22300 | 25450 | 28650 | 31800 | 34350 | 36900 | 39450 | 42000 | 5640 | Sussex County | New Jersey | 1 |
| NJ | 3403999999 | 34 | 39 | METRO35620MM5640 | Newark, NJ HUD Metro FMR Area | Union County | 106000 | 22300 | 25450 | 28650 | 31800 | 34350 | 36900 | 39450 | 42000 | 5640 | Union County | New Jersey | 1 |
| NJ | 3404199999 | 34 | 41 | METRO10900MM5640 | Warren County, NJ HUD Metro FMR Area | Warren County | 97800 | 20650 | 23600 | 26550 | 29500 | 31900 | 34250 | 36600 | 38950 | 5640 | Warren County | New Jersey | 1 |
| NM | 3500199999 | 35 | 1 | METRO10740M10740 | Albuquerque, NM MSA | Bernalillo County | 69100 | 14550 | 16600 | 18700 | 20750 | 22450 | 24100 | 25750 | 27400 | 200 | Bernalillo County | New Mexico | 1 |
| NM | 3500399999 | 35 | 3 | NCNTY35003N35003 | Catron County, NM | Catron County | 55200 | 11600 | 13250 | 14900 | 16550 | 17900 | 19200 | 20550 | 21850 | 9999 | Catron County | New Mexico | 0 |
| NM | 3500599999 | 35 | 5 | NCNTY35005N35005 | Chaves County, NM | Chaves County | 57000 | 12000 | 13700 | 15400 | 17100 | 18500 | 19850 | 21250 | 22600 | 9999 | Chaves County | New Mexico | 0 |
| NM | 3500699999 | 35 | 6 | NCNTY35006N35006 | Cibola County, NM | Cibola County | 48500 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Cibola County | New Mexico | 0 |
| NM | 3500799999 | 35 | 7 | NCNTY35007N35007 | Colfax County, NM | Colfax County | 49700 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Colfax County | New Mexico | 0 |
| NM | 3500999999 | 35 | 9 | NCNTY35009N35009 | Curry County, NM | Curry County | 51700 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Curry County | New Mexico | 0 |
| NM | 3501199999 | 35 | 11 | NCNTY35011N35011 | De Baca County, NM | De Baca County | 54900 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | De Baca County | New Mexico | 0 |
| NM | 3501399999 | 35 | 13 | METRO29740M29740 | Las Cruces, NM MSA | Dona Ana County | 52100 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 4100 | Dona Ana County | New Mexico | 1 |
| NM | 3501599999 | 35 | 15 | NCNTY35015N35015 | Eddy County, NM | Eddy County | 70700 | 14850 | 17000 | 19100 | 21200 | 22900 | 24600 | 26300 | 28000 | 9999 | Eddy County | New Mexico | 0 |
| NM | 3501799999 | 35 | 17 | NCNTY35017N35017 | Grant County, NM | Grant County | 53800 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Grant County | New Mexico | 0 |
| NM | 3501999999 | 35 | 19 | NCNTY35019N35019 | Guadalupe County, NM | Guadalupe County | 45200 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Guadalupe County | New Mexico | 0 |
| NM | 3502199999 | 35 | 21 | NCNTY35021N35021 | Harding County, NM | Harding County | 55000 | 11550 | 13200 | 14850 | 16500 | 17850 | 19150 | 20500 | 21800 | 9999 | Harding County | New Mexico | 0 |
| NM | 3502399999 | 35 | 23 | NCNTY35023N35023 | Hidalgo County, NM | Hidalgo County | 49900 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Hidalgo County | New Mexico | 0 |
| NM | 3502599999 | 35 | 25 | NCNTY35025N35025 | Lea County, NM | Lea County | 64300 | 13550 | 15450 | 17400 | 19300 | 20850 | 22400 | 23950 | 25500 | 9999 | Lea County | New Mexico | 0 |
| NM | 3502799999 | 35 | 27 | NCNTY35027N35027 | Lincoln County, NM | Lincoln County | 60000 | 12400 | 14200 | 15950 | 17700 | 19150 | 20550 | 21950 | 23400 | 9999 | Lincoln County | New Mexico | 0 |
| NM | 3502899999 | 35 | 28 | NCNTY35028N35028 | Los Alamos County, NM | Los Alamos County | 141800 | 26400 | 30200 | 33950 | 37700 | 40750 | 43750 | 46750 | 49800 | 7490 | Los Alamos County | New Mexico | 0 |
| NM | 3502999999 | 35 | 29 | NCNTY35029N35029 | Luna County, NM | Luna County | 38200 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Luna County | New Mexico | 0 |
| NM | 3503199999 | 35 | 31 | NCNTY35031N35031 | McKinley County, NM | McKinley County | 36600 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | McKinley County | New Mexico | 0 |
| NM | 3503399999 | 35 | 33 | NCNTY35033N35033 | Mora County, NM | Mora County | 40100 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Mora County | New Mexico | 0 |
| NM | 3503599999 | 35 | 35 | NCNTY35035N35035 | Otero County, NM | Otero County | 57200 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Otero County | New Mexico | 0 |
| NM | 3503799999 | 35 | 37 | NCNTY35037N35037 | Quay County, NM | Quay County | 41500 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Quay County | New Mexico | 0 |
| NM | 3503999999 | 35 | 39 | NCNTY35039N35039 | Rio Arriba County, NM | Rio Arriba County | 48200 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Rio Arriba County | New Mexico | 0 |
| NM | 3504199999 | 35 | 41 | NCNTY35041N35041 | Roosevelt County, NM | Roosevelt County | 47000 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Roosevelt County | New Mexico | 0 |
| NM | 3504399999 | 35 | 43 | METRO10740M10740 | Albuquerque, NM MSA | Sandoval County | 69100 | 14550 | 16600 | 18700 | 20750 | 22450 | 24100 | 25750 | 27400 | 200 | Sandoval County | New Mexico | 1 |
| NM | 3504599999 | 35 | 45 | METRO22140M22140 | Farmington, NM MSA | San Juan County | 54700 | 13200 | 15100 | 17000 | 18850 | 20400 | 21900 | 23400 | 24900 | 9999 | San Juan County | New Mexico | 1 |
| NM | 3504799999 | 35 | 47 | NCNTY35047N35047 | San Miguel County, NM | San Miguel County | 43100 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | San Miguel County | New Mexico | 0 |
| NM | 3504999999 | 35 | 49 | METRO42140M42140 | Santa Fe, NM MSA | Santa Fe County | 76000 | 16000 | 18250 | 20550 | 22800 | 24650 | 26450 | 28300 | 30100 | 7490 | Santa Fe County | New Mexico | 1 |
| NM | 3505199999 | 35 | 51 | NCNTY35051N35051 | Sierra County, NM | Sierra County | 43400 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Sierra County | New Mexico | 0 |
| NM | 3505399999 | 35 | 53 | NCNTY35053N35053 | Socorro County, NM | Socorro County | 46900 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Socorro County | New Mexico | 0 |
| NM | 3505599999 | 35 | 55 | NCNTY35055N35055 | Taos County, NM | Taos County | 48800 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Taos County | New Mexico | 0 |
| NM | 3505799999 | 35 | 57 | METRO10740M10740 | Albuquerque, NM MSA | Torrance County | 69100 | 14550 | 16600 | 18700 | 20750 | 22450 | 24100 | 25750 | 27400 | 9999 | Torrance County | New Mexico | 1 |
| NM | 3505999999 | 35 | 59 | NCNTY35059N35059 | Union County, NM | Union County | 58400 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Union County | New Mexico | 0 |
| NM | 3506199999 | 35 | 61 | METRO10740M10740 | Albuquerque, NM MSA | Valencia County | 69100 | 14550 | 16600 | 18700 | 20750 | 22450 | 24100 | 25750 | 27400 | 200 | Valencia County | New Mexico | 1 |
| NY | 3600199999 | 36 | 1 | METRO10580M10580 | Albany-Schenectady-Troy, NY MSA | Albany County | 99200 | 20400 | 23300 | 26200 | 29100 | 31450 | 33800 | 36100 | 38450 | 160 | Albany County | New York | 1 |
| NY | 3600399999 | 36 | 3 | NCNTY36003N36003 | Allegany County, NY | Allegany County | 58700 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 9999 | Allegany County | New York | 0 |
| NY | 3600599999 | 36 | 5 | METRO35620MM5600 | New York, NY HUD Metro FMR Area | Bronx County | 78700 | 23900 | 27300 | 30700 | 34100 | 36850 | 39600 | 42300 | 45050 | 5600 | Bronx County | New York | 1 |
| NY | 3600799999 | 36 | 7 | METRO13780M13780 | Binghamton, NY MSA | Broome County | 76900 | 16000 | 18300 | 20600 | 22850 | 24700 | 26550 | 28350 | 30200 | 960 | Broome County | New York | 1 |
| NY | 3600999999 | 36 | 9 | NCNTY36009N36009 | Cattaraugus County, NY | Cattaraugus County | 65700 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 9999 | Cattaraugus County | New York | 0 |
| NY | 3601199999 | 36 | 11 | NCNTY36011N36011 | Cayuga County, NY | Cayuga County | 71100 | 14950 | 17100 | 19250 | 21350 | 23100 | 24800 | 26500 | 28200 | 8160 | Cayuga County | New York | 0 |
| NY | 3601399999 | 36 | 13 | NCNTY36013N36013 | Chautauqua County, NY | Chautauqua County | 58600 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 3610 | Chautauqua County | New York | 0 |
| NY | 3601599999 | 36 | 15 | METRO21300M21300 | Elmira, NY MSA | Chemung County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 2335 | Chemung County | New York | 1 |
| NY | 3601799999 | 36 | 17 | NCNTY36017N36017 | Chenango County, NY | Chenango County | 63900 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 9999 | Chenango County | New York | 0 |
| NY | 3601999999 | 36 | 19 | NCNTY36019N36019 | Clinton County, NY | Clinton County | 76800 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Clinton County | New York | 0 |
| NY | 3602199999 | 36 | 21 | NCNTY36021N36021 | Columbia County, NY | Columbia County | 81300 | 17100 | 19550 | 22000 | 24400 | 26400 | 28350 | 30300 | 32250 | 9999 | Columbia County | New York | 0 |
| NY | 3602399999 | 36 | 23 | NCNTY36023N36023 | Cortland County, NY | Cortland County | 72300 | 15200 | 17400 | 19550 | 21700 | 23450 | 25200 | 26950 | 28650 | 9999 | Cortland County | New York | 0 |
| NY | 3602599999 | 36 | 25 | NCNTY36025N36025 | Delaware County, NY | Delaware County | 64300 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 9999 | Delaware County | New York | 0 |
| NY | 3602799999 | 36 | 27 | METRO35620M39100 | Poughkeepsie-Newburgh-Middletown, NY HUD Metro FMR Area | Dutchess County | 102300 | 21500 | 24600 | 27650 | 30700 | 33200 | 35650 | 38100 | 40550 | 2281 | Dutchess County | New York | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NY | 3602999999 | 36 | 29 | METRO15380M15380 | Buffalo-Cheektowaga-Niagara Falls, NY MSA | Erie County | 77600 | 16350 | 18650 | 21000 | 23300 | 25200 | 27050 | 28900 | 30800 | 1280 | Erie County | New York | 1 |
| NY | 3603199999 | 36 | 31 | NCNTY36031N36031 | Essex County, NY | Essex County | 73700 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Essex County | New York | 0 |
| NY | 3603399999 | 36 | 33 | NCNTY36033N36033 | Franklin County, NY | Franklin County | 65200 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 9999 | Franklin County | New York | 0 |
| NY | 3603599999 | 36 | 35 | NCNTY36035N36035 | Fulton County, NY | Fulton County | 63000 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 9999 | Fulton County | New York | 0 |
| NY | 3603799999 | 36 | 37 | NCNTY36037N36037 | Genesee County, NY | Genesee County | 73700 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 6840 | Genesee County | New York | 0 |
| NY | 3603999999 | 36 | 39 | NCNTY36039N36039 | Greene County, NY | Greene County | 73800 | 15550 | 17750 | 19950 | 22150 | 23950 | 25700 | 27500 | 29250 | 9999 | Greene County | New York | 0 |
| NY | 3604199999 | 36 | 41 | NCNTY36041N36041 | Hamilton County, NY | Hamilton County | 68400 | 14350 | 16400 | 18450 | 20500 | 22150 | 23800 | 25450 | 27100 | 9999 | Hamilton County | New York | 0 |
| NY | 3604399999 | 36 | 43 | METRO46540M46540 | Utica-Rome, NY MSA | Herkimer County | 71700 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 8680 | Herkimer County | New York | 1 |
| NY | 3604599999 | 36 | 45 | METRO48060M48060 | Watertown-Fort Drum, NY MSA | Jefferson County | 59500 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 9999 | Jefferson County | New York | 1 |
| NY | 3604799999 | 36 | 47 | METRO35620MM5600 | New York, NY HUD Metro FMR Area | Kings County | 78700 | 23900 | 27300 | 30700 | 34100 | 36850 | 39600 | 42300 | 45050 | 5600 | Kings County | New York | 1 |
| NY | 3604999999 | 36 | 49 | NCNTY36049N36049 | Lewis County, NY | Lewis County | 65600 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 9999 | Lewis County | New York | 0 |
| NY | 3605199999 | 36 | 51 | METRO40380M40380 | Rochester, NY HUD Metro FMR Area | Livingston County | 76400 | 16050 | 18350 | 20650 | 22900 | 24750 | 26600 | 28400 | 30250 | 6840 | Livingston County | New York | 1 |
| NY | 3605399999 | 36 | 53 | METRO45060M45060 | Syracuse, NY MSA | Madison County | 75800 | 15950 | 18200 | 20500 | 22750 | 24600 | 26400 | 28250 | 30050 | 8160 | Madison County | New York | 1 |
| NY | 3605599999 | 36 | 55 | METRO40380M40380 | Rochester, NY HUD Metro FMR Area | Monroe County | 76400 | 16050 | 18350 | 20650 | 22900 | 24750 | 26600 | 28400 | 30250 | 6840 | Monroe County | New York | 1 |
| NY | 3605799999 | 36 | 57 | NCNTY36057N36057 | Montgomery County, NY | Montgomery County | 62600 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 160 | Montgomery County | New York | 0 |
| NY | 3605999999 | 36 | 59 | METRO35620MM5380 | Nassau-Suffolk, NY HUD Metro FMR Area | Nassau County | 126600 | 26600 | 30400 | 34200 | 38000 | 41050 | 44100 | 47150 | 50200 | 5380 | Nassau County | New York | 1 |
| NY | 3606199999 | 36 | 61 | METRO35620MM5600 | New York, NY HUD Metro FMR Area | New York County | 78700 | 23900 | 27300 | 30700 | 34100 | 36850 | 39600 | 42300 | 45050 | 5600 | New York County | New York | 1 |
| NY | 3606399999 | 36 | 63 | METRO15380M15380 | Buffalo-Cheektowaga-Niagara Falls, NY MSA | Niagara County | 77600 | 16350 | 18650 | 21000 | 23300 | 25200 | 27050 | 28900 | 30800 | 1280 | Niagara County | New York | 1 |
| NY | 3606599999 | 36 | 65 | METRO46540M46540 | Utica-Rome, NY MSA | Oneida County | 71700 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 8680 | Oneida County | New York | 1 |
| NY | 3606799999 | 36 | 67 | METRO45060M45060 | Syracuse, NY MSA | Onondaga County | 75800 | 15950 | 18200 | 20500 | 22750 | 24600 | 26400 | 28250 | 30050 | 8160 | Onondaga County | New York | 1 |
| NY | 3606999999 | 36 | 69 | METRO40380M40380 | Rochester, NY HUD Metro FMR Area | Ontario County | 76400 | 16050 | 18350 | 20650 | 22900 | 24750 | 26600 | 28400 | 30250 | 6840 | Ontario County | New York | 1 |
| NY | 3607199999 | 36 | 71 | METRO35620M39100 | Poughkeepsie-Newburgh-Middletown, NY HUD Metro FMR Area | Orange County | 102300 | 21500 | 24600 | 27650 | 30700 | 33200 | 35650 | 38100 | 40550 | 5660 | Orange County | New York | 1 |
| NY | 3607399999 | 36 | 73 | METRO40380M40380 | Rochester, NY HUD Metro FMR Area | Orleans County | 76400 | 16050 | 18350 | 20650 | 22900 | 24750 | 26600 | 28400 | 30250 | 6840 | Orleans County | New York | 1 |
| NY | 3607599999 | 36 | 75 | METRO45060M45060 | Syracuse, NY MSA | Oswego County | 75800 | 15950 | 18200 | 20500 | 22750 | 24600 | 26400 | 28250 | 30050 | 8160 | Oswego County | New York | 1 |
| NY | 3607799999 | 36 | 77 | NCNTY36077N36077 | Otsego County, NY | Otsego County | 68100 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Otsego County | New York | 0 |
| NY | 3607999999 | 36 | 79 | METRO35620MM5600 | New York, NY HUD Metro FMR Area | Putnam County | 78700 | 23900 | 27300 | 30700 | 34100 | 36850 | 39600 | 42300 | 45050 | 5600 | Putnam County | New York | 1 |
| NY | 3608199999 | 36 | 81 | METRO35620MM5600 | New York, NY HUD Metro FMR Area | Queens County | 78700 | 23900 | 27300 | 30700 | 34100 | 36850 | 39600 | 42300 | 45050 | 5600 | Queens County | New York | 1 |
| NY | 3608399999 | 36 | 83 | METRO10580M10580 | Albany-Schenectady-Troy, NY MSA | Rensselaer County | 99200 | 20400 | 23300 | 26200 | 29100 | 31450 | 33800 | 36100 | 38450 | 160 | Rensselaer County | New York | 1 |
| NY | 3608599999 | 36 | 85 | METRO35620MM5600 | New York, NY HUD Metro FMR Area | Richmond County | 78700 | 23900 | 27300 | 30700 | 34100 | 36850 | 39600 | 42300 | 45050 | 5600 | Richmond County | New York | 1 |
| NY | 3608799998 | 36 | 87 | METRO35620MM5600 | New York, NY HUD Metro FMR Area | Rockland County | 78700 | 23900 | 27300 | 30700 | 34100 | 36850 | 39600 | 42300 | 45050 | 5602 | Rockland County | New York | 1 |
| NY | 3608799999 | 36 | 87 | METRO40525M40525 | Rockland County, NY HUD Metro FMR Area | Rockland County | 111900 | 23900 | 27300 | 30700 | 34100 | 36850 | 39600 | 42300 | 45050 | 5602 | Rockland County | New York | 1 |
| NY | 3608999999 | 36 | 89 | NCNTY36089N36089 | St. Lawrence County, NY | St. Lawrence County | 60500 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 9999 | St. Lawrence County | New York | 0 |
| NY | 3609199999 | 36 | 91 | METRO10580M10580 | Albany-Schenectady-Troy, NY MSA | Saratoga County | 99200 | 20400 | 23300 | 26200 | 29100 | 31450 | 33800 | 36100 | 38450 | 160 | Saratoga County | New York | 1 |
| NY | 3609399999 | 36 | 93 | METRO10580M10580 | Albany-Schenectady-Troy, NY MSA | Schenectady County | 99200 | 20400 | 23300 | 26200 | 29100 | 31450 | 33800 | 36100 | 38450 | 160 | Schenectady County | New York | 1 |
| NY | 3609599999 | 36 | 95 | METRO10580M10580 | Albany-Schenectady-Troy, NY MSA | Schoharie County | 99200 | 20400 | 23300 | 26200 | 29100 | 31450 | 33800 | 36100 | 38450 | 160 | Schoharie County | New York | 1 |
| NY | 3609799999 | 36 | 97 | NCNTY36097N36097 | Schuyler County, NY | Schuyler County | 66700 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 9999 | Schuyler County | New York | 0 |
| NY | 3609999999 | 36 | 99 | NCNTY36099N36099 | Seneca County, NY | Seneca County | 69700 | 14650 | 16750 | 18850 | 20900 | 22600 | 24250 | 25950 | 27600 | 9999 | Seneca County | New York | 0 |
| NY | 3610199999 | 36 | 101 | NCNTY36101N36101 | Steuben County, NY | Steuben County | 64600 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 9999 | Steuben County | New York | 0 |
| NY | 3610399999 | 36 | 103 | METRO35620MM5380 | Nassau-Suffolk, NY HUD Metro FMR Area | Suffolk County | 126600 | 26600 | 30400 | 34200 | 38000 | 41050 | 44100 | 47150 | 50200 | 5380 | Suffolk County | New York | 1 |
| NY | 3610599999 | 36 | 105 | NCNTY36105N36105 | Sullivan County, NY | Sullivan County | 75500 | 15900 | 18150 | 20400 | 22650 | 24500 | 26300 | 28100 | 29900 | 9999 | Sullivan County | New York | 0 |
| NY | 3610799999 | 36 | 107 | METRO13780M13780 | Binghamton, NY MSA | Tioga County | 76900 | 16000 | 18300 | 20600 | 22850 | 24700 | 26550 | 28350 | 30200 | 960 | Tioga County | New York | 1 |
| NY | 3610999999 | 36 | 109 | METRO27060M27060 | Ithaca, NY MSA | Tompkins County | 85600 | 18000 | 20600 | 23150 | 25700 | 27800 | 29850 | 31900 | 33950 | 9999 | Tompkins County | New York | 1 |
| NY | 3611199999 | 36 | 111 | METRO28740M28740 | Kingston, NY MSA | Ulster County | 83700 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Ulster County | New York | 1 |
| NY | 3611399999 | 36 | 113 | METRO24020M24020 | Glens Falls, NY MSA | Warren County | 76600 | 15800 | 18050 | 20300 | 22550 | 24400 | 26200 | 28000 | 29800 | 2975 | Warren County | New York | 1 |
| NY | 3611599999 | 36 | 115 | METRO24020M24020 | Glens Falls, NY MSA | Washington County | 76600 | 15800 | 18050 | 20300 | 22550 | 24400 | 26200 | 28000 | 29800 | 2975 | Washington County | New York | 1 |
| NY | 3611799999 | 36 | 117 | METRO40380M40380 | Rochester, NY HUD Metro FMR Area | Wayne County | 76400 | 16050 | 18350 | 20650 | 22900 | 24750 | 26600 | 28400 | 30250 | 6840 | Wayne County | New York | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NY | 3611999998 | 36 | 119 | METRO35620MM5600 | New York, NY HUD Metro FMR Area | Westchester County | 78700 | 23900 | 27300 | 30700 | 34100 | 36850 | 39600 | 42300 | 45050 | 5600 | Westchester County | New York | 1 |
| NY | 3611999999 | 36 | 119 | METRO48325M48325 | Westchester County, NY Statutory Exception Area | Westchester County | 125800 | 26450 | 30200 | 34000 | 37750 | 40800 | 43800 | 46850 | 49850 | 5601 | Westchester County | New York | 1 |
| NY | 3612199999 | 36 | 121 | NCNTY36121N36121 | Wyoming County, NY | Wyoming County | 70700 | 14850 | 17000 | 19100 | 21200 | 22900 | 24600 | 26300 | 28000 | 9999 | Wyoming County | New York | 0 |
| NY | 3612399999 | 36 | 123 | METRO40380N36123 | Yates County, NY HUD Metro FMR Area | Yates County | 70600 | 14850 | 17000 | 19100 | 21200 | 22900 | 24600 | 26300 | 28000 | 9999 | Yates County | New York | 1 |
| NC | 3700199999 | 37 | 1 | METRO15500M15500 | Burlington, NC MSA | Alamance County | 64200 | 13500 | 15400 | 17350 | 19250 | 20800 | 22350 | 23900 | 25450 | 3120 | Alamance County | North Carolina | 1 |
| NC | 3700399999 | 37 | 3 | METRO25860M25860 | Hickory-Lenoir-Morganton, NC MSA | Alexander County | 61000 | 12500 | 14300 | 16100 | 17850 | 19300 | 20750 | 22150 | 23600 | 3290 | Alexander County | North Carolina | 1 |
| NC | 3700599999 | 37 | 5 | NCNTY37005N37005 | Alleghany County, NC | Alleghany County | 47900 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Alleghany County | North Carolina | 0 |
| NC | 3700799999 | 37 | 7 | NCNTY37007N37007 | Anson County, NC | Anson County | 49100 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Anson County | North Carolina | 0 |
| NC | 3700999999 | 37 | 9 | NCNTY37009N37009 | Ashe County, NC | Ashe County | 52900 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Ashe County | North Carolina | 0 |
| NC | 3701199999 | 37 | 11 | NCNTY37011N37011 | Avery County, NC | Avery County | 48600 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Avery County | North Carolina | 0 |
| NC | 3701399999 | 37 | 13 | NCNTY37013N37013 | Beaufort County, NC | Beaufort County | 58300 | 12250 | 14000 | 15750 | 17500 | 18900 | 20300 | 21700 | 23100 | 9999 | Beaufort County | North Carolina | 0 |
| NC | 3701599999 | 37 | 15 | NCNTY37015N37015 | Bertie County, NC | Bertie County | 45000 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Bertie County | North Carolina | 0 |
| NC | 3701799999 | 37 | 17 | NCNTY37017N37017 | Bladen County, NC | Bladen County | 48600 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Bladen County | North Carolina | 0 |
| NC | 3701999999 | 37 | 19 | METRO34820M48900 | Brunswick County, NC HUD Metro FMR Area | Brunswick County | 71600 | 15050 | 17200 | 19350 | 21450 | 23200 | 24900 | 26600 | 28350 | 9200 | Brunswick County | North Carolina | 1 |
| NC | 3702199999 | 37 | 21 | METRO11700M11700 | Asheville, NC HUD Metro FMR Area | Buncombe County | 72500 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 480 | Buncombe County | North Carolina | 1 |
| NC | 3702399999 | 37 | 23 | METRO25860M25860 | Hickory-Lenoir-Morganton, NC MSA | Burke County | 61000 | 12500 | 14300 | 16100 | 17850 | 19300 | 20750 | 22150 | 23600 | 3290 | Burke County | North Carolina | 1 |
| NC | 3702599999 | 37 | 25 | METRO16740M16740 | Charlotte-Concord-Gastonia, NC-SC HUD Metro FMR Area | Cabarrus County | 83500 | 17550 | 20050 | 22550 | 25050 | 27100 | 29100 | 31100 | 33100 | 1520 | Cabarrus County | North Carolina | 1 |
| NC | 3702799999 | 37 | 27 | METRO25860M25860 | Hickory-Lenoir-Morganton, NC MSA | Caldwell County | 61000 | 12500 | 14300 | 16100 | 17850 | 19300 | 20750 | 22150 | 23600 | 3290 | Caldwell County | North Carolina | 1 |
| NC | 3702999999 | 37 | 29 | NCNTY37029N37029 | Camden County, NC | Camden County | 78200 | 16450 | 18800 | 21150 | 23450 | 25350 | 27250 | 29100 | 31000 | 9999 | Camden County | North Carolina | 0 |
| NC | 3703199999 | 37 | 31 | NCNTY37031N37031 | Carteret County, NC | Carteret County | 68900 | 14500 | 16550 | 18600 | 20650 | 22350 | 24000 | 25650 | 27300 | 9999 | Carteret County | North Carolina | 0 |
| NC | 3703399999 | 37 | 33 | NCNTY37033N37033 | Caswell County, NC | Caswell County | 54000 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Caswell County | North Carolina | 0 |
| NC | 3703599999 | 37 | 35 | METRO25860M25860 | Hickory-Lenoir-Morganton, NC MSA | Catawba County | 61000 | 12500 | 14300 | 16100 | 17850 | 19300 | 20750 | 22150 | 23600 | 3290 | Catawba County | North Carolina | 1 |
| NC | 3703799999 | 37 | 37 | METRO20500M20500 | Durham-Chapel Hill, NC HUD Metro FMR Area | Chatham County | 90900 | 19100 | 21800 | 24550 | 27250 | 29450 | 31650 | 33800 | 36000 | 6640 | Chatham County | North Carolina | 1 |
| NC | 3703999999 | 37 | 39 | NCNTY37039N37039 | Cherokee County, NC | Cherokee County | 51100 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Cherokee County | North Carolina | 0 |
| NC | 3704199999 | 37 | 41 | NCNTY37041N37041 | Chowan County, NC | Chowan County | 52300 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Chowan County | North Carolina | 0 |
| NC | 3704399999 | 37 | 43 | NCNTY37043N37043 | Clay County, NC | Clay County | 50100 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Clay County | North Carolina | 0 |
| NC | 3704599999 | 37 | 45 | NCNTY37045N37045 | Cleveland County, NC | Cleveland County | 52300 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Cleveland County | North Carolina | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NC | 3704799999 | 37 | 47 | NCNTY37047N37047 | Columbus County, NC | Columbus County | 49600 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Columbus County | North Carolina | 0 |
| NC | 3704999999 | 37 | 49 | METRO35100N37049 | Craven County, NC HUD Metro FMR Area | Craven County | 66200 | 13900 | 15900 | 17900 | 19850 | 21450 | 23050 | 24650 | 26250 | 9999 | Craven County | North Carolina | 1 |
| NC | 3705199999 | 37 | 51 | METRO22180M22180 | Fayetteville, NC HUD Metro FMR Area | Cumberland County | 58000 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 2560 | Cumberland County | North Carolina | 1 |
| NC | 3705399999 | 37 | 53 | METRO47260M47260 | Virginia Beach-Norfolk-Newport News, VA-NC HUD Metro FMR Area | Currituck County | 82500 | 17350 | 19800 | 22300 | 24750 | 26750 | 28750 | 30700 | 32700 | 5720 | Currituck County | North Carolina | 1 |
| NC | 3705599999 | 37 | 55 | NCNTY37055N37055 | Dare County, NC | Dare County | 69400 | 14600 | 16650 | 18750 | 20800 | 22500 | 24150 | 25800 | 27500 | 9999 | Dare County | North Carolina | 0 |
| NC | 3705799999 | 37 | 57 | METRO49180N37057 | Davidson County, NC HUD Metro FMR Area | Davidson County | 59300 | 12500 | 14250 | 16050 | 17800 | 19250 | 20650 | 22100 | 23500 | 3120 | Davidson County | North Carolina | 1 |
| NC | 3705999999 | 37 | 59 | METRO49180M49180 | Winston-Salem, NC HUD Metro FMR Area | Davie County | 68600 | 14050 | 16050 | 18050 | 20050 | 21700 | 23300 | 24900 | 26500 | 3120 | Davie County | North Carolina | 1 |
| NC | 3706199999 | 37 | 61 | NCNTY37061N37061 | Duplin County, NC | Duplin County | 46400 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Duplin County | North Carolina | 0 |
| NC | 3706399999 | 37 | 63 | METRO20500M20500 | Durham-Chapel Hill, NC HUD Metro FMR Area | Durham County | 90900 | 19100 | 21800 | 24550 | 27250 | 29450 | 31650 | 33800 | 36000 | 6640 | Durham County | North Carolina | 1 |
| NC | 3706599999 | 37 | 65 | METRO40580M40580 | Rocky Mount, NC MSA | Edgecombe County | 57700 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 6895 | Edgecombe County | North Carolina | 1 |
| NC | 3706799999 | 37 | 67 | METRO49180M49180 | Winston-Salem, NC HUD Metro FMR Area | Forsyth County | 68600 | 14050 | 16050 | 18050 | 20050 | 21700 | 23300 | 24900 | 26500 | 3120 | Forsyth County | North Carolina | 1 |
| NC | 3706999999 | 37 | 69 | METRO39580M39580 | Raleigh, NC MSA | Franklin County | 94100 | 19800 | 22600 | 25450 | 28250 | 30550 | 32800 | 35050 | 37300 | 6640 | Franklin County | North Carolina | 1 |
| NC | 3707199999 | 37 | 71 | METRO16740M16740 | Charlotte-Concord-Gastonia, NC-SC HUD Metro FMR Area | Gaston County | 83500 | 17550 | 20050 | 22550 | 25050 | 27100 | 29100 | 31100 | 33100 | 1520 | Gaston County | North Carolina | 1 |
| NC | 3707399999 | 37 | 73 | METRO47260N37073 | Gates County, NC HUD Metro FMR Area | Gates County | 68000 | 14300 | 16350 | 18400 | 20400 | 22050 | 23700 | 25300 | 26950 | 9999 | Gates County | North Carolina | 1 |
| NC | 3707599999 | 37 | 75 | NCNTY37075N37075 | Graham County, NC | Graham County | 49400 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Graham County | North Carolina | 0 |
| NC | 3707799999 | 37 | 77 | NCNTY37077N37077 | Granville County, NC | Granville County | 65300 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Granville County | North Carolina | 0 |
| NC | 3707999999 | 37 | 79 | NCNTY37079N37079 | Greene County, NC | Greene County | 54100 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Greene County | North Carolina | 0 |
| NC | 3708199999 | 37 | 81 | METRO24660M24660 | Greensboro-High Point, NC HUD Metro FMR Area | Guilford County | 66600 | 13900 | 15900 | 17900 | 19850 | 21450 | 23050 | 24650 | 26250 | 3120 | Guilford County | North Carolina | 1 |
| NC | 3708399999 | 37 | 83 | NCNTY37083N37083 | Halifax County, NC | Halifax County | 45200 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Halifax County | North Carolina | 0 |
| NC | 3708599999 | 37 | 85 | NCNTY37085N37085 | Harnett County, NC | Harnett County | 64800 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9999 | Harnett County | North Carolina | 0 |
| NC | 3708799999 | 37 | 87 | METRO11700N37087 | Haywood County, NC HUD Metro FMR Area | Haywood County | 60400 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Haywood County | North Carolina | 1 |
| NC | 3708999999 | 37 | 89 | METRO11700M11700 | Asheville, NC HUD Metro FMR Area | Henderson County | 72500 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Henderson County | North Carolina | 1 |
| NC | 3709199999 | 37 | 91 | NCNTY37091N37091 | Hertford County, NC | Hertford County | 46100 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Hertford County | North Carolina | 0 |
| NC | 3709399999 | 37 | 93 | METRO22180N37093 | Hoke County, NC HUD Metro FMR Area | Hoke County | 54800 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Hoke County | North Carolina | 1 |
| NC | 3709599999 | 37 | 95 | NCNTY37095N37095 | Hyde County, NC | Hyde County | 58100 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Hyde County | North Carolina | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NC | 3709799999 | 37 | 97 | METRO16740N37097 | Iredell County, NC HUD Metro FMR Area | Iredell County | 73100 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Iredell County | North Carolina | 1 |
| NC | 3709999999 | 37 | 99 | NCNTY37099N37099 | Jackson County, NC | Jackson County | 60700 | 12750 | 14550 | 16350 | 18150 | 19650 | 21100 | 22550 | 24000 | 9999 | Jackson County | North Carolina | 0 |
| NC | 3710199999 | 37 | 101 | METRO39580M39580 | Raleigh, NC MSA | Johnston County | 94100 | 19800 | 22600 | 25450 | 28250 | 30550 | 32800 | 35050 | 37300 | 6640 | Johnston County | North Carolina | 1 |
| NC | 3710399999 | 37 | 103 | METRO35100N37103 | Jones County, NC HUD Metro FMR Area | Jones County | 50100 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Jones County | North Carolina | 1 |
| NC | 3710599999 | 37 | 105 | NCNTY37105N37105 | Lee County, NC | Lee County | 62100 | 13100 | 14950 | 16800 | 18650 | 20150 | 21650 | 23150 | 24650 | 9999 | Lee County | North Carolina | 0 |
| NC | 3710799999 | 37 | 107 | NCNTY37107N37107 | Lenoir County, NC | Lenoir County | 51300 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Lenoir County | North Carolina | 0 |
| NC | 3710999999 | 37 | 109 | METRO16740N37109 | Lincoln County, NC HUD Metro FMR Area | Lincoln County | 65500 | 13800 | 15750 | 17700 | 19650 | 21250 | 22800 | 24400 | 25950 | 1520 | Lincoln County | North Carolina | 1 |
| NC | 3711199999 | 37 | 111 | NCNTY37111N37111 | McDowell County, NC | McDowell County | 49100 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | McDowell County | North Carolina | 0 |
| NC | 3711399999 | 37 | 113 | NCNTY37113N37113 | Macon County, NC | Macon County | 54300 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Macon County | North Carolina | 0 |
| NC | 3711599999 | 37 | 115 | METRO11700M11700 | Asheville, NC HUD Metro FMR Area | Madison County | 72500 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 480 | Madison County | North Carolina | 1 |
| NC | 3711799999 | 37 | 117 | NCNTY37117N37117 | Martin County, NC | Martin County | 46500 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Martin County | North Carolina | 0 |
| NC | 3711999999 | 37 | 119 | METRO16740M16740 | Charlotte-Concord-Gastonia, NC-SC HUD Metro FMR Area | Mecklenburg County | 83500 | 17550 | 20050 | 22550 | 25050 | 27100 | 29100 | 31100 | 33100 | 1520 | Mecklenburg County | North Carolina | 1 |
| NC | 3712199999 | 37 | 121 | NCNTY37121N37121 | Mitchell County, NC | Mitchell County | 56400 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Mitchell County | North Carolina | 0 |
| NC | 3712399999 | 37 | 123 | NCNTY37123N37123 | Montgomery County, NC | Montgomery County | 53900 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Montgomery County | North Carolina | 0 |
| NC | 3712599999 | 37 | 125 | NCNTY37125N37125 | Moore County, NC | Moore County | 88200 | 16550 | 18900 | 21250 | 23600 | 25500 | 27400 | 29300 | 31200 | 9999 | Moore County | North Carolina | 0 |
| NC | 3712799999 | 37 | 127 | METRO40580M40580 | Rocky Mount, NC MSA | Nash County | 57700 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 6895 | Nash County | North Carolina | 1 |
| NC | 3712999999 | 37 | 129 | METRO48900M48900 | Wilmington, NC HUD Metro FMR Area | New Hanover County | 81000 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 9200 | New Hanover County | North Carolina | 1 |
| NC | 3713199999 | 37 | 131 | NCNTY37131N37131 | Northampton County, NC | Northampton County | 43700 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Northampton County | North Carolina | 0 |
| NC | 3713399999 | 37 | 133 | METRO27340M27340 | Jacksonville, NC MSA | Onslow County | 57700 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 3605 | Onslow County | North Carolina | 1 |
| NC | 3713599999 | 37 | 135 | METRO20500M20500 | Durham-Chapel Hill, NC HUD Metro FMR Area | Orange County | 90900 | 19100 | 21800 | 24550 | 27250 | 29450 | 31650 | 33800 | 36000 | 6640 | Orange County | North Carolina | 1 |
| NC | 3713799999 | 37 | 137 | METRO35100N37137 | Pamlico County, NC HUD Metro FMR Area | Pamlico County | 60400 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Pamlico County | North Carolina | 1 |
| NC | 3713999999 | 37 | 139 | NCNTY37139N37139 | Pasquotank County, NC | Pasquotank County | 66200 | 13300 | 15200 | 17100 | 19000 | 20550 | 22050 | 23600 | 25100 | 9999 | Pasquotank County | North Carolina | 0 |
| NC | 3714199999 | 37 | 141 | METRO48900N37141 | Pender County, NC HUD Metro FMR Area | Pender County | 67900 | 14050 | 16050 | 18050 | 20050 | 21700 | 23300 | 24900 | 26500 | 9999 | Pender County | North Carolina | 1 |
| NC | 3714399999 | 37 | 143 | NCNTY37143N37143 | Perquimans County, NC | Perquimans County | 53300 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Perquimans County | North Carolina | 0 |
| NC | 3714599999 | 37 | 145 | METRO20500N37145 | Person County, NC HUD Metro FMR Area | Person County | 61800 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Person County | North Carolina | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NC | 3714799999 | 37 | 147 | METRO24780M24780 | Greenville, NC MSA | Pitt County | 66700 | 14000 | 16000 | 18000 | 20000 | 21600 | 23200 | 24800 | 26400 | 3150 | Pitt County | North Carolina | 1 |
| NC | 3714999999 | 37 | 149 | NCNTY37149N37149 | Polk County, NC | Polk County | 60600 | 12750 | 14600 | 16400 | 18200 | 19700 | 21150 | 22600 | 24050 | 9999 | Polk County | North Carolina | 0 |
| NC | 3715199999 | 37 | 151 | METRO24660M24660 | Greensboro-High Point, NC HUD Metro FMR Area | Randolph County | 66600 | 13900 | 15900 | 17900 | 19850 | 21450 | 23050 | 24650 | 26250 | 3120 | Randolph County | North Carolina | 1 |
| NC | 3715399999 | 37 | 153 | NCNTY37153N37153 | Richmond County, NC | Richmond County | 43300 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Richmond County | North Carolina | 0 |
| NC | 3715599999 | 37 | 155 | NCNTY37155N37155 | Robeson County, NC | Robeson County | 46200 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Robeson County | North Carolina | 0 |
| NC | 3715799999 | 37 | 157 | METRO24660N37157 | Rockingham County, NC HUD Metro FMR Area | Rockingham County | 61700 | 12500 | 14300 | 16100 | 17850 | 19300 | 20750 | 22150 | 23600 | 9999 | Rockingham County | North Carolina | 1 |
| NC | 3715999999 | 37 | 159 | METRO16740N37159 | Rowan County, NC HUD Metro FMR Area | Rowan County | 64400 | 13550 | 15450 | 17400 | 19300 | 20850 | 22400 | 23950 | 25500 | 1520 | Rowan County | North Carolina | 1 |
| NC | 3716199999 | 37 | 161 | NCNTY37161N37161 | Rutherford County, NC | Rutherford County | 55800 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Rutherford County | North Carolina | 0 |
| NC | 3716399999 | 37 | 163 | NCNTY37163N37163 | Sampson County, NC | Sampson County | 49300 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Sampson County | North Carolina | 0 |
| NC | 3716599999 | 37 | 165 | NCNTY37165N37165 | Scotland County, NC | Scotland County | 44000 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Scotland County | North Carolina | 0 |
| NC | 3716799999 | 37 | 167 | NCNTY37167N37167 | Stanly County, NC | Stanly County | 60700 | 12750 | 14600 | 16400 | 18200 | 19700 | 21150 | 22600 | 24050 | 9999 | Stanly County | North Carolina | 0 |
| NC | 3716999999 | 37 | 169 | METRO49180M49180 | Winston-Salem, NC HUD Metro FMR Area | Stokes County | 68600 | 14050 | 16050 | 18050 | 20050 | 21700 | 23300 | 24900 | 26500 | 3120 | Stokes County | North Carolina | 1 |
| NC | 3717199999 | 37 | 171 | NCNTY37171N37171 | Surry County, NC | Surry County | 59800 | 12500 | 14300 | 16100 | 17850 | 19300 | 20750 | 22150 | 23600 | 9999 | Surry County | North Carolina | 0 |
| NC | 3717399999 | 37 | 173 | NCNTY37173N37173 | Swain County, NC | Swain County | 47700 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Swain County | North Carolina | 0 |
| NC | 3717599999 | 37 | 175 | NCNTY37175N37175 | Transylvania County, NC | Transylvania County | 56700 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Transylvania County | North Carolina | 0 |
| NC | 3717799999 | 37 | 177 | NCNTY37177N37177 | Tyrrell County, NC | Tyrrell County | 42900 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Tyrrell County | North Carolina | 0 |
| NC | 3717999999 | 37 | 179 | METRO16740M16740 | Charlotte-Concord-Gastonia, NC-SC HUD Metro FMR Area | Union County | 83500 | 17550 | 20050 | 22550 | 25050 | 27100 | 29100 | 31100 | 33100 | 1520 | Union County | North Carolina | 1 |
| NC | 3718199999 | 37 | 181 | NCNTY37181N37181 | Vance County, NC | Vance County | 48100 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Vance County | North Carolina | 0 |
| NC | 3718399999 | 37 | 183 | METRO39580M39580 | Raleigh, NC MSA | Wake County | 94100 | 19800 | 22600 | 25450 | 28250 | 30550 | 32800 | 35050 | 37300 | 6640 | Wake County | North Carolina | 1 |
| NC | 3718599999 | 37 | 185 | NCNTY37185N37185 | Warren County, NC | Warren County | 51100 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Warren County | North Carolina | 0 |
| NC | 3718799999 | 37 | 187 | NCNTY37187N37187 | Washington County, NC | Washington County | 50800 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Washington County | North Carolina | 0 |
| NC | 3718999999 | 37 | 189 | NCNTY37189N37189 | Watauga County, NC | Watauga County | 69400 | 14600 | 16650 | 18750 | 20800 | 22500 | 24150 | 25800 | 27500 | 9999 | Watauga County | North Carolina | 0 |
| NC | 3719199999 | 37 | 191 | METRO24140M24140 | Goldsboro, NC MSA | Wayne County | 54100 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 2980 | Wayne County | North Carolina | 1 |
| NC | 3719399999 | 37 | 193 | NCNTY37193N37193 | Wilkes County, NC | Wilkes County | 53700 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Wilkes County | North Carolina | 0 |
| NC | 3719599999 | 37 | 195 | NCNTY37195N37195 | Wilson County, NC | Wilson County | 61000 | 12850 | 14650 | 16500 | 18300 | 19800 | 21250 | 22700 | 24200 | 9999 | Wilson County | North Carolina | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NC | 3719799999 | 37 | 197 | METRO49180M49180 | Winston-Salem, NC HUD Metro FMR Area | Yadkin County | 68600 | 14050 | 16050 | 18050 | 20050 | 21700 | 23300 | 24900 | 26500 | 3120 | Yadkin County | North Carolina | 1 |
| NC | 3719999999 | 37 | 199 | NCNTY37199N37199 | Yancey County, NC | Yancey County | 53400 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Yancey County | North Carolina | 0 |
| ND | 3800199999 | 38 | 1 | NCNTY38001N38001 | Adams County, ND | Adams County | 78400 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Adams County | North Dakota | 0 |
| ND | 3800399999 | 38 | 3 | NCNTY38003N38003 | Barnes County, ND | Barnes County | 80700 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Barnes County | North Dakota | 0 |
| ND | 3800599999 | 38 | 5 | NCNTY38005N38005 | Benson County, ND | Benson County | 52600 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Benson County | North Dakota | 0 |
| ND | 3800799999 | 38 | 7 | NCNTY38007N38007 | Billings County, ND | Billings County | 107700 | 21850 | 24950 | 28050 | 31150 | 33650 | 36150 | 38650 | 41150 | 9999 | Billings County | North Dakota | 0 |
| ND | 3800999999 | 38 | 9 | NCNTY38009N38009 | Bottineau County, ND | Bottineau County | 79700 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Bottineau County | North Dakota | 0 |
| ND | 3801199999 | 38 | 11 | NCNTY38011N38011 | Bowman County, ND | Bowman County | 99400 | 20900 | 23850 | 26850 | 29800 | 32200 | 34600 | 37000 | 39350 | 9999 | Bowman County | North Dakota | 0 |
| ND | 3801399999 | 38 | 13 | NCNTY38013N38013 | Burke County, ND | Burke County | 89800 | 18900 | 21600 | 24300 | 26950 | 29150 | 31300 | 33450 | 35600 | 9999 | Burke County | North Dakota | 0 |
| ND | 3801599999 | 38 | 15 | METRO13900M13900 | Bismarck, ND HUD Metro FMR Area | Burleigh County | 96000 | 20200 | 23050 | 25950 | 28800 | 31150 | 33450 | 35750 | 38050 | 1010 | Burleigh County | North Dakota | 1 |
| ND | 3801799999 | 38 | 17 | METRO22020M22020 | Fargo, ND-MN MSA | Cass County | 89400 | 18800 | 21450 | 24150 | 26800 | 28950 | 31100 | 33250 | 35400 | 2520 | Cass County | North Dakota | 1 |
| ND | 3801999999 | 38 | 19 | NCNTY38019N38019 | Cavalier County, ND | Cavalier County | 85500 | 18000 | 20550 | 23100 | 25650 | 27750 | 29800 | 31850 | 33900 | 9999 | Cavalier County | North Dakota | 0 |
| ND | 3802199999 | 38 | 21 | NCNTY38021N38021 | Dickey County, ND | Dickey County | 77500 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Dickey County | North Dakota | 0 |
| ND | 3802399999 | 38 | 23 | NCNTY38023N38023 | Divide County, ND | Divide County | 93300 | 19600 | 22400 | 25200 | 28000 | 30250 | 32500 | 34750 | 37000 | 9999 | Divide County | North Dakota | 0 |
| ND | 3802599999 | 38 | 25 | NCNTY38025N38025 | Dunn County, ND | Dunn County | 92000 | 19350 | 22100 | 24850 | 27600 | 29850 | 32050 | 34250 | 36450 | 9999 | Dunn County | North Dakota | 0 |
| ND | 3802799999 | 38 | 27 | NCNTY38027N38027 | Eddy County, ND | Eddy County | 76600 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Eddy County | North Dakota | 0 |
| ND | 3802999999 | 38 | 29 | NCNTY38029N38029 | Emmons County, ND | Emmons County | 64000 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Emmons County | North Dakota | 0 |
| ND | 3803199999 | 38 | 31 | NCNTY38031N38031 | Foster County, ND | Foster County | 77700 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Foster County | North Dakota | 0 |
| ND | 3803399999 | 38 | 33 | NCNTY38033N38033 | Golden Valley County, ND | Golden Valley County | 78600 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Golden Valley County | North Dakota | 0 |
| ND | 3803599999 | 38 | 35 | METRO24220M24220 | Grand Forks, ND-MN MSA | Grand Forks County | 89200 | 18550 | 21200 | 23850 | 26500 | 28650 | 30750 | 32900 | 35000 | 2985 | Grand Forks County | North Dakota | 1 |
| ND | 3803799999 | 38 | 37 | NCNTY38037N38037 | Grant County, ND | Grant County | 75800 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Grant County | North Dakota | 0 |
| ND | 3803999999 | 38 | 39 | NCNTY38039N38039 | Griggs County, ND | Griggs County | 79300 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Griggs County | North Dakota | 0 |
| ND | 3804199999 | 38 | 41 | NCNTY38041N38041 | Hettinger County, ND | Hettinger County | 79400 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Hettinger County | North Dakota | 0 |
| ND | 3804399999 | 38 | 43 | NCNTY38043N38043 | Kidder County, ND | Kidder County | 66400 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Kidder County | North Dakota | 0 |
| ND | 3804599999 | 38 | 45 | NCNTY38045N38045 | LaMoure County, ND | LaMoure County | 78500 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | LaMoure County | North Dakota | 0 |
| ND | 3804799999 | 38 | 47 | NCNTY38047N38047 | Logan County, ND | Logan County | 77700 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Logan County | North Dakota | 0 |
| ND | 3804999999 | 38 | 49 | NCNTY38049N38049 | McHenry County, ND | McHenry County | 90800 | 19100 | 21800 | 24550 | 27250 | 29450 | 31650 | 33800 | 36000 | 9999 | McHenry County | North Dakota | 0 |
| ND | 3805199999 | 38 | 51 | NCNTY38051N38051 | McIntosh County, ND | McIntosh County | 63600 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | McIntosh County | North Dakota | 0 |
| ND | 3805399999 | 38 | 53 | NCNTY38053N38053 | McKenzie County, ND | McKenzie County | 99000 | 20800 | 23800 | 26750 | 29700 | 32100 | 34500 | 36850 | 39250 | 9999 | McKenzie County | North Dakota | 0 |
| ND | 3805599999 | 38 | 55 | NCNTY38055N38055 | McLean County, ND | McLean County | 83000 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | McLean County | North Dakota | 0 |
| ND | 3805799999 | 38 | 57 | NCNTY38057N38057 | Mercer County, ND | Mercer County | 98400 | 20650 | 23600 | 26550 | 29500 | 31900 | 34250 | 36600 | 38950 | 9999 | Mercer County | North Dakota | 0 |
| ND | 3805999999 | 38 | 59 | METRO13900M13900 | Bismarck, ND HUD Metro FMR Area | Morton County | 96000 | 20200 | 23050 | 25950 | 28800 | 31150 | 33450 | 35750 | 38050 | 1010 | Morton County | North Dakota | 1 |
| ND | 3806199999 | 38 | 61 | NCNTY38061N38061 | Mountrail County, ND | Mountrail County | 91700 | 19200 | 21950 | 24700 | 27400 | 29600 | 31800 | 34000 | 36200 | 9999 | Mountrail County | North Dakota | 0 |
| ND | 3806399999 | 38 | 63 | NCNTY38063N38063 | Nelson County, ND | Nelson County | 74900 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Nelson County | North Dakota | 0 |
| ND | 3806599999 | 38 | 65 | METRO13900N38065 | Oliver County, ND HUD Metro FMR Area | Oliver County | 88800 | 18700 | 21350 | 24000 | 26650 | 28800 | 30950 | 33050 | 35200 | 9999 | Oliver County | North Dakota | 1 |
| ND | 3806799999 | 38 | 67 | NCNTY38067N38067 | Pembina County, ND | Pembina County | 82700 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Pembina County | North Dakota | 0 |
| ND | 3806999999 | 38 | 69 | NCNTY38069N38069 | Pierce County, ND | Pierce County | 59700 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Pierce County | North Dakota | 0 |
| ND | 3807199999 | 38 | 71 | NCNTY38071N38071 | Ramsey County, ND | Ramsey County | 85900 | 18050 | 20600 | 23200 | 25750 | 27850 | 29900 | 31950 | 34000 | 9999 | Ramsey County | North Dakota | 0 |
| ND | 3807399999 | 38 | 73 | NCNTY38073N38073 | Ransom County, ND | Ransom County | 77300 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Ransom County | North Dakota | 0 |
| ND | 3807599999 | 38 | 75 | NCNTY38075N38075 | Renville County, ND | Renville County | 82300 | 17650 | 20200 | 22700 | 25200 | 27250 | 29250 | 31250 | 33300 | 9999 | Renville County | North Dakota | 0 |
| ND | 3807799999 | 38 | 77 | NCNTY38077N38077 | Richland County, ND | Richland County | 80700 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Richland County | North Dakota | 0 |
| ND | 3807999999 | 38 | 79 | NCNTY38079N38079 | Rolette County, ND | Rolette County | 47400 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Rolette County | North Dakota | 0 |
| ND | 3808199999 | 38 | 81 | NCNTY38081N38081 | Sargent County, ND | Sargent County | 87700 | 18450 | 21050 | 23700 | 26300 | 28450 | 30550 | 32650 | 34750 | 9999 | Sargent County | North Dakota | 0 |
| ND | 3808399999 | 38 | 83 | NCNTY38083N38083 | Sheridan County, ND | Sheridan County | 63500 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Sheridan County | North Dakota | 0 |
| ND | 3808599999 | 38 | 85 | METRO13900N38085 | Sioux County, ND HUD Metro FMR Area | Sioux County | 44600 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Sioux County | North Dakota | 1 |
| ND | 3808799999 | 38 | 87 | NCNTY38087N38087 | Slope County, ND | Slope County | 84000 | 17650 | 20200 | 22700 | 25200 | 27250 | 29250 | 31250 | 33300 | 9999 | Slope County | North Dakota | 0 |
| ND | 3808999999 | 38 | 89 | NCNTY38089N38089 | Stark County, ND | Stark County | 104300 | 21950 | 25050 | 28200 | 31300 | 33850 | 36350 | 38850 | 41350 | 9999 | Stark County | North Dakota | 0 |
| ND | 3809199999 | 38 | 91 | NCNTY38091N38091 | Steele County, ND | Steele County | 93100 | 18550 | 21200 | 23850 | 26500 | 28650 | 30750 | 32900 | 35000 | 9999 | Steele County | North Dakota | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ND | 3809399999 | 38 | 93 | NCNTY38093N38093 | Stutsman County, ND | Stutsman County | 78900 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Stutsman County | North Dakota | 0 |
| ND | 3809599999 | 38 | 95 | NCNTY38095N38095 | Towner County, ND | Towner County | 77800 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Towner County | North Dakota | 0 |
| ND | 3809799999 | 38 | 97 | NCNTY38097N38097 | Traill County, ND | Traill County | 88400 | 18550 | 21200 | 23850 | 26500 | 28650 | 30750 | 32900 | 35000 | 9999 | Traill County | North Dakota | 0 |
| ND | 3809999999 | 38 | 99 | NCNTY38099N38099 | Walsh County, ND | Walsh County | 68500 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Walsh County | North Dakota | 0 |
| ND | 3810199999 | 38 | 101 | NCNTY38101N38101 | Ward County, ND | Ward County | 90900 | 18800 | 21450 | 24150 | 26800 | 28950 | 31100 | 33250 | 35400 | 9999 | Ward County | North Dakota | 0 |
| ND | 3810399999 | 38 | 103 | NCNTY38103N38103 | Wells County, ND | Wells County | 77400 | 17600 | 20100 | 22600 | 25100 | 27150 | 29150 | 31150 | 33150 | 9999 | Wells County | North Dakota | 0 |
| ND | 3810599999 | 38 | 105 | NCNTY38105N38105 | Williams County, ND | Williams County | 107400 | 22350 | 25550 | 28750 | 31900 | 34500 | 37050 | 39600 | 42150 | 9999 | Williams County | North Dakota | 0 |
| OH | 3900199999 | 39 | 1 | NCNTY39001N39001 | Adams County, OH | Adams County | 47500 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Adams County | Ohio | 0 |
| OH | 3900399999 | 39 | 3 | METRO30620M30620 | Lima, OH MSA | Allen County | 67100 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 4320 | Allen County | Ohio | 1 |
| OH | 3900599999 | 39 | 5 | NCNTY39005N39005 | Ashland County, OH | Ashland County | 67200 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 9999 | Ashland County | Ohio | 0 |
| OH | 3900799999 | 39 | 7 | NCNTY39007N39007 | Ashtabula County, OH | Ashtabula County | 55600 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 1680 | Ashtabula County | Ohio | 0 |
| OH | 3900999999 | 39 | 9 | NCNTY39009N39009 | Athens County, OH | Athens County | 72000 | 14850 | 16950 | 19050 | 21150 | 22850 | 24550 | 26250 | 27950 | 9999 | Athens County | Ohio | 0 |
| OH | 3901199999 | 39 | 11 | NCNTY39011N39011 | Auglaize County, OH | Auglaize County | 76700 | 16100 | 18400 | 20700 | 23000 | 24850 | 26700 | 28550 | 30400 | 4320 | Auglaize County | Ohio | 0 |
| OH | 3901399999 | 39 | 13 | METRO48540M48540 | Wheeling, WV-OH MSA | Belmont County | 68900 | 14500 | 16550 | 18600 | 20650 | 22350 | 24000 | 25650 | 27300 | 9000 | Belmont County | Ohio | 1 |
| OH | 3901599999 | 39 | 15 | METRO17140MM1220 | Brown County, OH HUD Metro FMR Area | Brown County | 60200 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 1220 | Brown County | Ohio | 1 |
| OH | 3901799999 | 39 | 17 | METRO17140M17140 | Cincinnati, OH-KY-IN HUD Metro FMR Area | Butler County | 86300 | 18150 | 20750 | 23350 | 25900 | 28000 | 30050 | 32150 | 34200 | 3200 | Butler County | Ohio | 1 |
| OH | 3901999999 | 39 | 19 | METRO15940M15940 | Canton-Massillon, OH MSA | Carroll County | 69500 | 14600 | 16700 | 18800 | 20850 | 22550 | 24200 | 25900 | 27550 | 1320 | Carroll County | Ohio | 1 |
| OH | 3902199999 | 39 | 21 | NCNTY39021N39021 | Champaign County, OH | Champaign County | 68200 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Champaign County | Ohio | 0 |
| OH | 3902399999 | 39 | 23 | METRO44220M44220 | Springfield, OH MSA | Clark County | 61100 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 2000 | Clark County | Ohio | 1 |
| OH | 3902599999 | 39 | 25 | METRO17140M17140 | Cincinnati, OH-KY-IN HUD Metro FMR Area | Clermont County | 86300 | 18150 | 20750 | 23350 | 25900 | 28000 | 30050 | 32150 | 34200 | 1640 | Clermont County | Ohio | 1 |
| OH | 3902799999 | 39 | 27 | NCNTY39027N39027 | Clinton County, OH | Clinton County | 64600 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Clinton County | Ohio | 0 |
| OH | 3902999999 | 39 | 29 | NCNTY39029N39029 | Columbiana County, OH | Columbiana County | 56600 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9320 | Columbiana County | Ohio | 0 |
| OH | 3903199999 | 39 | 31 | NCNTY39031N39031 | Coshocton County, OH | Coshocton County | 56000 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Coshocton County | Ohio | 0 |
| OH | 3903399999 | 39 | 33 | NCNTY39033N39033 | Crawford County, OH | Crawford County | 56600 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 4800 | Crawford County | Ohio | 0 |
| OH | 3903599999 | 39 | 35 | METRO17460M17460 | Cleveland-Elyria, OH MSA | Cuyahoga County | 76000 | 16000 | 18250 | 20550 | 22800 | 24650 | 26450 | 28300 | 30100 | 1680 | Cuyahoga County | Ohio | 1 |
| OH | 3903799999 | 39 | 37 | NCNTY39037N39037 | Darke County, OH | Darke County | 64300 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Darke County | Ohio | 0 |
| OH | 3903999999 | 39 | 39 | NCNTY39039N39039 | Defiance County, OH | Defiance County | 68700 | 14450 | 16500 | 18550 | 20600 | 22250 | 23900 | 25550 | 27200 | 9999 | Defiance County | Ohio | 0 |
| OH | 3904199999 | 39 | 41 | METRO18140M18140 | Columbus, OH HUD Metro FMR Area | Delaware County | 84500 | 17700 | 20200 | 22750 | 25250 | 27300 | 29300 | 31350 | 33350 | 1840 | Delaware County | Ohio | 1 |
| OH | 3904399999 | 39 | 43 | NCNTY39043N39043 | Erie County, OH | Erie County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Erie County | Ohio | 0 |
| OH | 3904599999 | 39 | 45 | METRO18140M18140 | Columbus, OH HUD Metro FMR Area | Fairfield County | 84500 | 17700 | 20200 | 22750 | 25250 | 27300 | 29300 | 31350 | 33350 | 1840 | Fairfield County | Ohio | 1 |
| OH | 3904799999 | 39 | 47 | NCNTY39047N39047 | Fayette County, OH | Fayette County | 56300 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Fayette County | Ohio | 0 |
| OH | 3904999999 | 39 | 49 | METRO18140M18140 | Columbus, OH HUD Metro FMR Area | Franklin County | 84500 | 17700 | 20200 | 22750 | 25250 | 27300 | 29300 | 31350 | 33350 | 1840 | Franklin County | Ohio | 1 |
| OH | 3905199999 | 39 | 51 | METRO45780M45780 | Toledo, OH MSA | Fulton County | 71900 | 15100 | 17250 | 19400 | 21550 | 23300 | 25000 | 26750 | 28450 | 8400 | Fulton County | Ohio | 1 |
| OH | 3905399999 | 39 | 53 | NCNTY39053N39053 | Gallia County, OH | Gallia County | 61600 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Gallia County | Ohio | 0 |
| OH | 3905599999 | 39 | 55 | METRO17460M17460 | Cleveland-Elyria, OH MSA | Geauga County | 76000 | 16000 | 18250 | 20550 | 22800 | 24650 | 26450 | 28300 | 30100 | 1680 | Geauga County | Ohio | 1 |
| OH | 3905799999 | 39 | 57 | METRO19380M19380 | Dayton, OH MSA | Greene County | 72800 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 2000 | Greene County | Ohio | 1 |
| OH | 3905999999 | 39 | 59 | NCNTY39059N39059 | Guernsey County, OH | Guernsey County | 55200 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Guernsey County | Ohio | 0 |
| OH | 3906199999 | 39 | 61 | METRO17140M17140 | Cincinnati, OH-KY-IN HUD Metro FMR Area | Hamilton County | 86300 | 18150 | 20750 | 23350 | 25900 | 28000 | 30050 | 32150 | 34200 | 1640 | Hamilton County | Ohio | 1 |
| OH | 3906399999 | 39 | 63 | NCNTY39063N39063 | Hancock County, OH | Hancock County | 74600 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Hancock County | Ohio | 0 |
| OH | 3906599999 | 39 | 65 | NCNTY39065N39065 | Hardin County, OH | Hardin County | 63900 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Hardin County | Ohio | 0 |
| OH | 3906799999 | 39 | 67 | NCNTY39067N39067 | Harrison County, OH | Harrison County | 59100 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Harrison County | Ohio | 0 |
| OH | 3906999999 | 39 | 69 | NCNTY39069N39069 | Henry County, OH | Henry County | 73200 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Henry County | Ohio | 0 |
| OH | 3907199999 | 39 | 71 | NCNTY39071N39071 | Highland County, OH | Highland County | 55800 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Highland County | Ohio | 0 |
| OH | 3907399999 | 39 | 73 | METRO18140N39073 | Hocking County, OH HUD Metro FMR Area | Hocking County | 64300 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Hocking County | Ohio | 1 |
| OH | 3907599999 | 39 | 75 | NCNTY39075N39075 | Holmes County, OH | Holmes County | 69300 | 14600 | 16650 | 18750 | 20800 | 22500 | 24150 | 25800 | 27500 | 9999 | Holmes County | Ohio | 0 |
| OH | 3907799999 | 39 | 77 | NCNTY39077N39077 | Huron County, OH | Huron County | 62500 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Huron County | Ohio | 0 |
| OH | 3907999999 | 39 | 79 | NCNTY39079N39079 | Jackson County, OH | Jackson County | 52600 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Jackson County | Ohio | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OH | 3908199999 | 39 | 81 | METRO48260M48260 | Weirton-Steubenville, WV-OH MSA | Jefferson County | 62400 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 8080 | Jefferson County | Ohio | 1 |
| OH | 3908399999 | 39 | 83 | NCNTY39083N39083 | Knox County, OH | Knox County | 65500 | 13800 | 15750 | 17700 | 19650 | 21250 | 22800 | 24400 | 25950 | 9999 | Knox County | Ohio | 0 |
| OH | 3908599999 | 39 | 85 | METRO17460M17460 | Cleveland-Elyria, OH MSA | Lake County | 76000 | 16000 | 18250 | 20550 | 22800 | 24650 | 26450 | 28300 | 30100 | 1680 | Lake County | Ohio | 1 |
| OH | 3908799999 | 39 | 87 | METRO26580M26580 | Huntington-Ashland, WV-KY-OH HUD Metro FMR Area | Lawrence County | 59100 | 12450 | 14200 | 16000 | 17750 | 19200 | 20600 | 22050 | 23450 | 3400 | Lawrence County | Ohio | 1 |
| OH | 3908999999 | 39 | 89 | METRO18140M18140 | Columbus, OH HUD Metro FMR Area | Licking County | 84500 | 17700 | 20200 | 22750 | 25250 | 27300 | 29300 | 31350 | 33350 | 1840 | Licking County | Ohio | 1 |
| OH | 3909199999 | 39 | 91 | NCNTY39091N39091 | Logan County, OH | Logan County | 68900 | 14500 | 16550 | 18600 | 20650 | 22350 | 24000 | 25650 | 27300 | 9999 | Logan County | Ohio | 0 |
| OH | 3909399999 | 39 | 93 | METRO17460M17460 | Cleveland-Elyria, OH MSA | Lorain County | 76000 | 16000 | 18250 | 20550 | 22800 | 24650 | 26450 | 28300 | 30100 | 1680 | Lorain County | Ohio | 1 |
| OH | 3909599999 | 39 | 95 | METRO45780M45780 | Toledo, OH MSA | Lucas County | 71900 | 15100 | 17250 | 19400 | 21550 | 23300 | 25000 | 26750 | 28450 | 8400 | Lucas County | Ohio | 1 |
| OH | 3909799999 | 39 | 97 | METRO18140M18140 | Columbus, OH HUD Metro FMR Area | Madison County | 84500 | 17700 | 20200 | 22750 | 25250 | 27300 | 29300 | 31350 | 33350 | 1840 | Madison County | Ohio | 1 |
| OH | 3909999999 | 39 | 99 | METRO49660M49660 | Youngstown-Warren-Boardman, OH HUD Metro FMR Area | Mahoning County | 60700 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9320 | Mahoning County | Ohio | 1 |
| OH | 3910199999 | 39 | 101 | NCNTY39101N39101 | Marion County, OH | Marion County | 61100 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Marion County | Ohio | 0 |
| OH | 3910399999 | 39 | 103 | METRO17460M17460 | Cleveland-Elyria, OH MSA | Medina County | 76000 | 16000 | 18250 | 20550 | 22800 | 24650 | 26450 | 28300 | 30100 | 1680 | Medina County | Ohio | 1 |
| OH | 3910599999 | 39 | 105 | NCNTY39105N39105 | Meigs County, OH | Meigs County | 55000 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Meigs County | Ohio | 0 |
| OH | 3910799999 | 39 | 107 | NCNTY39107N39107 | Mercer County, OH | Mercer County | 72500 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Mercer County | Ohio | 0 |
| OH | 3910999999 | 39 | 109 | METRO19380M19380 | Dayton, OH MSA | Miami County | 72800 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 2000 | Miami County | Ohio | 1 |
| OH | 3911199999 | 39 | 111 | NCNTY39111N39111 | Monroe County, OH | Monroe County | 52900 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Monroe County | Ohio | 0 |
| OH | 3911399999 | 39 | 113 | METRO19380M19380 | Dayton, OH MSA | Montgomery County | 72800 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 2000 | Montgomery County | Ohio | 1 |
| OH | 3911599999 | 39 | 115 | NCNTY39115N39115 | Morgan County, OH | Morgan County | 50100 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Morgan County | Ohio | 0 |
| OH | 3911799999 | 39 | 117 | METRO18140M18140 | Columbus, OH HUD Metro FMR Area | Morrow County | 84500 | 17700 | 20200 | 22750 | 25250 | 27300 | 29300 | 31350 | 33350 | 9999 | Morrow County | Ohio | 1 |
| OH | 3911999999 | 39 | 119 | NCNTY39119N39119 | Muskingum County, OH | Muskingum County | 62200 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Muskingum County | Ohio | 0 |
| OH | 3912199999 | 39 | 121 | NCNTY39121N39121 | Noble County, OH | Noble County | 58600 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Noble County | Ohio | 0 |
| OH | 3912399999 | 39 | 123 | NCNTY39123N39123 | Ottawa County, OH | Ottawa County | 73400 | 15400 | 17600 | 19800 | 22000 | 23800 | 25550 | 27300 | 29050 | 9999 | Ottawa County | Ohio | 0 |
| OH | 3912599999 | 39 | 125 | NCNTY39125N39125 | Paulding County, OH | Paulding County | 67000 | 14100 | 16100 | 18100 | 20100 | 21750 | 23350 | 24950 | 26550 | 9999 | Paulding County | Ohio | 0 |
| OH | 3912799999 | 39 | 127 | METRO18140N39127 | Perry County, OH HUD Metro FMR Area | Perry County | 56600 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Perry County | Ohio | 1 |
| OH | 3912999999 | 39 | 129 | METRO18140M18140 | Columbus, OH HUD Metro FMR Area | Pickaway County | 84500 | 17700 | 20200 | 22750 | 25250 | 27300 | 29300 | 31350 | 33350 | 1840 | Pickaway County | Ohio | 1 |
| OH | 3913199999 | 39 | 131 | NCNTY39131N39131 | Pike County, OH | Pike County | 57400 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Pike County | Ohio | 0 |
| OH | 3913399999 | 39 | 133 | METRO10420M10420 | Akron, OH MSA | Portage County | 76300 | 16050 | 18350 | 20650 | 22900 | 24750 | 26600 | 28400 | 30250 | 80 | Portage County | Ohio | 1 |
| OH | 3913599999 | 39 | 135 | NCNTY39135N39135 | Preble County, OH | Preble County | 67100 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 9999 | Preble County | Ohio | 0 |
| OH | 3913799999 | 39 | 137 | NCNTY39137N39137 | Putnam County, OH | Putnam County | 77200 | 16250 | 18550 | 20850 | 23150 | 25050 | 26900 | 28750 | 30600 | 9999 | Putnam County | Ohio | 0 |
| OH | 3913999999 | 39 | 139 | METRO31900M31900 | Mansfield, OH MSA | Richland County | 66300 | 13950 | 15950 | 17950 | 19900 | 21500 | 23100 | 24700 | 26300 | 4800 | Richland County | Ohio | 1 |
| OH | 3914199999 | 39 | 141 | NCNTY39141N39141 | Ross County, OH | Ross County | 62900 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Ross County | Ohio | 0 |
| OH | 3914399999 | 39 | 143 | NCNTY39143N39143 | Sandusky County, OH | Sandusky County | 63500 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Sandusky County | Ohio | 0 |
| OH | 3914599999 | 39 | 145 | NCNTY39145N39145 | Scioto County, OH | Scioto County | 59300 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Scioto County | Ohio | 0 |
| OH | 3914799999 | 39 | 147 | NCNTY39147N39147 | Seneca County, OH | Seneca County | 63400 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Seneca County | Ohio | 0 |
| OH | 3914999999 | 39 | 149 | NCNTY39149N39149 | Shelby County, OH | Shelby County | 74900 | 15750 | 18000 | 20250 | 22450 | 24250 | 26050 | 27850 | 29650 | 9999 | Shelby County | Ohio | 0 |
| OH | 3915199999 | 39 | 151 | METRO15940M15940 | Canton-Massillon, OH MSA | Stark County | 69500 | 14600 | 16700 | 18800 | 20850 | 22550 | 24200 | 25900 | 27550 | 1320 | Stark County | Ohio | 1 |
| OH | 3915399999 | 39 | 153 | METRO10420M10420 | Akron, OH MSA | Summit County | 76300 | 16050 | 18350 | 20650 | 22900 | 24750 | 26600 | 28400 | 30250 | 80 | Summit County | Ohio | 1 |
| OH | 3915599999 | 39 | 155 | METRO49660M49660 | Youngstown-Warren-Boardman, OH HUD Metro FMR Area | Trumbull County | 60700 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9320 | Trumbull County | Ohio | 1 |
| OH | 3915799999 | 39 | 157 | NCNTY39157N39157 | Tuscarawas County, OH | Tuscarawas County | 65100 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Tuscarawas County | Ohio | 0 |
| OH | 3915999999 | 39 | 159 | METRO18140N39159 | Union County, OH HUD Metro FMR Area | Union County | 95600 | 19800 | 22600 | 25450 | 28250 | 30550 | 32800 | 35050 | 37300 | 9999 | Union County | Ohio | 1 |
| OH | 3916199999 | 39 | 161 | NCNTY39161N39161 | Van Wert County, OH | Van Wert County | 64500 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Van Wert County | Ohio | 0 |
| OH | 3916399999 | 39 | 163 | NCNTY39163N39163 | Vinton County, OH | Vinton County | 55700 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Vinton County | Ohio | 0 |
| OH | 3916599999 | 39 | 165 | METRO17140M17140 | Cincinnati, OH-KY-IN HUD Metro FMR Area | Warren County | 86300 | 18150 | 20750 | 23350 | 25900 | 28000 | 30050 | 32150 | 34200 | 1640 | Warren County | Ohio | 1 |
| OH | 3916799999 | 39 | 167 | NCNTY39167N39167 | Washington County, OH | Washington County | 63800 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 6020 | Washington County | Ohio | 0 |
| OH | 3916999999 | 39 | 169 | NCNTY39169N39169 | Wayne County, OH | Wayne County | 70300 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 9999 | Wayne County | Ohio | 0 |
| OH | 3917199999 | 39 | 171 | NCNTY39171N39171 | Williams County, OH | Williams County | 61100 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Williams County | Ohio | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OH | 3917399999 | 39 | 173 | METRO45780M45780 | Toledo, OH MSA | Wood County | 71900 | 15100 | 17250 | 19400 | 21550 | 23300 | 25000 | 26750 | 28450 | 8400 | Wood County | Ohio | 1 |
| OH | 3917599999 | 39 | 175 | NCNTY39175N39175 | Wyandot County, OH | Wyandot County | 64000 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Wyandot County | Ohio | 0 |
| OK | 4000199999 | 40 | 1 | NCNTY40001N40001 | Adair County, OK | Adair County | 43800 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Adair County | Oklahoma | 0 |
| OK | 4000399999 | 40 | 3 | NCNTY40003N40003 | Alfalfa County, OK | Alfalfa County | 71600 | 15050 | 17200 | 19350 | 21450 | 23200 | 24900 | 26600 | 28350 | 9999 | Alfalfa County | Oklahoma | 0 |
| OK | 4000599999 | 40 | 5 | NCNTY40005N40005 | Atoka County, OK | Atoka County | 48600 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Atoka County | Oklahoma | 0 |
| OK | 4000799999 | 40 | 7 | NCNTY40007N40007 | Beaver County, OK | Beaver County | 64100 | 13500 | 15400 | 17350 | 19250 | 20800 | 22350 | 23900 | 25450 | 9999 | Beaver County | Oklahoma | 0 |
| OK | 4000999999 | 40 | 9 | NCNTY40009N40009 | Beckham County, OK | Beckham County | 66200 | 13900 | 15900 | 17900 | 19850 | 21450 | 23050 | 24650 | 26250 | 9999 | Beckham County | Oklahoma | 0 |
| OK | 4001199999 | 40 | 11 | NCNTY40011N40011 | Blaine County, OK | Blaine County | 62400 | 13100 | 15000 | 16850 | 18700 | 20200 | 21700 | 23200 | 24700 | 9999 | Blaine County | Oklahoma | 0 |
| OK | 4001399999 | 40 | 13 | NCNTY40013N40013 | Bryan County, OK | Bryan County | 55900 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Bryan County | Oklahoma | 0 |
| OK | 4001599999 | 40 | 15 | NCNTY40015N40015 | Caddo County, OK | Caddo County | 55900 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Caddo County | Oklahoma | 0 |
| OK | 4001799999 | 40 | 17 | METRO36420M36420 | Oklahoma City, OK HUD Metro FMR Area | Canadian County | 74400 | 15650 | 17850 | 20100 | 22300 | 24100 | 25900 | 27700 | 29450 | 5880 | Canadian County | Oklahoma | 1 |
| OK | 4001999999 | 40 | 19 | NCNTY40019N40019 | Carter County, OK | Carter County | 62700 | 13200 | 15050 | 16950 | 18800 | 20350 | 21850 | 23350 | 24850 | 9999 | Carter County | Oklahoma | 0 |
| OK | 4002199999 | 40 | 21 | NCNTY40021N40021 | Cherokee County, OK | Cherokee County | 54900 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Cherokee County | Oklahoma | 0 |
| OK | 4002399999 | 40 | 23 | NCNTY40023N40023 | Choctaw County, OK | Choctaw County | 45300 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Choctaw County | Oklahoma | 0 |
| OK | 4002599999 | 40 | 25 | NCNTY40025N40025 | Cimarron County, OK | Cimarron County | 59900 | 12600 | 14400 | 16200 | 17950 | 19400 | 20850 | 22300 | 23700 | 9999 | Cimarron County | Oklahoma | 0 |
| OK | 4002799999 | 40 | 27 | METRO36420M36420 | Oklahoma City, OK HUD Metro FMR Area | Cleveland County | 74400 | 15650 | 17850 | 20100 | 22300 | 24100 | 25900 | 27700 | 29450 | 5880 | Cleveland County | Oklahoma | 1 |
| OK | 4002999999 | 40 | 29 | NCNTY40029N40029 | Coal County, OK | Coal County | 61100 | 12850 | 14700 | 16550 | 18350 | 19850 | 21300 | 22800 | 24250 | 9999 | Coal County | Oklahoma | 0 |
| OK | 4003199999 | 40 | 31 | METRO30020M30020 | Lawton, OK HUD Metro FMR Area | Comanche County | 67100 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 4200 | Comanche County | Oklahoma | 1 |
| OK | 4003399999 | 40 | 33 | METRO30020N40033 | Cotton County, OK HUD Metro FMR Area | Cotton County | 60200 | 12650 | 14450 | 16250 | 18050 | 19500 | 20950 | 22400 | 23850 | 9999 | Cotton County | Oklahoma | 1 |
| OK | 4003599999 | 40 | 35 | NCNTY40035N40035 | Craig County, OK | Craig County | 50900 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Craig County | Oklahoma | 0 |
| OK | 4003799999 | 40 | 37 | METRO46140M46140 | Tulsa, OK HUD Metro FMR Area | Creek County | 68600 | 14450 | 16500 | 18550 | 20600 | 22250 | 23900 | 25550 | 27200 | 8560 | Creek County | Oklahoma | 1 |
| OK | 4003999999 | 40 | 39 | NCNTY40039N40039 | Custer County, OK | Custer County | 60000 | 12600 | 14400 | 16200 | 18000 | 19450 | 20900 | 22350 | 23800 | 9999 | Custer County | Oklahoma | 0 |
| OK | 4004199999 | 40 | 41 | NCNTY40041N40041 | Delaware County, OK | Delaware County | 50000 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Delaware County | Oklahoma | 0 |
| OK | 4004399999 | 40 | 43 | NCNTY40043N40043 | Dewey County, OK | Dewey County | 65100 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Dewey County | Oklahoma | 0 |
| OK | 4004599999 | 40 | 45 | NCNTY40045N40045 | Ellis County, OK | Ellis County | 66700 | 14500 | 16600 | 18650 | 20700 | 22400 | 24050 | 25700 | 27350 | 9999 | Ellis County | Oklahoma | 0 |
| OK | 4004799999 | 40 | 47 | METRO21420M21420 | Enid, OK MSA | Garfield County | 65200 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 2340 | Garfield County | Oklahoma | 1 |
| OK | 4004999999 | 40 | 49 | NCNTY40049N40049 | Garvin County, OK | Garvin County | 57000 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Garvin County | Oklahoma | 0 |
| OK | 4005199999 | 40 | 51 | METRO36420N40051 | Grady County, OK HUD Metro FMR Area | Grady County | 69800 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Grady County | Oklahoma | 1 |
| OK | 4005399999 | 40 | 53 | NCNTY40053N40053 | Grant County, OK | Grant County | 68600 | 14450 | 16500 | 18550 | 20600 | 22250 | 23900 | 25550 | 27200 | 9999 | Grant County | Oklahoma | 0 |
| OK | 4005599999 | 40 | 55 | NCNTY40055N40055 | Greer County, OK | Greer County | 55300 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Greer County | Oklahoma | 0 |
| OK | 4005799999 | 40 | 57 | NCNTY40057N40057 | Harmon County, OK | Harmon County | 54900 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Harmon County | Oklahoma | 0 |
| OK | 4005999999 | 40 | 59 | NCNTY40059N40059 | Harper County, OK | Harper County | 66000 | 13900 | 15850 | 17850 | 19800 | 21400 | 23000 | 24600 | 26150 | 9999 | Harper County | Oklahoma | 0 |
| OK | 4006199999 | 40 | 61 | NCNTY40061N40061 | Haskell County, OK | Haskell County | 53600 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Haskell County | Oklahoma | 0 |
| OK | 4006399999 | 40 | 63 | NCNTY40063N40063 | Hughes County, OK | Hughes County | 53300 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Hughes County | Oklahoma | 0 |
| OK | 4006599999 | 40 | 65 | NCNTY40065N40065 | Jackson County, OK | Jackson County | 57700 | 12150 | 13850 | 15600 | 17300 | 18700 | 20100 | 21500 | 22850 | 9999 | Jackson County | Oklahoma | 0 |
| OK | 4006799999 | 40 | 67 | NCNTY40067N40067 | Jefferson County, OK | Jefferson County | 47000 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Jefferson County | Oklahoma | 0 |
| OK | 4006999999 | 40 | 69 | NCNTY40069N40069 | Johnston County, OK | Johnston County | 52200 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Johnston County | Oklahoma | 0 |
| OK | 4007199999 | 40 | 71 | NCNTY40071N40071 | Kay County, OK | Kay County | 58600 | 12350 | 14100 | 15850 | 17600 | 19050 | 20450 | 21850 | 23250 | 9999 | Kay County | Oklahoma | 0 |
| OK | 4007399999 | 40 | 73 | NCNTY40073N40073 | Kingfisher County, OK | Kingfisher County | 75500 | 15900 | 18150 | 20400 | 22650 | 24500 | 26300 | 28100 | 29900 | 9999 | Kingfisher County | Oklahoma | 0 |
| OK | 4007599999 | 40 | 75 | NCNTY40075N40075 | Kiowa County, OK | Kiowa County | 53100 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Kiowa County | Oklahoma | 0 |
| OK | 4007799999 | 40 | 77 | NCNTY40077N40077 | Latimer County, OK | Latimer County | 53600 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Latimer County | Oklahoma | 0 |
| OK | 4007999999 | 40 | 79 | METRO22900N40079 | Le Flore County, OK HUD Metro FMR Area | Le Flore County | 51100 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Le Flore County | Oklahoma | 1 |
| OK | 4008199999 | 40 | 81 | METRO36420N40081 | Lincoln County, OK HUD Metro FMR Area | Lincoln County | 61600 | 12950 | 14800 | 16650 | 18500 | 20000 | 21500 | 22950 | 24450 | 9999 | Lincoln County | Oklahoma | 1 |
| OK | 4008399999 | 40 | 83 | METRO36420M36420 | Oklahoma City, OK HUD Metro FMR Area | Logan County | 74400 | 15650 | 17850 | 20100 | 22300 | 24100 | 25900 | 27700 | 29450 | 5880 | Logan County | Oklahoma | 1 |
| OK | 4008599999 | 40 | 85 | NCNTY40085N40085 | Love County, OK | Love County | 60200 | 12650 | 14450 | 16250 | 18050 | 19500 | 20950 | 22400 | 23850 | 9999 | Love County | Oklahoma | 0 |
| OK | 4008799999 | 40 | 87 | METRO36420M36420 | Oklahoma City, OK HUD Metro FMR Area | McClain County | 74400 | 15650 | 17850 | 20100 | 22300 | 24100 | 25900 | 27700 | 29450 | 5880 | McClain County | Oklahoma | 1 |
| OK | 4008999999 | 40 | 89 | NCNTY40089N40089 | McCurtain County, OK | McCurtain County | 45900 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | McCurtain County | Oklahoma | 0 |
| OK | 4009199999 | 40 | 91 | NCNTY40091N40091 | McIntosh County, OK | McIntosh County | 52200 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | McIntosh County | Oklahoma | 0 |
| OK | 4009399999 | 40 | 93 | NCNTY40093N40093 | Major County, OK | Major County | 68000 | 14300 | 16350 | 18400 | 20400 | 22050 | 23700 | 25300 | 26950 | 9999 | Major County | Oklahoma | 0 |
| OK | 4009599999 | 40 | 95 | NCNTY40095N40095 | Marshall County, OK | Marshall County | 56800 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Marshall County | Oklahoma | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OK | 4009799999 | 40 | 97 | NCNTY40097N40097 | Mayes County, OK | Mayes County | 59200 | 12450 | 14200 | 16000 | 17750 | 19200 | 20600 | 22050 | 23450 | 9999 | Mayes County | Oklahoma | 0 |
| OK | 4009999999 | 40 | 99 | NCNTY40099N40099 | Murray County, OK | Murray County | 65300 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Murray County | Oklahoma | 0 |
| OK | 4010199999 | 40 | 101 | NCNTY40101N40101 | Muskogee County, OK | Muskogee County | 49400 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Muskogee County | Oklahoma | 0 |
| OK | 4010399999 | 40 | 103 | NCNTY40103N40103 | Noble County, OK | Noble County | 68000 | 14300 | 16350 | 18400 | 20400 | 22050 | 23700 | 25300 | 26950 | 9999 | Noble County | Oklahoma | 0 |
| OK | 4010599999 | 40 | 105 | NCNTY40105N40105 | Nowata County, OK | Nowata County | 53200 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Nowata County | Oklahoma | 0 |
| OK | 4010799999 | 40 | 107 | NCNTY40107N40107 | Okfuskee County, OK | Okfuskee County | 50200 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Okfuskee County | Oklahoma | 0 |
| OK | 4010999999 | 40 | 109 | METRO36420M36420 | Oklahoma City, OK HUD Metro FMR Area | Oklahoma County | 74400 | 15650 | 17850 | 20100 | 22300 | 24100 | 25900 | 27700 | 29450 | 5880 | Oklahoma County | Oklahoma | 1 |
| OK | 4011199999 | 40 | 111 | METRO46140N40111 | Okmulgee County, OK HUD Metro FMR Area | Okmulgee County | 53300 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Okmulgee County | Oklahoma | 1 |
| OK | 4011399999 | 40 | 113 | METRO46140M46140 | Tulsa, OK HUD Metro FMR Area | Osage County | 68600 | 14450 | 16500 | 18550 | 20600 | 22250 | 23900 | 25550 | 27200 | 8560 | Osage County | Oklahoma | 1 |
| OK | 4011599999 | 40 | 115 | NCNTY40115N40115 | Ottawa County, OK | Ottawa County | 49900 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Ottawa County | Oklahoma | 0 |
| OK | 4011799999 | 40 | 117 | METRO46140N40117 | Pawnee County, OK HUD Metro FMR Area | Pawnee County | 57600 | 12150 | 13850 | 15600 | 17300 | 18700 | 20100 | 21500 | 22850 | 9999 | Pawnee County | Oklahoma | 1 |
| OK | 4011999999 | 40 | 119 | NCNTY40119N40119 | Payne County, OK | Payne County | 62200 | 13100 | 14950 | 16800 | 18650 | 20150 | 21650 | 23150 | 24650 | 9999 | Payne County | Oklahoma | 0 |
| OK | 4012199999 | 40 | 121 | NCNTY40121N40121 | Pittsburg County, OK | Pittsburg County | 60700 | 12750 | 14600 | 16400 | 18200 | 19700 | 21150 | 22600 | 24050 | 9999 | Pittsburg County | Oklahoma | 0 |
| OK | 4012399999 | 40 | 123 | NCNTY40123N40123 | Pontotoc County, OK | Pontotoc County | 62900 | 13200 | 15100 | 17000 | 18850 | 20400 | 21900 | 23400 | 24900 | 9999 | Pontotoc County | Oklahoma | 0 |
| OK | 4012599999 | 40 | 125 | NCNTY40125N40125 | Pottawatomie County, OK | Pottawatomie County | 65300 | 12950 | 14800 | 16650 | 18450 | 19950 | 21450 | 22900 | 24400 | 5880 | Pottawatomie County | Oklahoma | 0 |
| OK | 4012799999 | 40 | 127 | NCNTY40127N40127 | Pushmataha County, OK | Pushmataha County | 48800 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Pushmataha County | Oklahoma | 0 |
| OK | 4012999999 | 40 | 129 | NCNTY40129N40129 | Roger Mills County, OK | Roger Mills County | 66100 | 13900 | 15900 | 17900 | 19850 | 21450 | 23050 | 24650 | 26250 | 9999 | Roger Mills County | Oklahoma | 0 |
| OK | 4013199999 | 40 | 131 | METRO46140M46140 | Tulsa, OK HUD Metro FMR Area | Rogers County | 68600 | 14450 | 16500 | 18550 | 20600 | 22250 | 23900 | 25550 | 27200 | 8560 | Rogers County | Oklahoma | 1 |
| OK | 4013399999 | 40 | 133 | NCNTY40133N40133 | Seminole County, OK | Seminole County | 50400 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Seminole County | Oklahoma | 0 |
| OK | 4013599999 | 40 | 135 | METRO22900M22900 | Fort Smith, AR-OK HUD Metro FMR Area | Sequoyah County | 54200 | 11400 | 13000 | 14650 | 16250 | 17550 | 18850 | 20150 | 21450 | 2720 | Sequoyah County | Oklahoma | 1 |
| OK | 4013799999 | 40 | 137 | NCNTY40137N40137 | Stephens County, OK | Stephens County | 61800 | 13000 | 14850 | 16700 | 18550 | 20050 | 21550 | 23050 | 24500 | 9999 | Stephens County | Oklahoma | 0 |
| OK | 4013999999 | 40 | 139 | NCNTY40139N40139 | Texas County, OK | Texas County | 64100 | 13500 | 15400 | 17350 | 19250 | 20800 | 22350 | 23900 | 25450 | 9999 | Texas County | Oklahoma | 0 |
| OK | 4014199999 | 40 | 141 | NCNTY40141N40141 | Tillman County, OK | Tillman County | 52700 | 12050 | 13750 | 15450 | 17150 | 18550 | 19900 | 21300 | 22650 | 9999 | Tillman County | Oklahoma | 0 |
| OK | 4014399999 | 40 | 143 | METRO46140M46140 | Tulsa, OK HUD Metro FMR Area | Tulsa County | 68600 | 14450 | 16500 | 18550 | 20600 | 22250 | 23900 | 25550 | 27200 | 8560 | Tulsa County | Oklahoma | 1 |
| OK | 4014599999 | 40 | 145 | METRO46140M46140 | Tulsa, OK HUD Metro FMR Area | Wagoner County | 68600 | 14450 | 16500 | 18550 | 20600 | 22250 | 23900 | 25550 | 27200 | 8560 | Wagoner County | Oklahoma | 1 |
| OK | 4014799999 | 40 | 147 | NCNTY40147N40147 | Washington County, OK | Washington County | 65800 | 13850 | 15800 | 17800 | 19750 | 21350 | 22950 | 24500 | 26100 | 9999 | Washington County | Oklahoma | 0 |
| OK | 4014999999 | 40 | 149 | NCNTY40149N40149 | Washita County, OK | Washita County | 63800 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Washita County | Oklahoma | 0 |
| OK | 4015199999 | 40 | 151 | NCNTY40151N40151 | Woods County, OK | Woods County | 84300 | 17750 | 20250 | 22800 | 25300 | 27350 | 29350 | 31400 | 33400 | 9999 | Woods County | Oklahoma | 0 |
| OK | 4015399999 | 40 | 153 | NCNTY40153N40153 | Woodward County, OK | Woodward County | 74900 | 15750 | 18000 | 20250 | 22450 | 24250 | 26050 | 27850 | 29650 | 9999 | Woodward County | Oklahoma | 0 |
| OR | 4100199999 | 41 | 1 | NCNTY41001N41001 | Baker County, OR | Baker County | 58100 | 12900 | 14750 | 16600 | 18400 | 19900 | 21350 | 22850 | 24300 | 9999 | Baker County | Oregon | 0 |
| OR | 4100399999 | 41 | 3 | METRO18700M18700 | Corvallis, OR MSA | Benton County | 81000 | 17050 | 19450 | 21900 | 24300 | 26250 | 28200 | 30150 | 32100 | 1890 | Benton County | Oregon | 1 |
| OR | 4100599999 | 41 | 5 | METRO38900M38900 | Portland-Vancouver-Hillsboro, OR-WA MSA | Clackamas County | 92100 | 19400 | 22150 | 24900 | 27650 | 29900 | 32100 | 34300 | 36500 | 6440 | Clackamas County | Oregon | 1 |
| OR | 4100799999 | 41 | 7 | NCNTY41007N41007 | Clatsop County, OR | Clatsop County | 70600 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Clatsop County | Oregon | 0 |
| OR | 4100999999 | 41 | 9 | METRO38900M38900 | Portland-Vancouver-Hillsboro, OR-WA MSA | Columbia County | 92100 | 19400 | 22150 | 24900 | 27650 | 29900 | 32100 | 34300 | 36500 | 6440 | Columbia County | Oregon | 1 |
| OR | 4101199999 | 41 | 11 | NCNTY41011N41011 | Coos County, OR | Coos County | 53400 | 12900 | 14750 | 16600 | 18400 | 19900 | 21350 | 22850 | 24300 | 9999 | Coos County | Oregon | 0 |
| OR | 4101399999 | 41 | 13 | NCNTY41013N41013 | Crook County, OR | Crook County | 60500 | 12900 | 14750 | 16600 | 18400 | 19900 | 21350 | 22850 | 24300 | 9999 | Crook County | Oregon | 0 |
| OR | 4101599999 | 41 | 15 | NCNTY41015N41015 | Curry County, OR | Curry County | 59200 | 12900 | 14750 | 16600 | 18400 | 19900 | 21350 | 22850 | 24300 | 9999 | Curry County | Oregon | 0 |
| OR | 4101799999 | 41 | 17 | METRO13460M13460 | Bend-Redmond, OR MSA | Deschutes County | 76600 | 16100 | 18400 | 20700 | 23000 | 24850 | 26700 | 28550 | 30400 | 9999 | Deschutes County | Oregon | 1 |
| OR | 4101999999 | 41 | 19 | NCNTY41019N41019 | Douglas County, OR | Douglas County | 59600 | 13150 | 15000 | 16900 | 18750 | 20250 | 21750 | 23250 | 24750 | 9999 | Douglas County | Oregon | 0 |
| OR | 4102199999 | 41 | 21 | NCNTY41021N41021 | Gilliam County, OR | Gilliam County | 59100 | 12900 | 14750 | 16600 | 18400 | 19900 | 21350 | 22850 | 24300 | 9999 | Gilliam County | Oregon | 0 |
| OR | 4102399999 | 41 | 23 | NCNTY41023N41023 | Grant County, OR | Grant County | 60800 | 12900 | 14750 | 16600 | 18400 | 19900 | 21350 | 22850 | 24300 | 9999 | Grant County | Oregon | 0 |
| OR | 4102599999 | 41 | 25 | NCNTY41025N41025 | Harney County, OR | Harney County | 53300 | 12900 | 14750 | 16600 | 18400 | 19900 | 21350 | 22850 | 24300 | 9999 | Harney County | Oregon | 0 |
| OR | 4102799999 | 41 | 27 | NCNTY41027N41027 | Hood River County, OR | Hood River County | 71700 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Hood River County | Oregon | 0 |
| OR | 4102999999 | 41 | 29 | METRO32780M32780 | Medford, OR MSA | Jackson County | 65100 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 4890 | Jackson County | Oregon | 1 |
| OR | 4103199999 | 41 | 31 | NCNTY41031N41031 | Jefferson County, OR | Jefferson County | 60700 | 12900 | 14750 | 16600 | 18400 | 19900 | 21350 | 22850 | 24300 | 9999 | Jefferson County | Oregon | 0 |
| OR | 4103399999 | 41 | 33 | METRO24420M24420 | Grants Pass, OR MSA | Josephine County | 57800 | 13050 | 14900 | 16750 | 18600 | 20100 | 21600 | 23100 | 24600 | 9999 | Josephine County | Oregon | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OR | 4103599999 | 41 | 35 | NCNTY41035N41035 | Klamath County, OR | Klamath County | 53100 | 12900 | 14750 | 16600 | 18400 | 19900 | 21350 | 22850 | 24300 | 9999 | Klamath County | Oregon | 0 |
| OR | 4103799999 | 41 | 37 | NCNTY41037N41037 | Lake County, OR | Lake County | 44700 | 12900 | 14750 | 16600 | 18400 | 19900 | 21350 | 22850 | 24300 | 9999 | Lake County | Oregon | 0 |
| OR | 4103999999 | 41 | 39 | METRO21660M21660 | Eugene-Springfield, OR MSA | Lane County | 72200 | 14700 | 16800 | 18900 | 21000 | 22700 | 24400 | 26050 | 27750 | 2400 | Lane County | Oregon | 1 |
| OR | 4104199999 | 41 | 41 | NCNTY41041N41041 | Lincoln County, OR | Lincoln County | 55800 | 12900 | 14750 | 16600 | 18400 | 19900 | 21350 | 22850 | 24300 | 9999 | Lincoln County | Oregon | 0 |
| OR | 4104399999 | 41 | 43 | METRO10540M10540 | Albany, OR MSA | Linn County | 64500 | 13550 | 15500 | 17450 | 19350 | 20900 | 22450 | 24000 | 25550 | 9999 | Linn County | Oregon | 1 |
| OR | 4104599999 | 41 | 45 | NCNTY41045N41045 | Malheur County, OR | Malheur County | 49500 | 12900 | 14750 | 16600 | 18400 | 19900 | 21350 | 22850 | 24300 | 9999 | Malheur County | Oregon | 0 |
| OR | 4104799999 | 41 | 47 | METRO41420M41420 | Salem, OR MSA | Marion County | 70600 | 14850 | 17000 | 19100 | 21200 | 22900 | 24600 | 26300 | 28000 | 7080 | Marion County | Oregon | 1 |
| OR | 4104999999 | 41 | 49 | NCNTY41049N41049 | Morrow County, OR | Morrow County | 63200 | 13300 | 15200 | 17100 | 18950 | 20500 | 22000 | 23500 | 25050 | 9999 | Morrow County | Oregon | 0 |
| OR | 4105199999 | 41 | 51 | METRO38900M38900 | Portland-Vancouver-Hillsboro, OR-WA MSA | Multnomah County | 92100 | 19400 | 22150 | 24900 | 27650 | 29900 | 32100 | 34300 | 36500 | 6440 | Multnomah County | Oregon | 1 |
| OR | 4105399999 | 41 | 53 | METRO41420M41420 | Salem, OR MSA | Polk County | 70600 | 14850 | 17000 | 19100 | 21200 | 22900 | 24600 | 26300 | 28000 | 7080 | Polk County | Oregon | 1 |
| OR | 4105599999 | 41 | 55 | NCNTY41055N41055 | Sherman County, OR | Sherman County | 69500 | 14600 | 16700 | 18800 | 20850 | 22550 | 24200 | 25900 | 27550 | 9999 | Sherman County | Oregon | 0 |
| OR | 4105799999 | 41 | 57 | NCNTY41057N41057 | Tillamook County, OR | Tillamook County | 58500 | 12900 | 14750 | 16600 | 18400 | 19900 | 21350 | 22850 | 24300 | 9999 | Tillamook County | Oregon | 0 |
| OR | 4105999999 | 41 | 59 | NCNTY41059N41059 | Umatilla County, OR | Umatilla County | 65300 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Umatilla County | Oregon | 0 |
| OR | 4106199999 | 41 | 61 | NCNTY41061N41061 | Union County, OR | Union County | 58900 | 12900 | 14750 | 16600 | 18400 | 19900 | 21350 | 22850 | 24300 | 9999 | Union County | Oregon | 0 |
| OR | 4106399999 | 41 | 63 | NCNTY41063N41063 | Wallowa County, OR | Wallowa County | 64400 | 13400 | 15300 | 17200 | 19100 | 20650 | 22200 | 23700 | 25250 | 9999 | Wallowa County | Oregon | 0 |
| OR | 4106599999 | 41 | 65 | NCNTY41065N41065 | Wasco County, OR | Wasco County | 58900 | 14000 | 16000 | 18000 | 20000 | 21600 | 23200 | 24800 | 26400 | 9999 | Wasco County | Oregon | 0 |
| OR | 4106799999 | 41 | 67 | METRO38900M38900 | Portland-Vancouver-Hillsboro, OR-WA MSA | Washington County | 92100 | 19400 | 22150 | 24900 | 27650 | 29900 | 32100 | 34300 | 36500 | 6440 | Washington County | Oregon | 1 |
| OR | 4106999999 | 41 | 69 | NCNTY41069N41069 | Wheeler County, OR | Wheeler County | 53100 | 12900 | 14750 | 16600 | 18400 | 19900 | 21350 | 22850 | 24300 | 9999 | Wheeler County | Oregon | 0 |
| OR | 4107199999 | 41 | 71 | METRO38900M38900 | Portland-Vancouver-Hillsboro, OR-WA MSA | Yamhill County | 92100 | 19400 | 22150 | 24900 | 27650 | 29900 | 32100 | 34300 | 36500 | 6440 | Yamhill County | Oregon | 1 |
| PA | 4200199999 | 42 | 1 | METRO23900M23900 | Gettysburg, PA MSA | Adams County | 85800 | 18000 | 20600 | 23150 | 25700 | 27800 | 29850 | 31900 | 33950 | 9999 | Adams County | Pennsylvania | 1 |
| PA | 4200399999 | 42 | 3 | METRO38300M38300 | Pittsburgh, PA HUD Metro FMR Area | Allegheny County | 83000 | 17450 | 19950 | 22450 | 24900 | 26900 | 28900 | 30900 | 32900 | 6280 | Allegheny County | Pennsylvania | 1 |
| PA | 4200599999 | 42 | 5 | METRO38300N42005 | Armstrong County, PA HUD Metro FMR Area | Armstrong County | 64700 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9999 | Armstrong County | Pennsylvania | 1 |
| PA | 4200799999 | 42 | 7 | METRO38300M38300 | Pittsburgh, PA HUD Metro FMR Area | Beaver County | 83000 | 17450 | 19950 | 22450 | 24900 | 26900 | 28900 | 30900 | 32900 | 6280 | Beaver County | Pennsylvania | 1 |
| PA | 4200999999 | 42 | 9 | NCNTY42009N42009 | Bedford County, PA | Bedford County | 61700 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9999 | Bedford County | Pennsylvania | 0 |
| PA | 4201199999 | 42 | 11 | METRO39740M39740 | Reading, PA MSA | Berks County | 78600 | 16550 | 18900 | 21250 | 23600 | 25500 | 27400 | 29300 | 31200 | 6680 | Berks County | Pennsylvania | 1 |
| PA | 4201399999 | 42 | 13 | METRO11020M11020 | Altoona, PA MSA | Blair County | 60000 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 280 | Blair County | Pennsylvania | 1 |
| PA | 4201599999 | 42 | 15 | NCNTY42015N42015 | Bradford County, PA | Bradford County | 67100 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 9999 | Bradford County | Pennsylvania | 0 |
| PA | 4201799999 | 42 | 17 | METRO37980M37980 | Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA | Bucks County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 6160 | Bucks County | Pennsylvania | 1 |
| PA | 4201999999 | 42 | 19 | METRO38300M38300 | Pittsburgh, PA HUD Metro FMR Area | Butler County | 83000 | 17450 | 19950 | 22450 | 24900 | 26900 | 28900 | 30900 | 32900 | 6280 | Butler County | Pennsylvania | 1 |
| PA | 4202199999 | 42 | 21 | METRO27780M27780 | Johnstown, PA MSA | Cambria County | 62700 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 3680 | Cambria County | Pennsylvania | 1 |
| PA | 4202399999 | 42 | 23 | NCNTY42023N42023 | Cameron County, PA | Cameron County | 58600 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9999 | Cameron County | Pennsylvania | 0 |
| PA | 4202599999 | 42 | 25 | METRO10900M10900 | Allentown-Bethlehem-Easton, PA HUD Metro FMR Area | Carbon County | 78200 | 16450 | 18800 | 21150 | 23450 | 25350 | 27250 | 29100 | 31000 | 240 | Carbon County | Pennsylvania | 1 |
| PA | 4202799999 | 42 | 27 | METRO44300M44300 | State College, PA MSA | Centre County | 88700 | 18650 | 21300 | 23950 | 26600 | 28750 | 30900 | 33000 | 35150 | 8050 | Centre County | Pennsylvania | 1 |
| PA | 4202999999 | 42 | 29 | METRO37980M37980 | Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA | Chester County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 6160 | Chester County | Pennsylvania | 1 |
| PA | 4203199999 | 42 | 31 | NCNTY42031N42031 | Clarion County, PA | Clarion County | 60700 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9999 | Clarion County | Pennsylvania | 0 |
| PA | 4203399999 | 42 | 33 | NCNTY42033N42033 | Clearfield County, PA | Clearfield County | 62000 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9999 | Clearfield County | Pennsylvania | 0 |
| PA | 4203599999 | 42 | 35 | NCNTY42035N42035 | Clinton County, PA | Clinton County | 63800 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9999 | Clinton County | Pennsylvania | 0 |
| PA | 4203799999 | 42 | 37 | METRO14100N42037 | Columbia County, PA HUD Metro FMR Area | Columbia County | 65800 | 13850 | 15800 | 17800 | 19750 | 21350 | 22950 | 24500 | 26100 | 7560 | Columbia County | Pennsylvania | 1 |
| PA | 4203999999 | 42 | 39 | NCNTY42039N42039 | Crawford County, PA | Crawford County | 66000 | 13900 | 15850 | 17850 | 19800 | 21400 | 23000 | 24600 | 26150 | 9999 | Crawford County | Pennsylvania | 0 |
| PA | 4204199999 | 42 | 41 | METRO25420M25420 | Harrisburg-Carlisle, PA MSA | Cumberland County | 85000 | 17850 | 20400 | 22950 | 25500 | 27550 | 29600 | 31650 | 33700 | 3240 | Cumberland County | Pennsylvania | 1 |
| PA | 4204399999 | 42 | 43 | METRO25420M25420 | Harrisburg-Carlisle, PA MSA | Dauphin County | 85000 | 17850 | 20400 | 22950 | 25500 | 27550 | 29600 | 31650 | 33700 | 3240 | Dauphin County | Pennsylvania | 1 |
| PA | 4204599999 | 42 | 45 | METRO37980M37980 | Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA | Delaware County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 6160 | Delaware County | Pennsylvania | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PA | 4204799999 | 42 | 47 | NCNTY42047N42047 | Elk County, PA | Elk County | 66900 | 14050 | 16050 | 18050 | 20050 | 21700 | 23300 | 24900 | 26500 | 9999 | Elk County | Pennsylvania | 0 |
| PA | 4204999999 | 42 | 49 | METRO21500M21500 | Erie, PA MSA | Erie County | 71500 | 15050 | 17200 | 19350 | 21450 | 23200 | 24900 | 26600 | 28350 | 2360 | Erie County | Pennsylvania | 1 |
| PA | 4205199999 | 42 | 51 | METRO38300M38300 | Pittsburgh, PA HUD Metro FMR Area | Fayette County | 83000 | 17450 | 19950 | 22450 | 24900 | 26900 | 28900 | 30900 | 32900 | 6280 | Fayette County | Pennsylvania | 1 |
| PA | 4205399999 | 42 | 53 | NCNTY42053N42053 | Forest County, PA | Forest County | 47200 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9999 | Forest County | Pennsylvania | 0 |
| PA | 4205599999 | 42 | 55 | METRO16540M16540 | Chambersburg-Waynesboro, PA MSA | Franklin County | 78300 | 16450 | 18800 | 21150 | 23500 | 25400 | 27300 | 29150 | 31050 | 9999 | Franklin County | Pennsylvania | 1 |
| PA | 4205799999 | 42 | 57 | NCNTY42057N42057 | Fulton County, PA | Fulton County | 65300 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Fulton County | Pennsylvania | 0 |
| PA | 4205999999 | 42 | 59 | NCNTY42059N42059 | Greene County, PA | Greene County | 66900 | 14050 | 16050 | 18050 | 20050 | 21700 | 23300 | 24900 | 26500 | 9999 | Greene County | Pennsylvania | 0 |
| PA | 4206199999 | 42 | 61 | NCNTY42061N42061 | Huntingdon County, PA | Huntingdon County | 61700 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9999 | Huntingdon County | Pennsylvania | 0 |
| PA | 4206399999 | 42 | 63 | NCNTY42063N42063 | Indiana County, PA | Indiana County | 62500 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9999 | Indiana County | Pennsylvania | 0 |
| PA | 4206599999 | 42 | 65 | NCNTY42065N42065 | Jefferson County, PA | Jefferson County | 60900 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9999 | Jefferson County | Pennsylvania | 0 |
| PA | 4206799999 | 42 | 67 | NCNTY42067N42067 | Juniata County, PA | Juniata County | 65300 | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 | 9999 | Juniata County | Pennsylvania | 0 |
| PA | 4206999999 | 42 | 69 | METRO42540M42540 | Scranton--Wilkes-Barre, PA MSA | Lackawanna County | 71700 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 7560 | Lackawanna County | Pennsylvania | 1 |
| PA | 4207199999 | 42 | 71 | METRO29540M29540 | Lancaster, PA MSA | Lancaster County | 79500 | 16700 | 19100 | 21500 | 23850 | 25800 | 27700 | 29600 | 31500 | 4000 | Lancaster County | Pennsylvania | 1 |
| PA | 4207399999 | 42 | 73 | NCNTY42073N42073 | Lawrence County, PA | Lawrence County | 69200 | 14550 | 16600 | 18700 | 20750 | 22450 | 24100 | 25750 | 27400 | 9999 | Lawrence County | Pennsylvania | 0 |
| PA | 4207599999 | 42 | 75 | METRO30140M30140 | Lebanon, PA MSA | Lebanon County | 77000 | 16200 | 18500 | 20800 | 23100 | 24950 | 26800 | 28650 | 30500 | 3240 | Lebanon County | Pennsylvania | 1 |
| PA | 4207799999 | 42 | 77 | METRO10900M10900 | Allentown-Bethlehem-Easton, PA HUD Metro FMR Area | Lehigh County | 78200 | 16450 | 18800 | 21150 | 23450 | 25350 | 27250 | 29100 | 31000 | 240 | Lehigh County | Pennsylvania | 1 |
| PA | 4207999999 | 42 | 79 | METRO42540M42540 | Scranton--Wilkes-Barre, PA MSA | Luzerne County | 71700 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 7560 | Luzerne County | Pennsylvania | 1 |
| PA | 4208199999 | 42 | 81 | METRO48700M48700 | Williamsport, PA MSA | Lycoming County | 64800 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9140 | Lycoming County | Pennsylvania | 1 |
| PA | 4208399999 | 42 | 83 | NCNTY42083N42083 | McKean County, PA | McKean County | 59900 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9999 | McKean County | Pennsylvania | 0 |
| PA | 4208599999 | 42 | 85 | METRO49660MM7610 | Sharon, PA HUD Metro FMR Area | Mercer County | 66700 | 14000 | 16000 | 18000 | 20000 | 21600 | 23200 | 24800 | 26400 | 7610 | Mercer County | Pennsylvania | 1 |
| PA | 4208799999 | 42 | 87 | NCNTY42087N42087 | Mifflin County, PA | Mifflin County | 56200 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9999 | Mifflin County | Pennsylvania | 0 |
| PA | 4208999999 | 42 | 89 | METRO20700M20700 | East Stroudsburg, PA MSA | Monroe County | 79100 | 16650 | 19000 | 21400 | 23750 | 25650 | 27550 | 29450 | 31350 | 9999 | Monroe County | Pennsylvania | 1 |
| PA | 4209199999 | 42 | 91 | METRO37980M37980 | Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA | Montgomery County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 6160 | Montgomery County | Pennsylvania | 1 |
| PA | 4209399999 | 42 | 93 | METRO14100N42093 | Montour County, PA HUD Metro FMR Area | Montour County | 76300 | 16050 | 18350 | 20650 | 22900 | 24750 | 26600 | 28400 | 30250 | 9999 | Montour County | Pennsylvania | 1 |
| PA | 4209599999 | 42 | 95 | METRO10900M10900 | Allentown-Bethlehem-Easton, PA HUD Metro FMR Area | Northampton County | 78200 | 16450 | 18800 | 21150 | 23450 | 25350 | 27250 | 29100 | 31000 | 240 | Northampton County | Pennsylvania | 1 |
| PA | 4209799999 | 42 | 97 | NCNTY42097N42097 | Northumberland County, PA | Northumberland County | 68500 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Northumberland County | Pennsylvania | 0 |
| PA | 4209999999 | 42 | 99 | METRO25420M25420 | Harrisburg-Carlisle, PA MSA | Perry County | 85000 | 17850 | 20400 | 22950 | 25500 | 27550 | 29600 | 31650 | 33700 | 3240 | Perry County | Pennsylvania | 1 |
| PA | 4210199999 | 42 | 101 | METRO37980M37980 | Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA | Philadelphia County | 96600 | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 36000 | 38300 | 6160 | Philadelphia County | Pennsylvania | 1 |
| PA | 4210399999 | 42 | 103 | METRO35620MM5660 | Pike County, PA HUD Metro FMR Area | Pike County | 79100 | 16650 | 19000 | 21400 | 23750 | 25650 | 27550 | 29450 | 31350 | 5660 | Pike County | Pennsylvania | 1 |
| PA | 4210599999 | 42 | 105 | NCNTY42105N42105 | Potter County, PA | Potter County | 57700 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9999 | Potter County | Pennsylvania | 0 |
| PA | 4210799999 | 42 | 107 | NCNTY42107N42107 | Schuylkill County, PA | Schuylkill County | 66300 | 13950 | 15950 | 17950 | 19900 | 21500 | 23100 | 24700 | 26300 | 9999 | Schuylkill County | Pennsylvania | 0 |
| PA | 4210999999 | 42 | 109 | NCNTY42109N42109 | Snyder County, PA | Snyder County | 66900 | 14050 | 16050 | 18050 | 20050 | 21700 | 23300 | 24900 | 26500 | 9999 | Snyder County | Pennsylvania | 0 |
| PA | 4211199999 | 42 | 111 | NCNTY42111N42111 | Somerset County, PA | Somerset County | 63500 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 3680 | Somerset County | Pennsylvania | 0 |
| PA | 4211399999 | 42 | 113 | NCNTY42113N42113 | Sullivan County, PA | Sullivan County | 62200 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9999 | Sullivan County | Pennsylvania | 0 |
| PA | 4211599999 | 42 | 115 | NCNTY42115N42115 | Susquehanna County, PA | Susquehanna County | 66100 | 13900 | 15900 | 17900 | 19850 | 21450 | 23050 | 24650 | 26250 | 9999 | Susquehanna County | Pennsylvania | 0 |
| PA | 4211799999 | 42 | 117 | NCNTY42117N42117 | Tioga County, PA | Tioga County | 62000 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9999 | Tioga County | Pennsylvania | 0 |
| PA | 4211999999 | 42 | 119 | NCNTY42119N42119 | Union County, PA | Union County | 71500 | 15050 | 17200 | 19350 | 21450 | 23200 | 24900 | 26600 | 28350 | 9999 | Union County | Pennsylvania | 0 |
| PA | 4212199999 | 42 | 121 | NCNTY42121N42121 | Venango County, PA | Venango County | 61800 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9999 | Venango County | Pennsylvania | 0 |
| PA | 4212399999 | 42 | 123 | NCNTY42123N42123 | Warren County, PA | Warren County | 62500 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9999 | Warren County | Pennsylvania | 0 |
| PA | 4212599999 | 42 | 125 | METRO38300M38300 | Pittsburgh, PA HUD Metro FMR Area | Washington County | 83000 | 17450 | 19950 | 22450 | 24900 | 26900 | 28900 | 30900 | 32900 | 6280 | Washington County | Pennsylvania | 1 |
| PA | 4212799999 | 42 | 127 | NCNTY42127N42127 | Wayne County, PA | Wayne County | 69000 | 14500 | 16600 | 18650 | 20700 | 22400 | 24050 | 25700 | 27350 | 9999 | Wayne County | Pennsylvania | 0 |
| PA | 4212999999 | 42 | 129 | METRO38300M38300 | Pittsburgh, PA HUD Metro FMR Area | Westmoreland County | 83000 | 17450 | 19950 | 22450 | 24900 | 26900 | 28900 | 30900 | 32900 | 6280 | Westmoreland County | Pennsylvania | 1 |
| PA | 4213199999 | 42 | 131 | METRO42540M42540 | Scranton--Wilkes-Barre, PA MSA | Wyoming County | 71700 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 7560 | Wyoming County | Pennsylvania | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PA | 4213399999 | 42 | 133 | METRO49620M49620 | York-Hanover, PA MSA | York County | 82200 | 17300 | 19750 | 22200 | 24650 | 26650 | 28600 | 30600 | 32550 | 9280 | York County | Pennsylvania | 1 |
| RI | 4400105140 | 44 | 1 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Bristol County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Barrington town | Rhode Island | 1 |
| RI | 4400109280 | 44 | 1 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Bristol County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Bristol town | Rhode Island | 1 |
| RI | 4400173760 | 44 | 1 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Bristol County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Warren town | Rhode Island | 1 |
| RI | 4400318640 | 44 | 3 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Kent County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Coventry town | Rhode Island | 1 |
| RI | 4400322240 | 44 | 3 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Kent County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | East Greenwich town | Rhode Island | 1 |
| RI | 4400374300 | 44 | 3 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Kent County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Warwick city | Rhode Island | 1 |
| RI | 4400377720 | 44 | 3 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Kent County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | West Greenwich town | Rhode Island | 1 |
| RI | 4400378440 | 44 | 3 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Kent County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | West Warwick town | Rhode Island | 1 |
| RI | 4400536820 | 44 | 5 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Newport County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Jamestown town | Rhode Island | 1 |
| RI | 4400542400 | 44 | 5 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Newport County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Little Compton town | Rhode Island | 1 |
| RI | 4400545460 | 44 | 5 | METRO39300N44005 | Newport-Middleton-Portsmouth, RI HUD Metro FMR Area | Newport County | 100900 | 21200 | 24200 | 27250 | 30250 | 32700 | 35100 | 37550 | 39950 | 9999 | Middletown town | Rhode Island | 1 |
| RI | 4400549960 | 44 | 5 | METRO39300N44005 | Newport-Middleton-Portsmouth, RI HUD Metro FMR Area | Newport County | 100900 | 21200 | 24200 | 27250 | 30250 | 32700 | 35100 | 37550 | 39950 | 9999 | Newport city | Rhode Island | 1 |
| RI | 4400557880 | 44 | 5 | METRO39300N44005 | Newport-Middleton-Portsmouth, RI HUD Metro FMR Area | Newport County | 100900 | 21200 | 24200 | 27250 | 30250 | 32700 | 35100 | 37550 | 39950 | 9999 | Portsmouth town | Rhode Island | 1 |
| RI | 4400570880 | 44 | 5 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Newport County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Tiverton town | Rhode Island | 1 |
| RI | 4400711800 | 44 | 7 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Providence County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Burrillville town | Rhode Island | 1 |
| RI | 4400714140 | 44 | 7 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Providence County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Central Falls city | Rhode Island | 1 |
| RI | 4400719180 | 44 | 7 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Providence County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Cranston city | Rhode Island | 1 |
| RI | 4400720080 | 44 | 7 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Providence County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Cumberland town | Rhode Island | 1 |
| RI | 4400722960 | 44 | 7 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Providence County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | East Providence city | Rhode Island | 1 |
| RI | 4400727460 | 44 | 7 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Providence County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Foster town | Rhode Island | 1 |
| RI | 4400730340 | 44 | 7 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Providence County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Glocester town | Rhode Island | 1 |
| RI | 4400737720 | 44 | 7 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Providence County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Johnston town | Rhode Island | 1 |
| RI | 4400741500 | 44 | 7 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Providence County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Lincoln town | Rhode Island | 1 |
| RI | 4400751760 | 44 | 7 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Providence County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | North Providence town | Rhode Island | 1 |
| RI | 4400752480 | 44 | 7 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Providence County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | North Smithfield town | Rhode Island | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RI | 4400754640 | 44 | 7 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Providence County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Pawtucket city | Rhode Island | 1 |
| RI | 4400759000 | 44 | 7 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Providence County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Providence city | Rhode Island | 1 |
| RI | 4400764220 | 44 | 7 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Providence County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Scituate town | Rhode Island | 1 |
| RI | 4400766200 | 44 | 7 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Providence County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Smithfield town | Rhode Island | 1 |
| RI | 4400780780 | 44 | 7 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Providence County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Woonsocket city | Rhode Island | 1 |
| RI | 4400914500 | 44 | 9 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Washington County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Charlestown town | Rhode Island | 1 |
| RI | 4400925300 | 44 | 9 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Washington County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Exeter town | Rhode Island | 1 |
| RI | 4400935380 | 44 | 9 | METRO39300MM5520 | Westerly-Hopkinton-New Shoreham, RI HUD Metro FMR Area | Washington County | 91200 | 18800 | 21450 | 24150 | 26800 | 28950 | 31100 | 33250 | 35400 | 5520 | Hopkinton town | Rhode Island | 1 |
| RI | 4400948340 | 44 | 9 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Washington County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Narragansett town | Rhode Island | 1 |
| RI | 4400950500 | 44 | 9 | METRO39300MM5520 | Westerly-Hopkinton-New Shoreham, RI HUD Metro FMR Area | Washington County | 91200 | 18800 | 21450 | 24150 | 26800 | 28950 | 31100 | 33250 | 35400 | 9999 | New Shoreham town | Rhode Island | 1 |
| RI | 4400951580 | 44 | 9 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Washington County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | North Kingstown town | Rhode Island | 1 |
| RI | 4400961160 | 44 | 9 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Washington County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | Richmond town | Rhode Island | 1 |
| RI | 4400967460 | 44 | 9 | METRO39300M39300 | Providence-Fall River, RI-MA HUD Metro FMR Area | Washington County | 87000 | 18300 | 20900 | 23500 | 26100 | 28200 | 30300 | 32400 | 34500 | 6480 | South Kingstown town | Rhode Island | 1 |
| RI | 4400977000 | 44 | 9 | METRO39300MM5520 | Westerly-Hopkinton-New Shoreham, RI HUD Metro FMR Area | Washington County | 91200 | 18800 | 21450 | 24150 | 26800 | 28950 | 31100 | 33250 | 35400 | 5520 | Westerly town | Rhode Island | 1 |
| SC | 4500199999 | 45 | 1 | NCNTY45001N45001 | Abbeville County, SC | Abbeville County | 49000 | 11000 | 12600 | 14150 | 15700 | 17000 | 18250 | 19500 | 20750 | 9999 | Abbeville County | South Carolina | 0 |
| SC | 4500399999 | 45 | 3 | METRO12260M12260 | Augusta-Richmond County, GA-SC HUD Metro FMR Area | Aiken County | 65900 | 13850 | 15800 | 17800 | 19750 | 21350 | 22950 | 24500 | 26100 | 600 | Aiken County | South Carolina | 1 |
| SC | 4500599999 | 45 | 5 | NCNTY45005N45005 | Allendale County, SC | Allendale County | 36300 | 11000 | 12600 | 14150 | 15700 | 17000 | 18250 | 19500 | 20750 | 9999 | Allendale County | South Carolina | 0 |
| SC | 4500799999 | 45 | 7 | METRO24860M11340 | Anderson, SC HUD Metro FMR Area | Anderson County | 65200 | 13650 | 15600 | 17550 | 19500 | 21100 | 22650 | 24200 | 25750 | 3160 | Anderson County | South Carolina | 1 |
| SC | 4500999999 | 45 | 9 | NCNTY45009N45009 | Bamberg County, SC | Bamberg County | 49100 | 11000 | 12600 | 14150 | 15700 | 17000 | 18250 | 19500 | 20750 | 9999 | Bamberg County | South Carolina | 0 |
| SC | 4501199999 | 45 | 11 | NCNTY45011N45011 | Barnwell County, SC | Barnwell County | 48200 | 11000 | 12600 | 14150 | 15700 | 17000 | 18250 | 19500 | 20750 | 9999 | Barnwell County | South Carolina | 0 |
| SC | 4501399999 | 45 | 13 | METRO25940N45013 | Beaufort County, SC HUD Metro FMR Area | Beaufort County | 81500 | 17150 | 19600 | 22050 | 24450 | 26450 | 28400 | 30350 | 32300 | 9999 | Beaufort County | South Carolina | 1 |
| SC | 4501599999 | 45 | 15 | METRO16700M16700 | Charleston-North Charleston, SC MSA | Berkeley County | 81000 | 17050 | 19450 | 21900 | 24300 | 26250 | 28200 | 30150 | 32100 | 1440 | Berkeley County | South Carolina | 1 |
| SC | 4501799999 | 45 | 17 | METRO17900M17900 | Columbia, SC HUD Metro FMR Area | Calhoun County | 72600 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Calhoun County | South Carolina | 1 |
| SC | 4501999999 | 45 | 19 | METRO16700M16700 | Charleston-North Charleston, SC MSA | Charleston County | 81000 | 17050 | 19450 | 21900 | 24300 | 26250 | 28200 | 30150 | 32100 | 1440 | Charleston County | South Carolina | 1 |
| SC | 4502199999 | 45 | 21 | NCNTY45021N45021 | Cherokee County, SC | Cherokee County | 52200 | 11000 | 12600 | 14150 | 15700 | 17000 | 18250 | 19500 | 20750 | 3160 | Cherokee County | South Carolina | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SC | 4502399999 | 45 | 23 | METRO16740N45023 | Chester County, SC HUD Metro FMR Area | Chester County | 54100 | 11400 | 13000 | 14650 | 16250 | 17550 | 18850 | 20150 | 21450 | 9999 | Chester County | South Carolina | 1 |
| SC | 4502599999 | 45 | 25 | NCNTY45025N45025 | Chesterfield County, SC | Chesterfield County | 47900 | 11000 | 12600 | 14150 | 15700 | 17000 | 18250 | 19500 | 20750 | 9999 | Chesterfield County | South Carolina | 0 |
| SC | 4502799999 | 45 | 27 | NCNTY45027N45027 | Clarendon County, SC | Clarendon County | 48900 | 11000 | 12600 | 14150 | 15700 | 17000 | 18250 | 19500 | 20750 | 9999 | Clarendon County | South Carolina | 0 |
| SC | 4502999999 | 45 | 29 | NCNTY45029N45029 | Colleton County, SC | Colleton County | 43900 | 11000 | 12600 | 14150 | 15700 | 17000 | 18250 | 19500 | 20750 | 9999 | Colleton County | South Carolina | 0 |
| SC | 4503199999 | 45 | 31 | METRO22500N45031 | Darlington County, SC HUD Metro FMR Area | Darlington County | 52300 | 11000 | 12600 | 14150 | 15700 | 17000 | 18250 | 19500 | 20750 | 9999 | Darlington County | South Carolina | 1 |
| SC | 4503399999 | 45 | 33 | NCNTY45033N45033 | Dillon County, SC | Dillon County | 42400 | 11000 | 12600 | 14150 | 15700 | 17000 | 18250 | 19500 | 20750 | 9999 | Dillon County | South Carolina | 0 |
| SC | 4503599999 | 45 | 35 | METRO16700M16700 | Charleston-North Charleston, SC MSA | Dorchester County | 81000 | 17050 | 19450 | 21900 | 24300 | 26250 | 28200 | 30150 | 32100 | 1440 | Dorchester County | South Carolina | 1 |
| SC | 4503799999 | 45 | 37 | METRO12260M12260 | Augusta-Richmond County, GA-SC HUD Metro FMR Area | Edgefield County | 65900 | 13850 | 15800 | 17800 | 19750 | 21350 | 22950 | 24500 | 26100 | 600 | Edgefield County | South Carolina | 1 |
| SC | 4503999999 | 45 | 39 | METRO17900M17900 | Columbia, SC HUD Metro FMR Area | Fairfield County | 72600 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Fairfield County | South Carolina | 1 |
| SC | 4504199999 | 45 | 41 | METRO22500M22500 | Florence, SC HUD Metro FMR Area | Florence County | 56100 | 12150 | 13850 | 15600 | 17300 | 18700 | 20100 | 21500 | 22850 | 2655 | Florence County | South Carolina | 1 |
| SC | 4504399999 | 45 | 43 | NCNTY45043N45043 | Georgetown County, SC | Georgetown County | 62500 | 13150 | 15000 | 16900 | 18750 | 20250 | 21750 | 23250 | 24750 | 9999 | Georgetown County | South Carolina | 0 |
| SC | 4504599999 | 45 | 45 | METRO24860M24860 | Greenville-Mauldin-Easley, SC HUD Metro FMR Area | Greenville County | 74900 | 15750 | 18000 | 20250 | 22450 | 24250 | 26050 | 27850 | 29650 | 3160 | Greenville County | South Carolina | 1 |
| SC | 4504799999 | 45 | 47 | NCNTY45047N45047 | Greenwood County, SC | Greenwood County | 56300 | 11850 | 13550 | 15250 | 16900 | 18300 | 19650 | 21000 | 22350 | 9999 | Greenwood County | South Carolina | 0 |
| SC | 4504999999 | 45 | 49 | NCNTY45049N45049 | Hampton County, SC | Hampton County | 46900 | 11000 | 12600 | 14150 | 15700 | 17000 | 18250 | 19500 | 20750 | 9999 | Hampton County | South Carolina | 0 |
| SC | 4505199999 | 45 | 51 | METRO34820M34820 | Myrtle Beach-North Myrtle Beach-Conway, SC HUD Metro FMR Area | Horry County | 57400 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 5330 | Horry County | South Carolina | 1 |
| SC | 4505399999 | 45 | 53 | METRO25940N45053 | Jasper County, SC HUD Metro FMR Area | Jasper County | 46000 | 11000 | 12600 | 14150 | 15700 | 17000 | 18250 | 19500 | 20750 | 9999 | Jasper County | South Carolina | 1 |
| SC | 4505599999 | 45 | 55 | METRO17900N45055 | Kershaw County, SC HUD Metro FMR Area | Kershaw County | 64400 | 13500 | 15400 | 17350 | 19250 | 20800 | 22350 | 23900 | 25450 | 9999 | Kershaw County | South Carolina | 1 |
| SC | 4505799999 | 45 | 57 | METRO16740N45057 | Lancaster County, SC HUD Metro FMR Area | Lancaster County | 79000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Lancaster County | South Carolina | 1 |
| SC | 4505999999 | 45 | 59 | METRO24860N45059 | Laurens County, SC HUD Metro FMR Area | Laurens County | 45900 | 11100 | 12700 | 14300 | 15850 | 17150 | 18400 | 19700 | 20950 | 9999 | Laurens County | South Carolina | 1 |
| SC | 4506199999 | 45 | 61 | NCNTY45061N45061 | Lee County, SC | Lee County | 43600 | 11000 | 12600 | 14150 | 15700 | 17000 | 18250 | 19500 | 20750 | 9999 | Lee County | South Carolina | 0 |
| SC | 4506399999 | 45 | 63 | METRO17900M17900 | Columbia, SC HUD Metro FMR Area | Lexington County | 72600 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 1760 | Lexington County | South Carolina | 1 |
| SC | 4506599999 | 45 | 65 | NCNTY45065N45065 | McCormick County, SC | McCormick County | 54800 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | McCormick County | South Carolina | 0 |
| SC | 4506799999 | 45 | 67 | NCNTY45067N45067 | Marion County, SC | Marion County | 42100 | 11000 | 12600 | 14150 | 15700 | 17000 | 18250 | 19500 | 20750 | 9999 | Marion County | South Carolina | 0 |
| SC | 4506999999 | 45 | 69 | NCNTY45069N45069 | Marlboro County, SC | Marlboro County | 43100 | 11000 | 12600 | 14150 | 15700 | 17000 | 18250 | 19500 | 20750 | 9999 | Marlboro County | South Carolina | 0 |
| SC | 4507199999 | 45 | 71 | NCNTY45071N45071 | Newberry County, SC | Newberry County | 51300 | 11000 | 12600 | 14150 | 15700 | 17000 | 18250 | 19500 | 20750 | 9999 | Newberry County | South Carolina | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SC | 4507399999 | 45 | 73 | NCNTY45073N45073 | Oconee County, SC | Oconee County | 65500 | 13200 | 15100 | 17000 | 18850 | 20400 | 21900 | 23400 | 24900 | 9999 | Oconee County | South Carolina | 0 |
| SC | 4507599999 | 45 | 75 | NCNTY45075N45075 | Orangeburg County, SC | Orangeburg County | 52100 | 11000 | 12600 | 14150 | 15700 | 17000 | 18250 | 19500 | 20750 | 9999 | Orangeburg County | South Carolina | 0 |
| SC | 4507799999 | 45 | 77 | METRO24860M24860 | Greenville-Mauldin-Easley, SC HUD Metro FMR Area | Pickens County | 74900 | 15750 | 18000 | 20250 | 22450 | 24250 | 26050 | 27850 | 29650 | 3160 | Pickens County | South Carolina | 1 |
| SC | 4507999999 | 45 | 79 | METRO17900M17900 | Columbia, SC HUD Metro FMR Area | Richland County | 72600 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 1760 | Richland County | South Carolina | 1 |
| SC | 4508199999 | 45 | 81 | METRO17900M17900 | Columbia, SC HUD Metro FMR Area | Saluda County | 72600 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Saluda County | South Carolina | 1 |
| SC | 4508399999 | 45 | 83 | METRO43900M43900 | Spartanburg, SC HUD Metro FMR Area | Spartanburg County | 64700 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 3160 | Spartanburg County | South Carolina | 1 |
| SC | 4508599999 | 45 | 85 | METRO44940M44940 | Sumter, SC MSA | Sumter County | 54700 | 11500 | 13150 | 14800 | 16400 | 17750 | 19050 | 20350 | 21650 | 8140 | Sumter County | South Carolina | 1 |
| SC | 4508799999 | 45 | 87 | METRO43900N45087 | Union County, SC HUD Metro FMR Area | Union County | 50400 | 11000 | 12600 | 14150 | 15700 | 17000 | 18250 | 19500 | 20750 | 9999 | Union County | South Carolina | 1 |
| SC | 4508999999 | 45 | 89 | NCNTY45089N45089 | Williamsburg County, SC | Williamsburg County | 45700 | 11000 | 12600 | 14150 | 15700 | 17000 | 18250 | 19500 | 20750 | 9999 | Williamsburg County | South Carolina | 0 |
| SC | 4509199999 | 45 | 91 | METRO16740M16740 | Charlotte-Concord-Gastonia, NC-SC HUD Metro FMR Area | York County | 83500 | 17550 | 20050 | 22550 | 25050 | 27100 | 29100 | 31100 | 33100 | 1520 | York County | South Carolina | 1 |
| SD | 4600399999 | 46 | 3 | NCNTY46003N46003 | Aurora County, SD | Aurora County | 75500 | 15900 | 18150 | 20400 | 22650 | 24500 | 26300 | 28100 | 29900 | 9999 | Aurora County | South Dakota | 0 |
| SD | 4600599999 | 46 | 5 | NCNTY46005N46005 | Beadle County, SD | Beadle County | 67100 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Beadle County | South Dakota | 0 |
| SD | 4600799999 | 46 | 7 | NCNTY46007N46007 | Bennett County, SD | Bennett County | 50200 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Bennett County | South Dakota | 0 |
| SD | 4600999999 | 46 | 9 | NCNTY46009N46009 | Bon Homme County, SD | Bon Homme County | 71200 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Bon Homme County | South Dakota | 0 |
| SD | 4601199999 | 46 | 11 | NCNTY46011N46011 | Brookings County, SD | Brookings County | 84600 | 17250 | 19700 | 22150 | 24600 | 26600 | 28550 | 30550 | 32500 | 9999 | Brookings County | South Dakota | 0 |
| SD | 4601399999 | 46 | 13 | NCNTY46013N46013 | Brown County, SD | Brown County | 78000 | 16400 | 18750 | 21100 | 23400 | 25300 | 27150 | 29050 | 30900 | 9999 | Brown County | South Dakota | 0 |
| SD | 4601599999 | 46 | 15 | NCNTY46015N46015 | Brule County, SD | Brule County | 62700 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Brule County | South Dakota | 0 |
| SD | 4601799999 | 46 | 17 | NCNTY46017N46017 | Buffalo County, SD | Buffalo County | 36200 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Buffalo County | South Dakota | 0 |
| SD | 4601999999 | 46 | 19 | NCNTY46019N46019 | Butte County, SD | Butte County | 59000 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Butte County | South Dakota | 0 |
| SD | 4602199999 | 46 | 21 | NCNTY46021N46021 | Campbell County, SD | Campbell County | 80800 | 16000 | 18300 | 20600 | 22850 | 24700 | 26550 | 28350 | 30200 | 9999 | Campbell County | South Dakota | 0 |
| SD | 4602399999 | 46 | 23 | NCNTY46023N46023 | Charles Mix County, SD | Charles Mix County | 62000 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Charles Mix County | South Dakota | 0 |
| SD | 4602599999 | 46 | 25 | NCNTY46025N46025 | Clark County, SD | Clark County | 68600 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Clark County | South Dakota | 0 |
| SD | 4602799999 | 46 | 27 | NCNTY46027N46027 | Clay County, SD | Clay County | 77600 | 16000 | 18300 | 20600 | 22850 | 24700 | 26550 | 28350 | 30200 | 9999 | Clay County | South Dakota | 0 |
| SD | 4602999999 | 46 | 29 | NCNTY46029N46029 | Codington County, SD | Codington County | 75700 | 15900 | 18200 | 20450 | 22700 | 24550 | 26350 | 28150 | 30000 | 9999 | Codington County | South Dakota | 0 |
| SD | 4603199999 | 46 | 31 | NCNTY46031N46031 | Corson County, SD | Corson County | 37800 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Corson County | South Dakota | 0 |
| SD | 4603399999 | 46 | 33 | METRO39660N46033 | Custer County, SD HUD Metro FMR Area | Custer County | 71300 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Custer County | South Dakota | 1 |
| SD | 4603599999 | 46 | 35 | NCNTY46035N46035 | Davison County, SD | Davison County | 68800 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Davison County | South Dakota | 0 |
| SD | 4603799999 | 46 | 37 | NCNTY46037N46037 | Day County, SD | Day County | 62300 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Day County | South Dakota | 0 |
| SD | 4603999999 | 46 | 39 | NCNTY46039N46039 | Deuel County, SD | Deuel County | 74700 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Deuel County | South Dakota | 0 |
| SD | 4604199999 | 46 | 41 | NCNTY46041N46041 | Dewey County, SD | Dewey County | 52700 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Dewey County | South Dakota | 0 |
| SD | 4604399999 | 46 | 43 | NCNTY46043N46043 | Douglas County, SD | Douglas County | 70300 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Douglas County | South Dakota | 0 |
| SD | 4604599999 | 46 | 45 | NCNTY46045N46045 | Edmunds County, SD | Edmunds County | 81000 | 17050 | 19450 | 21900 | 24300 | 26250 | 28200 | 30150 | 32100 | 9999 | Edmunds County | South Dakota | 0 |
| SD | 4604799999 | 46 | 47 | NCNTY46047N46047 | Fall River County, SD | Fall River County | 69900 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Fall River County | South Dakota | 0 |
| SD | 4604999999 | 46 | 49 | NCNTY46049N46049 | Faulk County, SD | Faulk County | 83200 | 17500 | 20000 | 22500 | 24950 | 26950 | 28950 | 30950 | 32950 | 9999 | Faulk County | South Dakota | 0 |
| SD | 4605199999 | 46 | 51 | NCNTY46051N46051 | Grant County, SD | Grant County | 69300 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Grant County | South Dakota | 0 |
| SD | 4605399999 | 46 | 53 | NCNTY46053N46053 | Gregory County, SD | Gregory County | 61700 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Gregory County | South Dakota | 0 |
| SD | 4605599999 | 46 | 55 | NCNTY46055N46055 | Haakon County, SD | Haakon County | 47000 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Haakon County | South Dakota | 0 |
| SD | 4605799999 | 46 | 57 | NCNTY46057N46057 | Hamlin County, SD | Hamlin County | 71600 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Hamlin County | South Dakota | 0 |
| SD | 4605999999 | 46 | 59 | NCNTY46059N46059 | Hand County, SD | Hand County | 77100 | 16250 | 18550 | 20850 | 23150 | 25050 | 26900 | 28750 | 30600 | 9999 | Hand County | South Dakota | 0 |
| SD | 4606199999 | 46 | 61 | NCNTY46061N46061 | Hanson County, SD | Hanson County | 79900 | 16800 | 19200 | 21600 | 23950 | 25900 | 27800 | 29700 | 31650 | 9999 | Hanson County | South Dakota | 0 |
| SD | 4606399999 | 46 | 63 | NCNTY46063N46063 | Harding County, SD | Harding County | 75100 | 15800 | 18050 | 20300 | 22550 | 24400 | 26200 | 28000 | 29800 | 9999 | Harding County | South Dakota | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD | 4606599999 | 46 | 65 | NCNTY46065N46065 | Hughes County, SD | Hughes County | 95800 | 20150 | 23000 | 25900 | 28750 | 31050 | 33350 | 35650 | 37950 | 9999 | Hughes County | South Dakota | 0 |
| SD | 4606799999 | 46 | 67 | NCNTY46067N46067 | Hutchinson County, SD | Hutchinson County | 69300 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Hutchinson County | South Dakota | 0 |
| SD | 4606999999 | 46 | 69 | NCNTY46069N46069 | Hyde County, SD | Hyde County | 83400 | 17500 | 20000 | 22500 | 25000 | 27000 | 29000 | 31000 | 33000 | 9999 | Hyde County | South Dakota | 0 |
| SD | 4607199999 | 46 | 71 | NCNTY46071N46071 | Jackson County, SD | Jackson County | 42700 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Jackson County | South Dakota | 0 |
| SD | 4607399999 | 46 | 73 | NCNTY46073N46073 | Jerauld County, SD | Jerauld County | 66100 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Jerauld County | South Dakota | 0 |
| SD | 4607599999 | 46 | 75 | NCNTY46075N46075 | Jones County, SD | Jones County | 57700 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Jones County | South Dakota | 0 |
| SD | 4607799999 | 46 | 77 | NCNTY46077N46077 | Kingsbury County, SD | Kingsbury County | 72800 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Kingsbury County | South Dakota | 0 |
| SD | 4607999999 | 46 | 79 | NCNTY46079N46079 | Lake County, SD | Lake County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Lake County | South Dakota | 0 |
| SD | 4608199999 | 46 | 81 | NCNTY46081N46081 | Lawrence County, SD | Lawrence County | 74900 | 15750 | 18000 | 20250 | 22450 | 24250 | 26050 | 27850 | 29650 | 9999 | Lawrence County | South Dakota | 0 |
| SD | 4608399999 | 46 | 83 | METRO43620M43620 | Sioux Falls, SD MSA | Lincoln County | 86200 | 18100 | 20700 | 23300 | 25850 | 27950 | 30000 | 32100 | 34150 | 7760 | Lincoln County | South Dakota | 1 |
| SD | 4608599999 | 46 | 85 | NCNTY46085N46085 | Lyman County, SD | Lyman County | 55700 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Lyman County | South Dakota | 0 |
| SD | 4608799999 | 46 | 87 | METRO43620M43620 | Sioux Falls, SD MSA | McCook County | 86200 | 18100 | 20700 | 23300 | 25850 | 27950 | 30000 | 32100 | 34150 | 9999 | McCook County | South Dakota | 1 |
| SD | 4608999999 | 46 | 89 | NCNTY46089N46089 | McPherson County, SD | McPherson County | 65500 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | McPherson County | South Dakota | 0 |
| SD | 4609199999 | 46 | 91 | NCNTY46091N46091 | Marshall County, SD | Marshall County | 74400 | 15650 | 17850 | 20100 | 22300 | 24100 | 25900 | 27700 | 29450 | 9999 | Marshall County | South Dakota | 0 |
| SD | 4609399999 | 46 | 93 | METRO39660N46093 | Meade County, SD HUD Metro FMR Area | Meade County | 68500 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Meade County | South Dakota | 1 |
| SD | 4609599999 | 46 | 95 | NCNTY46095N46095 | Mellette County, SD | Mellette County | 36900 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Mellette County | South Dakota | 0 |
| SD | 4609799999 | 46 | 97 | NCNTY46097N46097 | Miner County, SD | Miner County | 66200 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Miner County | South Dakota | 0 |
| SD | 4609999999 | 46 | 99 | METRO43620M43620 | Sioux Falls, SD MSA | Minnehaha County | 86200 | 18100 | 20700 | 23300 | 25850 | 27950 | 30000 | 32100 | 34150 | 7760 | Minnehaha County | South Dakota | 1 |
| SD | 4610199999 | 46 | 101 | NCNTY46101N46101 | Moody County, SD | Moody County | 72400 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Moody County | South Dakota | 0 |
| SD | 4610299999 | 46 | 102 | NCNTY46102N46102 | Oglala Lakota County | Oglala Lakota County | 29600 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Oglala Lakota County | South Dakota | 0 |
| SD | 4610399999 | 46 | 103 | METRO39660M39660 | Rapid City, SD HUD Metro FMR Area | Pennington County | 76000 | 16000 | 18250 | 20550 | 22800 | 24650 | 26450 | 28300 | 30100 | 6660 | Pennington County | South Dakota | 1 |
| SD | 4610599999 | 46 | 105 | NCNTY46105N46105 | Perkins County, SD | Perkins County | 69900 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Perkins County | South Dakota | 0 |
| SD | 4610799999 | 46 | 107 | NCNTY46107N46107 | Potter County, SD | Potter County | 65100 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Potter County | South Dakota | 0 |
| SD | 4610999999 | 46 | 109 | NCNTY46109N46109 | Roberts County, SD | Roberts County | 63800 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Roberts County | South Dakota | 0 |
| SD | 4611199999 | 46 | 111 | NCNTY46111N46111 | Sanborn County, SD | Sanborn County | 71800 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Sanborn County | South Dakota | 0 |
| SD | 4611599999 | 46 | 115 | NCNTY46115N46115 | Spink County, SD | Spink County | 68900 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Spink County | South Dakota | 0 |
| SD | 4611799999 | 46 | 117 | NCNTY46117N46117 | Stanley County, SD | Stanley County | 76100 | 16000 | 18300 | 20600 | 22850 | 24700 | 26550 | 28350 | 30200 | 9999 | Stanley County | South Dakota | 0 |
| SD | 4611999999 | 46 | 119 | NCNTY46119N46119 | Sully County, SD | Sully County | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 9999 | Sully County | South Dakota | 0 |
| SD | 4612199999 | 46 | 121 | NCNTY46121N46121 | Todd County, SD | Todd County | 27200 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Todd County | South Dakota | 0 |
| SD | 4612399999 | 46 | 123 | NCNTY46123N46123 | Tripp County, SD | Tripp County | 65500 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Tripp County | South Dakota | 0 |
| SD | 4612599999 | 46 | 125 | METRO43620M43620 | Sioux Falls, SD MSA | Turner County | 86200 | 18100 | 20700 | 23300 | 25850 | 27950 | 30000 | 32100 | 34150 | 9999 | Turner County | South Dakota | 1 |
| SD | 4612799999 | 46 | 127 | METRO43580M43580 | Sioux City, IA-NE-SD HUD Metro FMR Area | Union County | 75200 | 15750 | 18000 | 20250 | 22500 | 24300 | 26100 | 27900 | 29700 | 9999 | Union County | South Dakota | 1 |
| SD | 4612999999 | 46 | 129 | NCNTY46129N46129 | Walworth County, SD | Walworth County | 70200 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Walworth County | South Dakota | 0 |
| SD | 4613599999 | 46 | 135 | NCNTY46135N46135 | Yankton County, SD | Yankton County | 68600 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Yankton County | South Dakota | 0 |
| SD | 4613799999 | 46 | 137 | NCNTY46137N46137 | Ziebach County, SD | Ziebach County | 35400 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Ziebach County | South Dakota | 0 |
| TN | 4700199999 | 47 | 1 | METRO28940M28940 | Knoxville, TN HUD Metro FMR Area | Anderson County | 73900 | 15550 | 17750 | 19950 | 22150 | 23950 | 25700 | 27500 | 29250 | 3840 | Anderson County | Tennessee | 1 |
| TN | 4700399999 | 47 | 3 | NCNTY47003N47003 | Bedford County, TN | Bedford County | 55200 | 11600 | 13250 | 14900 | 16550 | 17900 | 19200 | 20550 | 21850 | 9999 | Bedford County | Tennessee | 0 |
| TN | 4700599999 | 47 | 5 | NCNTY47005N47005 | Benton County, TN | Benton County | 51100 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Benton County | Tennessee | 0 |
| TN | 4700799999 | 47 | 7 | NCNTY47007N47007 | Bledsoe County, TN | Bledsoe County | 52400 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Bledsoe County | Tennessee | 0 |
| TN | 4700999999 | 47 | 9 | METRO28940M28940 | Knoxville, TN HUD Metro FMR Area | Blount County | 73900 | 15550 | 17750 | 19950 | 22150 | 23950 | 25700 | 27500 | 29250 | 3840 | Blount County | Tennessee | 1 |
| TN | 4701199999 | 47 | 11 | METRO17420M17420 | Cleveland, TN MSA | Bradley County | 61400 | 12900 | 14750 | 16600 | 18400 | 19900 | 21350 | 22850 | 24300 | 9999 | Bradley County | Tennessee | 1 |
| TN | 4701399999 | 47 | 13 | METRO28940N47013 | Campbell County, TN HUD Metro FMR Area | Campbell County | 46800 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Campbell County | Tennessee | 1 |
| TN | 4701599999 | 47 | 15 | METRO34980M34980 | Nashville-Davidson--Murfreesboro--Franklin, TN HUD Metro FMR Area | Cannon County | 82300 | 17300 | 19800 | 22250 | 24700 | 26700 | 28700 | 30650 | 32650 | 9999 | Cannon County | Tennessee | 1 |
| TN | 4701799999 | 47 | 17 | NCNTY47017N47017 | Carroll County, TN | Carroll County | 55400 | 11650 | 13300 | 14950 | 16600 | 17950 | 19300 | 20600 | 21950 | 9999 | Carroll County | Tennessee | 0 |
| TN | 4701999999 | 47 | 19 | METRO27740M27740 | Johnson City, TN MSA | Carter County | 57500 | 12100 | 13800 | 15550 | 17250 | 18650 | 20050 | 21400 | 22800 | 3660 | Carter County | Tennessee | 1 |
| TN | 4702199999 | 47 | 21 | METRO34980M34980 | Nashville-Davidson--Murfreesboro--Franklin, TN HUD Metro FMR Area | Cheatham County | 82300 | 17300 | 19800 | 22250 | 24700 | 26700 | 28700 | 30650 | 32650 | 5360 | Cheatham County | Tennessee | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TN | 4702399999 | 47 | 23 | METRO27180M27180 | Jackson, TN HUD Metro FMR Area | Chester County | 59600 | 12550 | 14350 | 16150 | 17900 | 19350 | 20800 | 22200 | 23650 | 3580 | Chester County | Tennessee | 1 |
| TN | 4702599999 | 47 | 25 | NCNTY47025N47025 | Claiborne County, TN | Claiborne County | 48000 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Claiborne County | Tennessee | 0 |
| TN | 4702799999 | 47 | 27 | NCNTY47027N47027 | Clay County, TN | Clay County | 43600 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Clay County | Tennessee | 0 |
| TN | 4702999999 | 47 | 29 | NCNTY47029N47029 | Cocke County, TN | Cocke County | 44000 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Cocke County | Tennessee | 0 |
| TN | 4703199999 | 47 | 31 | NCNTY47031N47031 | Coffee County, TN | Coffee County | 60800 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Coffee County | Tennessee | 0 |
| TN | 4703399999 | 47 | 33 | METRO27180N47033 | Crockett County, TN HUD Metro FMR Area | Crockett County | 53700 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Crockett County | Tennessee | 1 |
| TN | 4703599999 | 47 | 35 | NCNTY47035N47035 | Cumberland County, TN | Cumberland County | 52300 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Cumberland County | Tennessee | 0 |
| TN | 4703799999 | 47 | 37 | METRO34980M34980 | Nashville-Davidson--Murfreesboro--Franklin, TN HUD Metro FMR Area | Davidson County | 82300 | 17300 | 19800 | 22250 | 24700 | 26700 | 28700 | 30650 | 32650 | 5360 | Davidson County | Tennessee | 1 |
| TN | 4703999999 | 47 | 39 | NCNTY47039N47039 | Decatur County, TN | Decatur County | 47600 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Decatur County | Tennessee | 0 |
| TN | 4704199999 | 47 | 41 | NCNTY47041N47041 | DeKalb County, TN | DeKalb County | 51700 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | DeKalb County | Tennessee | 0 |
| TN | 4704399999 | 47 | 43 | METRO34980M34980 | Nashville-Davidson--Murfreesboro--Franklin, TN HUD Metro FMR Area | Dickson County | 82300 | 17300 | 19800 | 22250 | 24700 | 26700 | 28700 | 30650 | 32650 | 5360 | Dickson County | Tennessee | 1 |
| TN | 4704599999 | 47 | 45 | NCNTY47045N47045 | Dyer County, TN | Dyer County | 57700 | 12150 | 13850 | 15600 | 17300 | 18700 | 20100 | 21500 | 22850 | 9999 | Dyer County | Tennessee | 0 |
| TN | 4704799999 | 47 | 47 | METRO32820M32820 | Memphis, TN-MS-AR HUD Metro FMR Area | Fayette County | 67900 | 14250 | 16300 | 18350 | 20350 | 22000 | 23650 | 25250 | 26900 | 4920 | Fayette County | Tennessee | 1 |
| TN | 4704999999 | 47 | 49 | NCNTY47049N47049 | Fentress County, TN | Fentress County | 42000 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Fentress County | Tennessee | 0 |
| TN | 4705199999 | 47 | 51 | NCNTY47051N47051 | Franklin County, TN | Franklin County | 57500 | 12100 | 13800 | 15550 | 17250 | 18650 | 20050 | 21400 | 22800 | 9999 | Franklin County | Tennessee | 0 |
| TN | 4705399999 | 47 | 53 | NCNTY47053N47053 | Gibson County, TN | Gibson County | 55200 | 11600 | 13250 | 14900 | 16550 | 17900 | 19200 | 20550 | 21850 | 9999 | Gibson County | Tennessee | 0 |
| TN | 4705599999 | 47 | 55 | NCNTY47055N47055 | Giles County, TN | Giles County | 57300 | 12050 | 13800 | 15500 | 17200 | 18600 | 20000 | 21350 | 22750 | 9999 | Giles County | Tennessee | 0 |
| TN | 4705799999 | 47 | 57 | METRO28940M34100 | Grainger County, TN HUD Metro FMR Area | Grainger County | 52700 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Grainger County | Tennessee | 1 |
| TN | 4705999999 | 47 | 59 | NCNTY47059N47059 | Greene County, TN | Greene County | 53400 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Greene County | Tennessee | 0 |
| TN | 4706199999 | 47 | 61 | NCNTY47061N47061 | Grundy County, TN | Grundy County | 42300 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Grundy County | Tennessee | 0 |
| TN | 4706399999 | 47 | 63 | METRO34100M34100 | Morristown, TN MSA | Hamblen County | 55400 | 11650 | 13300 | 14950 | 16600 | 17950 | 19300 | 20600 | 21950 | 9999 | Hamblen County | Tennessee | 1 |
| TN | 4706599999 | 47 | 65 | METRO16860M16860 | Chattanooga, TN-GA MSA | Hamilton County | 72600 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 1560 | Hamilton County | Tennessee | 1 |
| TN | 4706799999 | 47 | 67 | NCNTY47067N47067 | Hancock County, TN | Hancock County | 43400 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Hancock County | Tennessee | 0 |
| TN | 4706999999 | 47 | 69 | NCNTY47069N47069 | Hardeman County, TN | Hardeman County | 47900 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Hardeman County | Tennessee | 0 |
| TN | 4707199999 | 47 | 71 | NCNTY47071N47071 | Hardin County, TN | Hardin County | 53900 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Hardin County | Tennessee | 0 |
| TN | 4707399999 | 47 | 73 | METRO28700M28700 | Kingsport-Bristol-Bristol, TN-VA MSA | Hawkins County | 59100 | 12450 | 14200 | 16000 | 17750 | 19200 | 20600 | 22050 | 23450 | 3660 | Hawkins County | Tennessee | 1 |
| TN | 4707599999 | 47 | 75 | NCNTY47075N47075 | Haywood County, TN | Haywood County | 49800 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Haywood County | Tennessee | 0 |
| TN | 4707799999 | 47 | 77 | NCNTY47077N47077 | Henderson County, TN | Henderson County | 56000 | 11800 | 13450 | 15150 | 16800 | 18150 | 19500 | 20850 | 22200 | 9999 | Henderson County | Tennessee | 0 |
| TN | 4707999999 | 47 | 79 | NCNTY47079N47079 | Henry County, TN | Henry County | 52100 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Henry County | Tennessee | 0 |
| TN | 4708199999 | 47 | 81 | METRO34980N47081 | Hickman County, TN HUD Metro FMR Area | Hickman County | 50200 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Hickman County | Tennessee | 1 |
| TN | 4708399999 | 47 | 83 | NCNTY47083N47083 | Houston County, TN | Houston County | 52600 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Houston County | Tennessee | 0 |
| TN | 4708599999 | 47 | 85 | NCNTY47085N47085 | Humphreys County, TN | Humphreys County | 54500 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Humphreys County | Tennessee | 0 |
| TN | 4708799999 | 47 | 87 | NCNTY47087N47087 | Jackson County, TN | Jackson County | 46800 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Jackson County | Tennessee | 0 |
| TN | 4708999999 | 47 | 89 | METRO34100M34100 | Morristown, TN MSA | Jefferson County | 55400 | 11650 | 13300 | 14950 | 16600 | 17950 | 19300 | 20600 | 21950 | 9999 | Jefferson County | Tennessee | 1 |
| TN | 4709199999 | 47 | 91 | NCNTY47091N47091 | Johnson County, TN | Johnson County | 41100 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Johnson County | Tennessee | 0 |
| TN | 4709399999 | 47 | 93 | METRO28940M28940 | Knoxville, TN HUD Metro FMR Area | Knox County | 73900 | 15550 | 17750 | 19950 | 22150 | 23950 | 25700 | 27500 | 29250 | 3840 | Knox County | Tennessee | 1 |
| TN | 4709599999 | 47 | 95 | NCNTY47095N47095 | Lake County, TN | Lake County | 50200 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Lake County | Tennessee | 0 |
| TN | 4709799999 | 47 | 97 | NCNTY47097N47097 | Lauderdale County, TN | Lauderdale County | 46200 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Lauderdale County | Tennessee | 0 |
| TN | 4709999999 | 47 | 99 | NCNTY47099N47099 | Lawrence County, TN | Lawrence County | 52100 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Lawrence County | Tennessee | 0 |
| TN | 4710199999 | 47 | 101 | NCNTY47101N47101 | Lewis County, TN | Lewis County | 49200 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Lewis County | Tennessee | 0 |
| TN | 4710399999 | 47 | 103 | NCNTY47103N47103 | Lincoln County, TN | Lincoln County | 53800 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Lincoln County | Tennessee | 0 |
| TN | 4710599999 | 47 | 105 | METRO28940M28940 | Knoxville, TN HUD Metro FMR Area | Loudon County | 73900 | 15550 | 17750 | 19950 | 22150 | 23950 | 25700 | 27500 | 29250 | 3840 | Loudon County | Tennessee | 1 |
| TN | 4710799999 | 47 | 107 | NCNTY47107N47107 | McMinn County, TN | McMinn County | 54600 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | McMinn County | Tennessee | 0 |
| TN | 4710999999 | 47 | 109 | NCNTY47109N47109 | McNairy County, TN | McNairy County | 48200 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | McNairy County | Tennessee | 0 |
| TN | 4711199999 | 47 | 111 | METRO34980N47111 | Macon County, TN HUD Metro FMR Area | Macon County | 44600 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Macon County | Tennessee | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TN | 4711399999 | 47 | 113 | METRO27180M27180 | Jackson, TN HUD Metro FMR Area | Madison County | 59600 | 12550 | 14350 | 16150 | 17900 | 19350 | 20800 | 22200 | 23650 | 3580 | Madison County | Tennessee | 1 |
| TN | 4711599999 | 47 | 115 | METRO16860M16860 | Chattanooga, TN-GA MSA | Marion County | 72600 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 1560 | Marion County | Tennessee | 1 |
| TN | 4711799999 | 47 | 117 | NCNTY47117N47117 | Marshall County, TN | Marshall County | 58600 | 12350 | 14100 | 15850 | 17600 | 19050 | 20450 | 21850 | 23250 | 9999 | Marshall County | Tennessee | 0 |
| TN | 4711999999 | 47 | 119 | METRO34980N47119 | Maury County, TN HUD Metro FMR Area | Maury County | 70800 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Maury County | Tennessee | 1 |
| TN | 4712199999 | 47 | 121 | NCNTY47121N47121 | Meigs County, TN | Meigs County | 49400 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Meigs County | Tennessee | 0 |
| TN | 4712399999 | 47 | 123 | NCNTY47123N47123 | Monroe County, TN | Monroe County | 48300 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Monroe County | Tennessee | 0 |
| TN | 4712599999 | 47 | 125 | METRO17300M17300 | Clarksville, TN-KY MSA | Montgomery County | 68900 | 13800 | 15800 | 17750 | 19700 | 21300 | 22900 | 24450 | 26050 | 1660 | Montgomery County | Tennessee | 1 |
| TN | 4712799999 | 47 | 127 | NCNTY47127N47127 | Moore County, TN | Moore County | 65700 | 13800 | 15800 | 17750 | 19700 | 21300 | 22900 | 24450 | 26050 | 9999 | Moore County | Tennessee | 0 |
| TN | 4712999999 | 47 | 129 | METRO28940N47129 | Morgan County, TN HUD Metro FMR Area | Morgan County | 52000 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Morgan County | Tennessee | 1 |
| TN | 4713199999 | 47 | 131 | NCNTY47131N47131 | Obion County, TN | Obion County | 51400 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Obion County | Tennessee | 0 |
| TN | 4713399999 | 47 | 133 | NCNTY47133N47133 | Overton County, TN | Overton County | 48100 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Overton County | Tennessee | 0 |
| TN | 4713599999 | 47 | 135 | NCNTY47135N47135 | Perry County, TN | Perry County | 43500 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Perry County | Tennessee | 0 |
| TN | 4713799999 | 47 | 137 | NCNTY47137N47137 | Pickett County, TN | Pickett County | 47900 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Pickett County | Tennessee | 0 |
| TN | 4713999999 | 47 | 139 | METRO17420M17420 | Cleveland, TN MSA | Polk County | 61400 | 12900 | 14750 | 16600 | 18400 | 19900 | 21350 | 22850 | 24300 | 9999 | Polk County | Tennessee | 1 |
| TN | 4714199999 | 47 | 141 | NCNTY47141N47141 | Putnam County, TN | Putnam County | 56500 | 11900 | 13600 | 15300 | 16950 | 18350 | 19700 | 21050 | 22400 | 9999 | Putnam County | Tennessee | 0 |
| TN | 4714399999 | 47 | 143 | NCNTY47143N47143 | Rhea County, TN | Rhea County | 54900 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Rhea County | Tennessee | 0 |
| TN | 4714599999 | 47 | 145 | METRO28940N47145 | Roane County, TN HUD Metro FMR Area | Roane County | 63300 | 13300 | 15200 | 17100 | 19000 | 20550 | 22050 | 23600 | 25100 | 9999 | Roane County | Tennessee | 1 |
| TN | 4714799999 | 47 | 147 | METRO34980M34980 | Nashville-Davidson--Murfreesboro--Franklin, TN HUD Metro FMR Area | Robertson County | 82300 | 17300 | 19800 | 22250 | 24700 | 26700 | 28700 | 30650 | 32650 | 5360 | Robertson County | Tennessee | 1 |
| TN | 4714999999 | 47 | 149 | METRO34980M34980 | Nashville-Davidson--Murfreesboro--Franklin, TN HUD Metro FMR Area | Rutherford County | 82300 | 17300 | 19800 | 22250 | 24700 | 26700 | 28700 | 30650 | 32650 | 5360 | Rutherford County | Tennessee | 1 |
| TN | 4715199999 | 47 | 151 | NCNTY47151N47151 | Scott County, TN | Scott County | 42500 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Scott County | Tennessee | 0 |
| TN | 4715399999 | 47 | 153 | METRO16860M16860 | Chattanooga, TN-GA MSA | Sequatchie County | 72600 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Sequatchie County | Tennessee | 1 |
| TN | 4715599999 | 47 | 155 | NCNTY47155N47155 | Sevier County, TN | Sevier County | 58200 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 3840 | Sevier County | Tennessee | 0 |
| TN | 4715799999 | 47 | 157 | METRO32820M32820 | Memphis, TN-MS-AR HUD Metro FMR Area | Shelby County | 67900 | 14250 | 16300 | 18350 | 20350 | 22000 | 23650 | 25250 | 26900 | 4920 | Shelby County | Tennessee | 1 |
| TN | 4715999999 | 47 | 159 | METRO34980N47159 | Smith County, TN HUD Metro FMR Area | Smith County | 56200 | 11800 | 13500 | 15200 | 16850 | 18200 | 19550 | 20900 | 22250 | 9999 | Smith County | Tennessee | 1 |
| TN | 4716199999 | 47 | 161 | NCNTY47161N47161 | Stewart County, TN | Stewart County | 59300 | 12500 | 14250 | 16050 | 17800 | 19250 | 20650 | 22100 | 23500 | 9999 | Stewart County | Tennessee | 0 |
| TN | 4716399999 | 47 | 163 | METRO28700M28700 | Kingsport-Bristol-Bristol, TN-VA MSA | Sullivan County | 59100 | 12450 | 14200 | 16000 | 17750 | 19200 | 20600 | 22050 | 23450 | 3660 | Sullivan County | Tennessee | 1 |
| TN | 4716599999 | 47 | 165 | METRO34980M34980 | Nashville-Davidson--Murfreesboro--Franklin, TN HUD Metro FMR Area | Sumner County | 82300 | 17300 | 19800 | 22250 | 24700 | 26700 | 28700 | 30650 | 32650 | 5360 | Sumner County | Tennessee | 1 |
| TN | 4716799999 | 47 | 167 | METRO32820M32820 | Memphis, TN-MS-AR HUD Metro FMR Area | Tipton County | 67900 | 14250 | 16300 | 18350 | 20350 | 22000 | 23650 | 25250 | 26900 | 4920 | Tipton County | Tennessee | 1 |
| TN | 4716999999 | 47 | 169 | METRO34980M34980 | Nashville-Davidson--Murfreesboro--Franklin, TN HUD Metro FMR Area | Trousdale County | 82300 | 17300 | 19800 | 22250 | 24700 | 26700 | 28700 | 30650 | 32650 | 9999 | Trousdale County | Tennessee | 1 |
| TN | 4717199999 | 47 | 171 | METRO27740M27740 | Johnson City, TN MSA | Unicoi County | 57500 | 12100 | 13800 | 15550 | 17250 | 18650 | 20050 | 21400 | 22800 | 3660 | Unicoi County | Tennessee | 1 |
| TN | 4717399999 | 47 | 173 | METRO28940M28940 | Knoxville, TN HUD Metro FMR Area | Union County | 73900 | 15550 | 17750 | 19950 | 22150 | 23950 | 25700 | 27500 | 29250 | 3840 | Union County | Tennessee | 1 |
| TN | 4717599999 | 47 | 175 | NCNTY47175N47175 | Van Buren County, TN | Van Buren County | 54200 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Van Buren County | Tennessee | 0 |
| TN | 4717799999 | 47 | 177 | NCNTY47177N47177 | Warren County, TN | Warren County | 51500 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Warren County | Tennessee | 0 |
| TN | 4717999999 | 47 | 179 | METRO27740M27740 | Johnson City, TN MSA | Washington County | 57500 | 12100 | 13800 | 15550 | 17250 | 18650 | 20050 | 21400 | 22800 | 3660 | Washington County | Tennessee | 1 |
| TN | 4718199999 | 47 | 181 | NCNTY47181N47181 | Wayne County, TN | Wayne County | 45600 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Wayne County | Tennessee | 0 |
| TN | 4718399999 | 47 | 183 | NCNTY47183N47183 | Weakley County, TN | Weakley County | 52300 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Weakley County | Tennessee | 0 |
| TN | 4718599999 | 47 | 185 | NCNTY47185N47185 | White County, TN | White County | 48000 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | White County | Tennessee | 0 |
| TN | 4718799999 | 47 | 187 | METRO34980M34980 | Nashville-Davidson--Murfreesboro--Franklin, TN HUD Metro FMR Area | Williamson County | 82300 | 17300 | 19800 | 22250 | 24700 | 26700 | 28700 | 30650 | 32650 | 5360 | Williamson County | Tennessee | 1 |
| TN | 4718999999 | 47 | 189 | METRO34980M34980 | Nashville-Davidson--Murfreesboro--Franklin, TN HUD Metro FMR Area | Wilson County | 82300 | 17300 | 19800 | 22250 | 24700 | 26700 | 28700 | 30650 | 32650 | 5360 | Wilson County | Tennessee | 1 |
| TX | 4800199999 | 48 | 1 | NCNTY48001N48001 | Anderson County, TX | Anderson County | 55900 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Anderson County | Texas | 0 |
| TX | 4800399999 | 48 | 3 | NCNTY48003N48003 | Andrews County, TX | Andrews County | 84200 | 17700 | 20200 | 22750 | 25250 | 27300 | 29300 | 31350 | 33350 | 9999 | Andrews County | Texas | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TX | 4800599999 | 48 | 5 | NCNTY48005N48005 | Angelina County, TX | Angelina County | 57500 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Angelina County | Texas | 0 |
| TX | 4800799999 | 48 | 7 | METRO18580N48007 | Aransas County, TX HUD Metro FMR Area | Aransas County | 61500 | 12950 | 14800 | 16650 | 18450 | 19950 | 21450 | 22900 | 24400 | 9999 | Aransas County | Texas | 1 |
| TX | 4800999999 | 48 | 9 | METRO48660M48660 | Wichita Falls, TX MSA | Archer County | 64700 | 13550 | 15500 | 17450 | 19350 | 20900 | 22450 | 24000 | 25550 | 9080 | Archer County | Texas | 1 |
| TX | 4801199999 | 48 | 11 | METRO11100M11100 | Amarillo, TX HUD Metro FMR Area | Armstrong County | 66900 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Armstrong County | Texas | 1 |
| TX | 4801399999 | 48 | 13 | METRO41700N48013 | Atascosa County, TX HUD Metro FMR Area | Atascosa County | 62900 | 13200 | 15100 | 17000 | 18850 | 20400 | 21900 | 23400 | 24900 | 9999 | Atascosa County | Texas | 1 |
| TX | 4801599999 | 48 | 15 | METRO26420N48015 | Austin County, TX HUD Metro FMR Area | Austin County | 82200 | 17200 | 19650 | 22100 | 24550 | 26550 | 28500 | 30450 | 32450 | 9999 | Austin County | Texas | 1 |
| TX | 4801799999 | 48 | 17 | NCNTY48017N48017 | Bailey County, TX | Bailey County | 53700 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Bailey County | Texas | 0 |
| TX | 4801999999 | 48 | 19 | METRO41700M41700 | San Antonio-New Braunfels, TX HUD Metro FMR Area | Bandera County | 72000 | 15150 | 17300 | 19450 | 21600 | 23350 | 25100 | 26800 | 28550 | 9999 | Bandera County | Texas | 1 |
| TX | 4802199999 | 48 | 21 | METRO12420M12420 | Austin-Round Rock, TX MSA | Bastrop County | 97600 | 20550 | 23450 | 26400 | 29300 | 31650 | 34000 | 36350 | 38700 | 640 | Bastrop County | Texas | 1 |
| TX | 4802399999 | 48 | 23 | NCNTY48023N48023 | Baylor County, TX | Baylor County | 63100 | 13300 | 15200 | 17100 | 18950 | 20500 | 22000 | 23500 | 25050 | 9999 | Baylor County | Texas | 0 |
| TX | 4802599999 | 48 | 25 | NCNTY48025N48025 | Bee County, TX | Bee County | 51200 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Bee County | Texas | 0 |
| TX | 4802799999 | 48 | 27 | METRO28660M28660 | Killeen-Temple, TX HUD Metro FMR Area | Bell County | 63900 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 3810 | Bell County | Texas | 1 |
| TX | 4802999999 | 48 | 29 | METRO41700M41700 | San Antonio-New Braunfels, TX HUD Metro FMR Area | Bexar County | 72000 | 15150 | 17300 | 19450 | 21600 | 23350 | 25100 | 26800 | 28550 | 7240 | Bexar County | Texas | 1 |
| TX | 4803199999 | 48 | 31 | NCNTY48031N48031 | Blanco County, TX | Blanco County | 68800 | 14600 | 16650 | 18750 | 20800 | 22500 | 24150 | 25800 | 27500 | 9999 | Blanco County | Texas | 0 |
| TX | 4803399999 | 48 | 33 | NCNTY48033N48033 | Borden County, TX | Borden County | 92600 | 18550 | 21200 | 23850 | 26500 | 28650 | 30750 | 32900 | 35000 | 9999 | Borden County | Texas | 0 |
| TX | 4803599999 | 48 | 35 | NCNTY48035N48035 | Bosque County, TX | Bosque County | 59800 | 12600 | 14400 | 16200 | 17950 | 19400 | 20850 | 22300 | 23700 | 9999 | Bosque County | Texas | 0 |
| TX | 4803799999 | 48 | 37 | METRO45500M45500 | Texarkana, TX-Texarkana, AR HUD Metro FMR Area | Bowie County | 69800 | 13300 | 15200 | 17100 | 19000 | 20550 | 22050 | 23600 | 25100 | 8360 | Bowie County | Texas | 1 |
| TX | 4803999999 | 48 | 39 | METRO26420MM1145 | Brazoria County, TX HUD Metro FMR Area | Brazoria County | 104200 | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37850 | 40300 | 1145 | Brazoria County | Texas | 1 |
| TX | 4804199999 | 48 | 41 | METRO17780M17780 | College Station-Bryan, TX MSA | Brazos County | 65600 | 13800 | 15800 | 17750 | 19700 | 21300 | 22900 | 24450 | 26050 | 1260 | Brazos County | Texas | 1 |
| TX | 4804399999 | 48 | 43 | NCNTY48043N48043 | Brewster County, TX | Brewster County | 56900 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Brewster County | Texas | 0 |
| TX | 4804599999 | 48 | 45 | NCNTY48045N48045 | Briscoe County, TX | Briscoe County | 55400 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Briscoe County | Texas | 0 |
| TX | 4804799999 | 48 | 47 | NCNTY48047N48047 | Brooks County, TX | Brooks County | 29800 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Brooks County | Texas | 0 |
| TX | 4804999999 | 48 | 49 | NCNTY48049N48049 | Brown County, TX | Brown County | 57900 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Brown County | Texas | 0 |
| TX | 4805199999 | 48 | 51 | METRO17780M17780 | College Station-Bryan, TX MSA | Burleson County | 65600 | 13800 | 15800 | 17750 | 19700 | 21300 | 22900 | 24450 | 26050 | 9999 | Burleson County | Texas | 1 |
| TX | 4805399999 | 48 | 53 | NCNTY48053N48053 | Burnet County, TX | Burnet County | 70800 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Burnet County | Texas | 0 |
| TX | 4805599999 | 48 | 55 | METRO12420M12420 | Austin-Round Rock, TX MSA | Caldwell County | 97600 | 20550 | 23450 | 26400 | 29300 | 31650 | 34000 | 36350 | 38700 | 640 | Caldwell County | Texas | 1 |
| TX | 4805799999 | 48 | 57 | NCNTY48057N48057 | Calhoun County, TX | Calhoun County | 72700 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Calhoun County | Texas | 0 |
| TX | 4805999999 | 48 | 59 | METRO10180M10180 | Abilene, TX MSA | Callahan County | 64800 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9999 | Callahan County | Texas | 1 |
| TX | 4806199999 | 48 | 61 | METRO15180M15180 | Brownsville-Harlingen, TX MSA | Cameron County | 47800 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 1240 | Cameron County | Texas | 1 |
| TX | 4806399999 | 48 | 63 | NCNTY48063N48063 | Camp County, TX | Camp County | 54700 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Camp County | Texas | 0 |
| TX | 4806599999 | 48 | 65 | METRO11100M11100 | Amarillo, TX HUD Metro FMR Area | Carson County | 66900 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Carson County | Texas | 1 |
| TX | 4806799999 | 48 | 67 | NCNTY48067N48067 | Cass County, TX | Cass County | 54500 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Cass County | Texas | 0 |
| TX | 4806999999 | 48 | 69 | NCNTY48069N48069 | Castro County, TX | Castro County | 52800 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Castro County | Texas | 0 |
| TX | 4807199999 | 48 | 71 | METRO26420M26420 | Houston-The Woodlands-Sugar Land, TX HUD Metro FMR Area | Chambers County | 78800 | 16600 | 18950 | 21300 | 23650 | 25550 | 27450 | 29350 | 31250 | 3360 | Chambers County | Texas | 1 |
| TX | 4807399999 | 48 | 73 | NCNTY48073N48073 | Cherokee County, TX | Cherokee County | 55900 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Cherokee County | Texas | 0 |
| TX | 4807599999 | 48 | 75 | NCNTY48075N48075 | Childress County, TX | Childress County | 64700 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Childress County | Texas | 0 |
| TX | 4807799999 | 48 | 77 | METRO48660M48660 | Wichita Falls, TX MSA | Clay County | 64700 | 13550 | 15500 | 17450 | 19350 | 20900 | 22450 | 24000 | 25550 | 9999 | Clay County | Texas | 1 |
| TX | 4807999999 | 48 | 79 | NCNTY48079N48079 | Cochran County, TX | Cochran County | 55500 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Cochran County | Texas | 0 |
| TX | 4808199999 | 48 | 81 | NCNTY48081N48081 | Coke County, TX | Coke County | 62400 | 13100 | 15000 | 16850 | 18700 | 20200 | 21700 | 23200 | 24700 | 9999 | Coke County | Texas | 0 |
| TX | 4808399999 | 48 | 83 | NCNTY48083N48083 | Coleman County, TX | Coleman County | 49200 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Coleman County | Texas | 0 |
| TX | 4808599999 | 48 | 85 | METRO19100M19100 | Dallas, TX HUD Metro FMR Area | Collin County | 86200 | 18100 | 20700 | 23300 | 25850 | 27950 | 30000 | 32100 | 34150 | 1920 | Collin County | Texas | 1 |
| TX | 4808799999 | 48 | 87 | NCNTY48087N48087 | Collingsworth County, TX | Collingsworth County | 56200 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Collingsworth County | Texas | 0 |
| TX | 4808999999 | 48 | 89 | NCNTY48089N48089 | Colorado County, TX | Colorado County | 69100 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 9999 | Colorado County | Texas | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TX | 4809199999 | 48 | 91 | METRO41700M41700 | San Antonio-New Braunfels, TX HUD Metro FMR Area | Comal County | 72000 | 15150 | 17300 | 19450 | 21600 | 23350 | 25100 | 26800 | 28550 | 7240 | Comal County | Texas | 1 |
| TX | 4809399999 | 48 | 93 | NCNTY48093N48093 | Comanche County, TX | Comanche County | 52200 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Comanche County | Texas | 0 |
| TX | 4809599999 | 48 | 95 | NCNTY48095N48095 | Concho County, TX | Concho County | 63900 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Concho County | Texas | 0 |
| TX | 4809799999 | 48 | 97 | NCNTY48097N48097 | Cooke County, TX | Cooke County | 74200 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Cooke County | Texas | 0 |
| TX | 4809999999 | 48 | 99 | METRO28660M28660 | Killeen-Temple, TX HUD Metro FMR Area | Coryell County | 63900 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 3810 | Coryell County | Texas | 1 |
| TX | 4810199999 | 48 | 101 | NCNTY48101N48101 | Cottle County, TX | Cottle County | 49900 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Cottle County | Texas | 0 |
| TX | 4810399999 | 48 | 103 | NCNTY48103N48103 | Crane County, TX | Crane County | 79900 | 16800 | 19200 | 21600 | 23950 | 25900 | 27800 | 29700 | 31650 | 9999 | Crane County | Texas | 0 |
| TX | 4810599999 | 48 | 105 | NCNTY48105N48105 | Crockett County, TX | Crockett County | 71400 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Crockett County | Texas | 0 |
| TX | 4810799999 | 48 | 107 | METRO31180M31180 | Lubbock, TX HUD Metro FMR Area | Crosby County | 69200 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 9999 | Crosby County | Texas | 1 |
| TX | 4810999999 | 48 | 109 | NCNTY48109N48109 | Culberson County, TX | Culberson County | 46100 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Culberson County | Texas | 0 |
| TX | 4811199999 | 48 | 111 | NCNTY48111N48111 | Dallam County, TX | Dallam County | 56500 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Dallam County | Texas | 0 |
| TX | 4811399999 | 48 | 113 | METRO19100M19100 | Dallas, TX HUD Metro FMR Area | Dallas County | 86200 | 18100 | 20700 | 23300 | 25850 | 27950 | 30000 | 32100 | 34150 | 1920 | Dallas County | Texas | 1 |
| TX | 4811599999 | 48 | 115 | NCNTY48115N48115 | Dawson County, TX | Dawson County | 55500 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Dawson County | Texas | 0 |
| TX | 4811799999 | 48 | 117 | NCNTY48117N48117 | Deaf Smith County, TX | Deaf Smith County | 63400 | 13300 | 15200 | 17100 | 19000 | 20550 | 22050 | 23600 | 25100 | 9999 | Deaf Smith County | Texas | 0 |
| TX | 4811999999 | 48 | 119 | NCNTY48119N48119 | Delta County, TX | Delta County | 56100 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Delta County | Texas | 0 |
| TX | 4812199999 | 48 | 121 | METRO19100M19100 | Dallas, TX HUD Metro FMR Area | Denton County | 86200 | 18100 | 20700 | 23300 | 25850 | 27950 | 30000 | 32100 | 34150 | 1920 | Denton County | Texas | 1 |
| TX | 4812399999 | 48 | 123 | NCNTY48123N48123 | DeWitt County, TX | DeWitt County | 69700 | 14650 | 16750 | 18850 | 20900 | 22600 | 24250 | 25950 | 27600 | 9999 | DeWitt County | Texas | 0 |
| TX | 4812599999 | 48 | 125 | NCNTY48125N48125 | Dickens County, TX | Dickens County | 58800 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Dickens County | Texas | 0 |
| TX | 4812799999 | 48 | 127 | NCNTY48127N48127 | Dimmit County, TX | Dimmit County | 40000 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Dimmit County | Texas | 0 |
| TX | 4812999999 | 48 | 129 | NCNTY48129N48129 | Donley County, TX | Donley County | 59100 | 12450 | 14200 | 16000 | 17750 | 19200 | 20600 | 22050 | 23450 | 9999 | Donley County | Texas | 0 |
| TX | 4813199999 | 48 | 131 | NCNTY48131N48131 | Duval County, TX | Duval County | 43100 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Duval County | Texas | 0 |
| TX | 4813399999 | 48 | 133 | NCNTY48133N48133 | Eastland County, TX | Eastland County | 46700 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Eastland County | Texas | 0 |
| TX | 4813599999 | 48 | 135 | METRO36220M36220 | Odessa, TX MSA | Ector County | 65500 | 14800 | 16900 | 19000 | 21100 | 22800 | 24500 | 26200 | 27900 | 5800 | Ector County | Texas | 1 |
| TX | 4813799999 | 48 | 137 | NCNTY48137N48137 | Edwards County, TX | Edwards County | 67400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Edwards County | Texas | 0 |
| TX | 4813999999 | 48 | 139 | METRO19100M19100 | Dallas, TX HUD Metro FMR Area | Ellis County | 86200 | 18100 | 20700 | 23300 | 25850 | 27950 | 30000 | 32100 | 34150 | 1920 | Ellis County | Texas | 1 |
| TX | 4814199999 | 48 | 141 | METRO21340M21340 | El Paso, TX HUD Metro FMR Area | El Paso County | 52500 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 2320 | El Paso County | Texas | 1 |
| TX | 4814399999 | 48 | 143 | NCNTY48143N48143 | Erath County, TX | Erath County | 65400 | 13300 | 15200 | 17100 | 19000 | 20550 | 22050 | 23600 | 25100 | 9999 | Erath County | Texas | 0 |
| TX | 4814599999 | 48 | 145 | METRO47380N48145 | Falls County, TX HUD Metro FMR Area | Falls County | 53700 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Falls County | Texas | 1 |
| TX | 4814799999 | 48 | 147 | NCNTY48147N48147 | Fannin County, TX | Fannin County | 63200 | 13300 | 15200 | 17100 | 18950 | 20500 | 22000 | 23500 | 25050 | 9999 | Fannin County | Texas | 0 |
| TX | 4814999999 | 48 | 149 | NCNTY48149N48149 | Fayette County, TX | Fayette County | 72400 | 15200 | 17400 | 19550 | 21700 | 23450 | 25200 | 26950 | 28650 | 9999 | Fayette County | Texas | 0 |
| TX | 4815199999 | 48 | 151 | NCNTY48151N48151 | Fisher County, TX | Fisher County | 66000 | 13300 | 15200 | 17100 | 19000 | 20550 | 22050 | 23600 | 25100 | 9999 | Fisher County | Texas | 0 |
| TX | 4815399999 | 48 | 153 | NCNTY48153N48153 | Floyd County, TX | Floyd County | 56100 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Floyd County | Texas | 0 |
| TX | 4815599999 | 48 | 155 | NCNTY48155N48155 | Foard County, TX | Foard County | 58200 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Foard County | Texas | 0 |
| TX | 4815799999 | 48 | 157 | METRO26420M26420 | Houston-The Woodlands-Sugar Land, TX HUD Metro FMR Area | Fort Bend County | 78800 | 16600 | 18950 | 21300 | 23650 | 25550 | 27450 | 29350 | 31250 | 3360 | Fort Bend County | Texas | 1 |
| TX | 4815999999 | 48 | 159 | NCNTY48159N48159 | Franklin County, TX | Franklin County | 64500 | 13550 | 15500 | 17450 | 19350 | 20900 | 22450 | 24000 | 25550 | 9999 | Franklin County | Texas | 0 |
| TX | 4816199999 | 48 | 161 | NCNTY48161N48161 | Freestone County, TX | Freestone County | 58700 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Freestone County | Texas | 0 |
| TX | 4816399999 | 48 | 163 | NCNTY48163N48163 | Frio County, TX | Frio County | 47900 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Frio County | Texas | 0 |
| TX | 4816599999 | 48 | 165 | NCNTY48165N48165 | Gaines County, TX | Gaines County | 66900 | 14050 | 16050 | 18050 | 20050 | 21700 | 23300 | 24900 | 26500 | 9999 | Gaines County | Texas | 0 |
| TX | 4816799999 | 48 | 167 | METRO26420M26420 | Houston-The Woodlands-Sugar Land, TX HUD Metro FMR Area | Galveston County | 78800 | 16600 | 18950 | 21300 | 23650 | 25550 | 27450 | 29350 | 31250 | 2920 | Galveston County | Texas | 1 |
| TX | 4816999999 | 48 | 169 | NCNTY48169N48169 | Garza County, TX | Garza County | 60100 | 12650 | 14450 | 16250 | 18050 | 19500 | 20950 | 22400 | 23850 | 9999 | Garza County | Texas | 0 |
| TX | 4817199999 | 48 | 171 | NCNTY48171N48171 | Gillespie County, TX | Gillespie County | 73700 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Gillespie County | Texas | 0 |
| TX | 4817399999 | 48 | 173 | NCNTY48173N48173 | Glasscock County, TX | Glasscock County | 97600 | 20550 | 23450 | 26400 | 29300 | 31650 | 34000 | 36350 | 38700 | 9999 | Glasscock County | Texas | 0 |
| TX | 4817599999 | 48 | 175 | METRO47020M47020 | Victoria, TX MSA | Goliad County | 68800 | 14500 | 16550 | 18600 | 20650 | 22350 | 24000 | 25650 | 27300 | 9999 | Goliad County | Texas | 1 |
| TX | 4817799999 | 48 | 177 | NCNTY48177N48177 | Gonzales County, TX | Gonzales County | 62000 | 13050 | 14900 | 16750 | 18600 | 20100 | 21600 | 23100 | 24600 | 9999 | Gonzales County | Texas | 0 |
| TX | 4817999999 | 48 | 179 | NCNTY48179N48179 | Gray County, TX | Gray County | 63900 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Gray County | Texas | 0 |
| TX | 4818199999 | 48 | 181 | METRO43300M43300 | Sherman-Denison, TX MSA | Grayson County | 76000 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 7640 | Grayson County | Texas | 1 |
| TX | 4818399999 | 48 | 183 | METRO30980M30980 | Longview, TX HUD Metro FMR Area | Gregg County | 64800 | 13300 | 15200 | 17100 | 19000 | 20550 | 22050 | 23600 | 25100 | 4420 | Gregg County | Texas | 1 |
| TX | 4818599999 | 48 | 185 | NCNTY48185N48185 | Grimes County, TX | Grimes County | 60800 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Grimes County | Texas | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TX | 4818799999 | 48 | 187 | METRO41700M41700 | San Antonio-New Braunfels, TX HUD Metro FMR Area | Guadalupe County | 72000 | 15150 | 17300 | 19450 | 21600 | 23350 | 25100 | 26800 | 28550 | 7240 | Guadalupe County | Texas | 1 |
| TX | 4818999999 | 48 | 189 | NCNTY48189N48189 | Hale County, TX | Hale County | 55500 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Hale County | Texas | 0 |
| TX | 4819199999 | 48 | 191 | NCNTY48191N48191 | Hall County, TX | Hall County | 40000 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Hall County | Texas | 0 |
| TX | 4819399999 | 48 | 193 | NCNTY48193N48193 | Hamilton County, TX | Hamilton County | 64300 | 13550 | 15450 | 17400 | 19300 | 20850 | 22400 | 23950 | 25500 | 9999 | Hamilton County | Texas | 0 |
| TX | 4819599999 | 48 | 195 | NCNTY48195N48195 | Hansford County, TX | Hansford County | 43600 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Hansford County | Texas | 0 |
| TX | 4819799999 | 48 | 197 | NCNTY48197N48197 | Hardeman County, TX | Hardeman County | 55800 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Hardeman County | Texas | 0 |
| TX | 4819999999 | 48 | 199 | METRO13140M13140 | Beaumont-Port Arthur, TX HUD Metro FMR Area | Hardin County | 67500 | 14200 | 16200 | 18250 | 20250 | 21900 | 23500 | 25150 | 26750 | 840 | Hardin County | Texas | 1 |
| TX | 4820199999 | 48 | 201 | METRO26420M26420 | Houston-The Woodlands-Sugar Land, TX HUD Metro FMR Area | Harris County | 78800 | 16600 | 18950 | 21300 | 23650 | 25550 | 27450 | 29350 | 31250 | 3360 | Harris County | Texas | 1 |
| TX | 4820399999 | 48 | 203 | NCNTY48203N48203 | Harrison County, TX | Harrison County | 70200 | 13300 | 15200 | 17100 | 19000 | 20550 | 22050 | 23600 | 25100 | 4420 | Harrison County | Texas | 0 |
| TX | 4820599999 | 48 | 205 | NCNTY48205N48205 | Hartley County, TX | Hartley County | 72700 | 15300 | 17450 | 19650 | 21800 | 23550 | 25300 | 27050 | 28800 | 9999 | Hartley County | Texas | 0 |
| TX | 4820799999 | 48 | 207 | NCNTY48207N48207 | Haskell County, TX | Haskell County | 55200 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Haskell County | Texas | 0 |
| TX | 4820999999 | 48 | 209 | METRO12420M12420 | Austin-Round Rock, TX MSA | Hays County | 97600 | 20550 | 23450 | 26400 | 29300 | 31650 | 34000 | 36350 | 38700 | 640 | Hays County | Texas | 1 |
| TX | 4821199999 | 48 | 211 | NCNTY48211N48211 | Hemphill County, TX | Hemphill County | 77000 | 16200 | 18500 | 20800 | 23100 | 24950 | 26800 | 28650 | 30500 | 9999 | Hemphill County | Texas | 0 |
| TX | 4821399999 | 48 | 213 | NCNTY48213N48213 | Henderson County, TX | Henderson County | 59200 | 12450 | 14200 | 16000 | 17750 | 19200 | 20600 | 22050 | 23450 | 3286 | Henderson County | Texas | 0 |
| TX | 4821599999 | 48 | 215 | METRO32580M32580 | McAllen-Edinburg-Mission, TX MSA | Hidalgo County | 45100 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 4880 | Hidalgo County | Texas | 1 |
| TX | 4821799999 | 48 | 217 | NCNTY48217N48217 | Hill County, TX | Hill County | 61100 | 12850 | 14700 | 16550 | 18350 | 19850 | 21300 | 22800 | 24250 | 9999 | Hill County | Texas | 0 |
| TX | 4821999999 | 48 | 219 | NCNTY48219N48219 | Hockley County, TX | Hockley County | 62600 | 13200 | 15050 | 16950 | 18800 | 20350 | 21850 | 23350 | 24850 | 9999 | Hockley County | Texas | 0 |
| TX | 4822199999 | 48 | 221 | METRO19100N48221 | Hood County, TX HUD Metro FMR Area | Hood County | 76700 | 16100 | 18400 | 20700 | 23000 | 24850 | 26700 | 28550 | 30400 | 2800 | Hood County | Texas | 1 |
| TX | 4822399999 | 48 | 223 | NCNTY48223N48223 | Hopkins County, TX | Hopkins County | 60800 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Hopkins County | Texas | 0 |
| TX | 4822599999 | 48 | 225 | NCNTY48225N48225 | Houston County, TX | Houston County | 46800 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Houston County | Texas | 0 |
| TX | 4822799999 | 48 | 227 | NCNTY48227N48227 | Howard County, TX | Howard County | 64200 | 13500 | 15400 | 17350 | 19250 | 20800 | 22350 | 23900 | 25450 | 9999 | Howard County | Texas | 0 |
| TX | 4822999999 | 48 | 229 | METRO21340N48229 | Hudspeth County, TX HUD Metro FMR Area | Hudspeth County | 52500 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Hudspeth County | Texas | 1 |
| TX | 4823199999 | 48 | 231 | METRO19100M19100 | Dallas, TX HUD Metro FMR Area | Hunt County | 86200 | 18100 | 20700 | 23300 | 25850 | 27950 | 30000 | 32100 | 34150 | 1920 | Hunt County | Texas | 1 |
| TX | 4823399999 | 48 | 233 | NCNTY48233N48233 | Hutchinson County, TX | Hutchinson County | 65700 | 13800 | 15800 | 17750 | 19700 | 21300 | 22900 | 24450 | 26050 | 9999 | Hutchinson County | Texas | 0 |
| TX | 4823599999 | 48 | 235 | METRO41660M41660 | San Angelo, TX MSA | Irion County | 72400 | 14700 | 16800 | 18900 | 21000 | 22700 | 24400 | 26050 | 27750 | 9999 | Irion County | Texas | 1 |
| TX | 4823799999 | 48 | 237 | NCNTY48237N48237 | Jack County, TX | Jack County | 72300 | 14650 | 16750 | 18850 | 20900 | 22600 | 24250 | 25950 | 27600 | 9999 | Jack County | Texas | 0 |
| TX | 4823999999 | 48 | 239 | NCNTY48239N48239 | Jackson County, TX | Jackson County | 75300 | 15850 | 18100 | 20350 | 22600 | 24450 | 26250 | 28050 | 29850 | 9999 | Jackson County | Texas | 0 |
| TX | 4824199999 | 48 | 241 | NCNTY48241N48241 | Jasper County, TX | Jasper County | 61700 | 12950 | 14800 | 16650 | 18500 | 20000 | 21500 | 22950 | 24450 | 9999 | Jasper County | Texas | 0 |
| TX | 4824399999 | 48 | 243 | NCNTY48243N48243 | Jeff Davis County, TX | Jeff Davis County | 69700 | 14650 | 16750 | 18850 | 20900 | 22600 | 24250 | 25950 | 27600 | 9999 | Jeff Davis County | Texas | 0 |
| TX | 4824599999 | 48 | 245 | METRO13140M13140 | Beaumont-Port Arthur, TX HUD Metro FMR Area | Jefferson County | 67500 | 14200 | 16200 | 18250 | 20250 | 21900 | 23500 | 25150 | 26750 | 840 | Jefferson County | Texas | 1 |
| TX | 4824799999 | 48 | 247 | NCNTY48247N48247 | Jim Hogg County, TX | Jim Hogg County | 44800 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Jim Hogg County | Texas | 0 |
| TX | 4824999999 | 48 | 249 | NCNTY48249N48249 | Jim Wells County, TX | Jim Wells County | 55400 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Jim Wells County | Texas | 0 |
| TX | 4825199999 | 48 | 251 | METRO19100MM2800 | Fort Worth-Arlington, TX HUD Metro FMR Area | Johnson County | 81500 | 17150 | 19600 | 22050 | 24450 | 26450 | 28400 | 30350 | 32300 | 2800 | Johnson County | Texas | 1 |
| TX | 4825399999 | 48 | 253 | METRO10180M10180 | Abilene, TX MSA | Jones County | 64800 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 9999 | Jones County | Texas | 1 |
| TX | 4825599999 | 48 | 255 | NCNTY48255N48255 | Karnes County, TX | Karnes County | 68200 | 14050 | 16050 | 18050 | 20050 | 21700 | 23300 | 24900 | 26500 | 9999 | Karnes County | Texas | 0 |
| TX | 4825799999 | 48 | 257 | METRO19100M19100 | Dallas, TX HUD Metro FMR Area | Kaufman County | 86200 | 18100 | 20700 | 23300 | 25850 | 27950 | 30000 | 32100 | 34150 | 1920 | Kaufman County | Texas | 1 |
| TX | 4825999999 | 48 | 259 | METRO41700N48259 | Kendall County, TX HUD Metro FMR Area | Kendall County | 100800 | 21200 | 24200 | 27250 | 30250 | 32700 | 35100 | 37550 | 39950 | 9999 | Kendall County | Texas | 1 |
| TX | 4826199999 | 48 | 261 | NCNTY48261N48261 | Kenedy County, TX | Kenedy County | 58900 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Kenedy County | Texas | 0 |
| TX | 4826399999 | 48 | 263 | NCNTY48263N48263 | Kent County, TX | Kent County | 74300 | 15350 | 17550 | 19750 | 21900 | 23700 | 25450 | 27200 | 28950 | 9999 | Kent County | Texas | 0 |
| TX | 4826599999 | 48 | 265 | NCNTY48265N48265 | Kerr County, TX | Kerr County | 63300 | 13300 | 15200 | 17100 | 19000 | 20550 | 22050 | 23600 | 25100 | 9999 | Kerr County | Texas | 0 |
| TX | 4826799999 | 48 | 267 | NCNTY48267N48267 | Kimble County, TX | Kimble County | 51500 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Kimble County | Texas | 0 |
| TX | 4826999999 | 48 | 269 | NCNTY48269N48269 | King County, TX | King County | 86900 | 18250 | 20850 | 23450 | 26050 | 28150 | 30250 | 32350 | 34400 | 9999 | King County | Texas | 0 |
| TX | 4827199999 | 48 | 271 | NCNTY48271N48271 | Kinney County, TX | Kinney County | 55300 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Kinney County | Texas | 0 |
| TX | 4827399999 | 48 | 273 | NCNTY48273N48273 | Kleberg County, TX | Kleberg County | 57600 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Kleberg County | Texas | 0 |
| TX | 4827599999 | 48 | 275 | NCNTY48275N48275 | Knox County, TX | Knox County | 61500 | 12950 | 14800 | 16650 | 18450 | 19950 | 21450 | 22900 | 24400 | 9999 | Knox County | Texas | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TX | 4827799999 | 48 | 277 | NCNTY48277N48277 | Lamar County, TX | Lamar County | 56600 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Lamar County | Texas | 0 |
| TX | 4827999999 | 48 | 279 | NCNTY48279N48279 | Lamb County, TX | Lamb County | 55800 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Lamb County | Texas | 0 |
| TX | 4828199999 | 48 | 281 | METRO28660N48281 | Lampasas County, TX HUD Metro FMR Area | Lampasas County | 70800 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Lampasas County | Texas | 1 |
| TX | 4828399999 | 48 | 283 | NCNTY48283N48283 | La Salle County, TX | La Salle County | 50900 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | La Salle County | Texas | 0 |
| TX | 4828599999 | 48 | 285 | NCNTY48285N48285 | Lavaca County, TX | Lavaca County | 66100 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Lavaca County | Texas | 0 |
| TX | 4828799999 | 48 | 287 | NCNTY48287N48287 | Lee County, TX | Lee County | 70200 | 14750 | 16850 | 18950 | 21050 | 22750 | 24450 | 26150 | 27800 | 9999 | Lee County | Texas | 0 |
| TX | 4828999999 | 48 | 289 | NCNTY48289N48289 | Leon County, TX | Leon County | 60200 | 12650 | 14450 | 16250 | 18050 | 19500 | 20950 | 22400 | 23850 | 9999 | Leon County | Texas | 0 |
| TX | 4829199999 | 48 | 291 | METRO26420M26420 | Houston-The Woodlands-Sugar Land, TX HUD Metro FMR Area | Liberty County | 78800 | 16600 | 18950 | 21300 | 23650 | 25550 | 27450 | 29350 | 31250 | 3360 | Liberty County | Texas | 1 |
| TX | 4829399999 | 48 | 293 | NCNTY48293N48293 | Limestone County, TX | Limestone County | 54100 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Limestone County | Texas | 0 |
| TX | 4829599999 | 48 | 295 | NCNTY48295N48295 | Lipscomb County, TX | Lipscomb County | 77000 | 16200 | 18500 | 20800 | 23100 | 24950 | 26800 | 28650 | 30500 | 9999 | Lipscomb County | Texas | 0 |
| TX | 4829799999 | 48 | 297 | NCNTY48297N48297 | Live Oak County, TX | Live Oak County | 64500 | 13400 | 15300 | 17200 | 19100 | 20650 | 22200 | 23700 | 25250 | 9999 | Live Oak County | Texas | 0 |
| TX | 4829999999 | 48 | 299 | NCNTY48299N48299 | Llano County, TX | Llano County | 66600 | 14000 | 16000 | 18000 | 20000 | 21600 | 23200 | 24800 | 26400 | 9999 | Llano County | Texas | 0 |
| TX | 4830199999 | 48 | 301 | NCNTY48301N48301 | Loving County, TX | Loving County | 91200 | 18550 | 21200 | 23850 | 26450 | 28600 | 30700 | 32800 | 34950 | 9999 | Loving County | Texas | 0 |
| TX | 4830399999 | 48 | 303 | METRO31180M31180 | Lubbock, TX HUD Metro FMR Area | Lubbock County | 69200 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 4600 | Lubbock County | Texas | 1 |
| TX | 4830599999 | 48 | 305 | METRO31180N48305 | Lynn County, TX HUD Metro FMR Area | Lynn County | 57100 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Lynn County | Texas | 1 |
| TX | 4830799999 | 48 | 307 | NCNTY48307N48307 | McCulloch County, TX | McCulloch County | 56900 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | McCulloch County | Texas | 0 |
| TX | 4830999999 | 48 | 309 | METRO47380M47380 | Waco, TX HUD Metro FMR Area | McLennan County | 65700 | 13800 | 15800 | 17750 | 19700 | 21300 | 22900 | 24450 | 26050 | 8800 | McLennan County | Texas | 1 |
| TX | 4831199999 | 48 | 311 | NCNTY48311N48311 | McMullen County, TX | McMullen County | 71900 | 14450 | 16500 | 18550 | 20600 | 22250 | 23900 | 25550 | 27200 | 9999 | McMullen County | Texas | 0 |
| TX | 4831399999 | 48 | 313 | NCNTY48313N48313 | Madison County, TX | Madison County | 59900 | 12600 | 14400 | 16200 | 17950 | 19400 | 20850 | 22300 | 23700 | 9999 | Madison County | Texas | 0 |
| TX | 4831599999 | 48 | 315 | NCNTY48315N48315 | Marion County, TX | Marion County | 53500 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Marion County | Texas | 0 |
| TX | 4831799999 | 48 | 317 | METRO33260N48317 | Martin County, TX HUD Metro FMR Area | Martin County | 88000 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Martin County | Texas | 1 |
| TX | 4831999999 | 48 | 319 | NCNTY48319N48319 | Mason County, TX | Mason County | 63100 | 13300 | 15200 | 17100 | 18950 | 20500 | 22000 | 23500 | 25050 | 9999 | Mason County | Texas | 0 |
| TX | 4832199999 | 48 | 321 | NCNTY48321N48321 | Matagorda County, TX | Matagorda County | 58600 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Matagorda County | Texas | 0 |
| TX | 4832399999 | 48 | 323 | NCNTY48323N48323 | Maverick County, TX | Maverick County | 45100 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Maverick County | Texas | 0 |
| TX | 4832599999 | 48 | 325 | METRO41700N48325 | Medina County, TX HUD Metro FMR Area | Medina County | 74200 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Medina County | Texas | 1 |
| TX | 4832799999 | 48 | 327 | NCNTY48327N48327 | Menard County, TX | Menard County | 53700 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Menard County | Texas | 0 |
| TX | 4832999999 | 48 | 329 | METRO33260M33260 | Midland, TX HUD Metro FMR Area | Midland County | 90700 | 19050 | 21800 | 24500 | 27200 | 29400 | 31600 | 33750 | 35950 | 5800 | Midland County | Texas | 1 |
| TX | 4833199999 | 48 | 331 | NCNTY48331N48331 | Milam County, TX | Milam County | 58100 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Milam County | Texas | 0 |
| TX | 4833399999 | 48 | 333 | NCNTY48333N48333 | Mills County, TX | Mills County | 62500 | 13150 | 15000 | 16900 | 18750 | 20250 | 21750 | 23250 | 24750 | 9999 | Mills County | Texas | 0 |
| TX | 4833599999 | 48 | 335 | NCNTY48335N48335 | Mitchell County, TX | Mitchell County | 70800 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Mitchell County | Texas | 0 |
| TX | 4833799999 | 48 | 337 | NCNTY48337N48337 | Montague County, TX | Montague County | 55400 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Montague County | Texas | 0 |
| TX | 4833999999 | 48 | 339 | METRO26420M26420 | Houston-The Woodlands-Sugar Land, TX HUD Metro FMR Area | Montgomery County | 78800 | 16600 | 18950 | 21300 | 23650 | 25550 | 27450 | 29350 | 31250 | 3360 | Montgomery County | Texas | 1 |
| TX | 4834199999 | 48 | 341 | NCNTY48341N48341 | Moore County, TX | Moore County | 61900 | 13000 | 14850 | 16700 | 18550 | 20050 | 21550 | 23050 | 24500 | 9999 | Moore County | Texas | 0 |
| TX | 4834399999 | 48 | 343 | NCNTY48343N48343 | Morris County, TX | Morris County | 55000 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Morris County | Texas | 0 |
| TX | 4834599999 | 48 | 345 | NCNTY48345N48345 | Motley County, TX | Motley County | 55100 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Motley County | Texas | 0 |
| TX | 4834799999 | 48 | 347 | NCNTY48347N48347 | Nacogdoches County, TX | Nacogdoches County | 65100 | 13300 | 15200 | 17100 | 19000 | 20550 | 22050 | 23600 | 25100 | 9999 | Nacogdoches County | Texas | 0 |
| TX | 4834999999 | 48 | 349 | NCNTY48349N48349 | Navarro County, TX | Navarro County | 55600 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Navarro County | Texas | 0 |
| TX | 4835199999 | 48 | 351 | METRO13140N48351 | Newton County, TX HUD Metro FMR Area | Newton County | 54600 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Newton County | Texas | 1 |
| TX | 4835399999 | 48 | 353 | NCNTY48353N48353 | Nolan County, TX | Nolan County | 60400 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Nolan County | Texas | 0 |
| TX | 4835599999 | 48 | 355 | METRO18580M18580 | Corpus Christi, TX HUD Metro FMR Area | Nueces County | 66600 | 14000 | 16000 | 18000 | 20000 | 21600 | 23200 | 24800 | 26400 | 1880 | Nueces County | Texas | 1 |
| TX | 4835799999 | 48 | 357 | NCNTY48357N48357 | Ochiltree County, TX | Ochiltree County | 62200 | 13100 | 14950 | 16800 | 18650 | 20150 | 21650 | 23150 | 24650 | 9999 | Ochiltree County | Texas | 0 |
| TX | 4835999999 | 48 | 359 | METRO11100N48359 | Oldham County, TX HUD Metro FMR Area | Oldham County | 80000 | 15900 | 18200 | 20450 | 22700 | 24550 | 26350 | 28150 | 30000 | 9999 | Oldham County | Texas | 1 |
| TX | 4836199999 | 48 | 361 | METRO13140M13140 | Beaumont-Port Arthur, TX HUD Metro FMR Area | Orange County | 67500 | 14200 | 16200 | 18250 | 20250 | 21900 | 23500 | 25150 | 26750 | 840 | Orange County | Texas | 1 |
| TX | 4836399999 | 48 | 363 | NCNTY48363N48363 | Palo Pinto County, TX | Palo Pinto County | 57400 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Palo Pinto County | Texas | 0 |
| TX | 4836599999 | 48 | 365 | NCNTY48365N48365 | Panola County, TX | Panola County | 61100 | 12850 | 14700 | 16550 | 18350 | 19850 | 21300 | 22800 | 24250 | 9999 | Panola County | Texas | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TX | 4836799999 | 48 | 367 | METRO19100MM2800 | Fort Worth-Arlington, TX HUD Metro FMR Area | Parker County | 81500 | 17150 | 19600 | 22050 | 24450 | 26450 | 28400 | 30350 | 32300 | 2800 | Parker County | Texas | 1 |
| TX | 4836999999 | 48 | 369 | NCNTY48369N48369 | Parmer County, TX | Parmer County | 57400 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Parmer County | Texas | 0 |
| TX | 4837199999 | 48 | 371 | NCNTY48371N48371 | Pecos County, TX | Pecos County | 74200 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Pecos County | Texas | 0 |
| TX | 4837399999 | 48 | 373 | NCNTY48373N48373 | Polk County, TX | Polk County | 57600 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Polk County | Texas | 0 |
| TX | 4837599999 | 48 | 375 | METRO11100M11100 | Amarillo, TX HUD Metro FMR Area | Potter County | 66900 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 320 | Potter County | Texas | 1 |
| TX | 4837799999 | 48 | 377 | NCNTY48377N48377 | Presidio County, TX | Presidio County | 36900 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Presidio County | Texas | 0 |
| TX | 4837999999 | 48 | 379 | NCNTY48379N48379 | Rains County, TX | Rains County | 63900 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Rains County | Texas | 0 |
| TX | 4838199999 | 48 | 381 | METRO11100M11100 | Amarillo, TX HUD Metro FMR Area | Randall County | 66900 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 320 | Randall County | Texas | 1 |
| TX | 4838399999 | 48 | 383 | NCNTY48383N48383 | Reagan County, TX | Reagan County | 79700 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 9999 | Reagan County | Texas | 0 |
| TX | 4838599999 | 48 | 385 | NCNTY48385N48385 | Real County, TX | Real County | 53900 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Real County | Texas | 0 |
| TX | 4838799999 | 48 | 387 | NCNTY48387N48387 | Red River County, TX | Red River County | 47400 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Red River County | Texas | 0 |
| TX | 4838999999 | 48 | 389 | NCNTY48389N48389 | Reeves County, TX | Reeves County | 63300 | 13300 | 15200 | 17100 | 19000 | 20550 | 22050 | 23600 | 25100 | 9999 | Reeves County | Texas | 0 |
| TX | 4839199999 | 48 | 391 | NCNTY48391N48391 | Refugio County, TX | Refugio County | 63400 | 13300 | 15200 | 17100 | 19000 | 20550 | 22050 | 23600 | 25100 | 9999 | Refugio County | Texas | 0 |
| TX | 4839399999 | 48 | 393 | NCNTY48393N48393 | Roberts County, TX | Roberts County | 95700 | 20100 | 23000 | 25850 | 28700 | 31000 | 33300 | 35600 | 37900 | 9999 | Roberts County | Texas | 0 |
| TX | 4839599999 | 48 | 395 | METRO17780M17780 | College Station-Bryan, TX MSA | Robertson County | 65600 | 13800 | 15800 | 17750 | 19700 | 21300 | 22900 | 24450 | 26050 | 9999 | Robertson County | Texas | 1 |
| TX | 4839799999 | 48 | 397 | METRO19100M19100 | Dallas, TX HUD Metro FMR Area | Rockwall County | 86200 | 18100 | 20700 | 23300 | 25850 | 27950 | 30000 | 32100 | 34150 | 1920 | Rockwall County | Texas | 1 |
| TX | 4839999999 | 48 | 399 | NCNTY48399N48399 | Runnels County, TX | Runnels County | 53800 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Runnels County | Texas | 0 |
| TX | 4840199999 | 48 | 401 | METRO30980N48401 | Rusk County, TX HUD Metro FMR Area | Rusk County | 59800 | 12600 | 14400 | 16200 | 17950 | 19400 | 20850 | 22300 | 23700 | 9999 | Rusk County | Texas | 1 |
| TX | 4840399999 | 48 | 403 | NCNTY48403N48403 | Sabine County, TX | Sabine County | 44100 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Sabine County | Texas | 0 |
| TX | 4840599999 | 48 | 405 | NCNTY48405N48405 | San Augustine County, TX | San Augustine County | 51700 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | San Augustine County | Texas | 0 |
| TX | 4840799999 | 48 | 407 | NCNTY48407N48407 | San Jacinto County, TX | San Jacinto County | 59600 | 12550 | 14350 | 16150 | 17900 | 19350 | 20800 | 22200 | 23650 | 9999 | San Jacinto County | Texas | 0 |
| TX | 4840999999 | 48 | 409 | METRO18580M18580 | Corpus Christi, TX HUD Metro FMR Area | San Patricio County | 66600 | 14000 | 16000 | 18000 | 20000 | 21600 | 23200 | 24800 | 26400 | 1880 | San Patricio County | Texas | 1 |
| TX | 4841199999 | 48 | 411 | NCNTY48411N48411 | San Saba County, TX | San Saba County | 55200 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | San Saba County | Texas | 0 |
| TX | 4841399999 | 48 | 413 | NCNTY48413N48413 | Schleicher County, TX | Schleicher County | 76600 | 16100 | 18400 | 20700 | 23000 | 24850 | 26700 | 28550 | 30400 | 9999 | Schleicher County | Texas | 0 |
| TX | 4841599999 | 48 | 415 | NCNTY48415N48415 | Scurry County, TX | Scurry County | 72900 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 9999 | Scurry County | Texas | 0 |
| TX | 4841799999 | 48 | 417 | NCNTY48417N48417 | Shackelford County, TX | Shackelford County | 60500 | 12750 | 14550 | 16350 | 18150 | 19650 | 21100 | 22550 | 24000 | 9999 | Shackelford County | Texas | 0 |
| TX | 4841999999 | 48 | 419 | NCNTY48419N48419 | Shelby County, TX | Shelby County | 50000 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Shelby County | Texas | 0 |
| TX | 4842199999 | 48 | 421 | NCNTY48421N48421 | Sherman County, TX | Sherman County | 66300 | 13950 | 15950 | 17950 | 19900 | 21500 | 23100 | 24700 | 26300 | 9999 | Sherman County | Texas | 0 |
| TX | 4842399999 | 48 | 423 | METRO46340M46340 | Tyler, TX MSA | Smith County | 65600 | 14050 | 16050 | 18050 | 20050 | 21700 | 23300 | 24900 | 26500 | 8640 | Smith County | Texas | 1 |
| TX | 4842599999 | 48 | 425 | METRO19100N48425 | Somervell County, TX HUD Metro FMR Area | Somervell County | 62700 | 13200 | 15050 | 16950 | 18800 | 20350 | 21850 | 23350 | 24850 | 9999 | Somervell County | Texas | 1 |
| TX | 4842799999 | 48 | 427 | NCNTY48427N48427 | Starr County, TX | Starr County | 32500 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Starr County | Texas | 0 |
| TX | 4842999999 | 48 | 429 | NCNTY48429N48429 | Stephens County, TX | Stephens County | 58200 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Stephens County | Texas | 0 |
| TX | 4843199999 | 48 | 431 | NCNTY48431N48431 | Sterling County, TX | Sterling County | 72000 | 15150 | 17300 | 19450 | 21600 | 23350 | 25100 | 26800 | 28550 | 9999 | Sterling County | Texas | 0 |
| TX | 4843399999 | 48 | 433 | NCNTY48433N48433 | Stonewall County, TX | Stonewall County | 75300 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Stonewall County | Texas | 0 |
| TX | 4843599999 | 48 | 435 | NCNTY48435N48435 | Sutton County, TX | Sutton County | 65700 | 13800 | 15800 | 17750 | 19700 | 21300 | 22900 | 24450 | 26050 | 9999 | Sutton County | Texas | 0 |
| TX | 4843799999 | 48 | 437 | NCNTY48437N48437 | Swisher County, TX | Swisher County | 49600 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Swisher County | Texas | 0 |
| TX | 4843999999 | 48 | 439 | METRO19100MM2800 | Fort Worth-Arlington, TX HUD Metro FMR Area | Tarrant County | 81500 | 17150 | 19600 | 22050 | 24450 | 26450 | 28400 | 30350 | 32300 | 2800 | Tarrant County | Texas | 1 |
| TX | 4844199999 | 48 | 441 | METRO10180M10180 | Abilene, TX MSA | Taylor County | 64800 | 13650 | 15600 | 17550 | 19450 | 21050 | 22600 | 24150 | 25700 | 40 | Taylor County | Texas | 1 |
| TX | 4844399999 | 48 | 443 | NCNTY48443N48443 | Terrell County, TX | Terrell County | 58900 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Terrell County | Texas | 0 |
| TX | 4844599999 | 48 | 445 | NCNTY48445N48445 | Terry County, TX | Terry County | 50200 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Terry County | Texas | 0 |
| TX | 4844799999 | 48 | 447 | NCNTY48447N48447 | Throckmorton County, TX | Throckmorton County | 61800 | 13000 | 14850 | 16700 | 18550 | 20050 | 21550 | 23050 | 24500 | 9999 | Throckmorton County | Texas | 0 |
| TX | 4844999999 | 48 | 449 | NCNTY48449N48449 | Titus County, TX | Titus County | 54100 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Titus County | Texas | 0 |
| TX | 4845199999 | 48 | 451 | METRO41660M41660 | San Angelo, TX MSA | Tom Green County | 72400 | 14700 | 16800 | 18900 | 21000 | 22700 | 24400 | 26050 | 27750 | 7200 | Tom Green County | Texas | 1 |
| TX | 4845399999 | 48 | 453 | METRO12420M12420 | Austin-Round Rock, TX MSA | Travis County | 97600 | 20550 | 23450 | 26400 | 29300 | 31650 | 34000 | 36350 | 38700 | 640 | Travis County | Texas | 1 |
| TX | 4845599999 | 48 | 455 | NCNTY48455N48455 | Trinity County, TX | Trinity County | 45500 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Trinity County | Texas | 0 |
| TX | 4845799999 | 48 | 457 | NCNTY48457N48457 | Tyler County, TX | Tyler County | 63800 | 13450 | 15350 | 17250 | 19150 | 20700 | 22250 | 23750 | 25300 | 9999 | Tyler County | Texas | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TX | 4845999999 | 48 | 459 | METRO30980M30980 | Longview, TX HUD Metro FMR Area | Upshur County | 64800 | 13300 | 15200 | 17100 | 19000 | 20550 | 22050 | 23600 | 25100 | 4420 | Upshur County | Texas | 1 |
| TX | 4846199999 | 48 | 461 | NCNTY48461N48461 | Upton County, TX | Upton County | 71700 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Upton County | Texas | 0 |
| TX | 4846399999 | 48 | 463 | NCNTY48463N48463 | Uvalde County, TX | Uvalde County | 56100 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Uvalde County | Texas | 0 |
| TX | 4846599999 | 48 | 465 | NCNTY48465N48465 | Val Verde County, TX | Val Verde County | 54600 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Val Verde County | Texas | 0 |
| TX | 4846799999 | 48 | 467 | NCNTY48467N48467 | Van Zandt County, TX | Van Zandt County | 62700 | 13200 | 15050 | 16950 | 18800 | 20350 | 21850 | 23350 | 24850 | 9999 | Van Zandt County | Texas | 0 |
| TX | 4846999999 | 48 | 469 | METRO47020M47020 | Victoria, TX MSA | Victoria County | 68800 | 14500 | 16550 | 18600 | 20650 | 22350 | 24000 | 25650 | 27300 | 8750 | Victoria County | Texas | 1 |
| TX | 4847199999 | 48 | 471 | NCNTY48471N48471 | Walker County, TX | Walker County | 55500 | 13600 | 15550 | 17500 | 19400 | 21000 | 22550 | 24100 | 25650 | 9999 | Walker County | Texas | 0 |
| TX | 4847399999 | 48 | 473 | METRO26420M26420 | Houston-The Woodlands-Sugar Land, TX HUD Metro FMR Area | Waller County | 78800 | 16600 | 18950 | 21300 | 23650 | 25550 | 27450 | 29350 | 31250 | 3360 | Waller County | Texas | 1 |
| TX | 4847599999 | 48 | 475 | NCNTY48475N48475 | Ward County, TX | Ward County | 80700 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Ward County | Texas | 0 |
| TX | 4847799999 | 48 | 477 | NCNTY48477N48477 | Washington County, TX | Washington County | 71000 | 14950 | 17050 | 19200 | 21300 | 23050 | 24750 | 26450 | 28150 | 9999 | Washington County | Texas | 0 |
| TX | 4847999999 | 48 | 479 | METRO29700M29700 | Laredo, TX MSA | Webb County | 50600 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 4080 | Webb County | Texas | 1 |
| TX | 4848199999 | 48 | 481 | NCNTY48481N48481 | Wharton County, TX | Wharton County | 61000 | 12850 | 14650 | 16500 | 18300 | 19800 | 21250 | 22700 | 24200 | 9999 | Wharton County | Texas | 0 |
| TX | 4848399999 | 48 | 483 | NCNTY48483N48483 | Wheeler County, TX | Wheeler County | 60900 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Wheeler County | Texas | 0 |
| TX | 4848599999 | 48 | 485 | METRO48660M48660 | Wichita Falls, TX MSA | Wichita County | 64700 | 13550 | 15500 | 17450 | 19350 | 20900 | 22450 | 24000 | 25550 | 9080 | Wichita County | Texas | 1 |
| TX | 4848799999 | 48 | 487 | NCNTY48487N48487 | Wilbarger County, TX | Wilbarger County | 56400 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Wilbarger County | Texas | 0 |
| TX | 4848999999 | 48 | 489 | NCNTY48489N48489 | Willacy County, TX | Willacy County | 33300 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Willacy County | Texas | 0 |
| TX | 4849199999 | 48 | 491 | METRO12420M12420 | Austin-Round Rock, TX MSA | Williamson County | 97600 | 20550 | 23450 | 26400 | 29300 | 31650 | 34000 | 36350 | 38700 | 640 | Williamson County | Texas | 1 |
| TX | 4849399999 | 48 | 493 | METRO41700M41700 | San Antonio-New Braunfels, TX HUD Metro FMR Area | Wilson County | 72000 | 15150 | 17300 | 19450 | 21600 | 23350 | 25100 | 26800 | 28550 | 7240 | Wilson County | Texas | 1 |
| TX | 4849599999 | 48 | 495 | NCNTY48495N48495 | Winkler County, TX | Winkler County | 65900 | 13850 | 15800 | 17800 | 19750 | 21350 | 22950 | 24500 | 26100 | 9999 | Winkler County | Texas | 0 |
| TX | 4849799999 | 48 | 497 | METRO19100N48497 | Wise County, TX HUD Metro FMR Area | Wise County | 70800 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Wise County | Texas | 1 |
| TX | 4849999999 | 48 | 499 | NCNTY48499N48499 | Wood County, TX | Wood County | 59100 | 12450 | 14200 | 16000 | 17750 | 19200 | 20600 | 22050 | 23450 | 9999 | Wood County | Texas | 0 |
| TX | 4850199999 | 48 | 501 | NCNTY48501N48501 | Yoakum County, TX | Yoakum County | 73700 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Yoakum County | Texas | 0 |
| TX | 4850399999 | 48 | 503 | NCNTY48503N48503 | Young County, TX | Young County | 61600 | 12950 | 14800 | 16650 | 18500 | 20000 | 21500 | 22950 | 24450 | 9999 | Young County | Texas | 0 |
| TX | 4850599999 | 48 | 505 | NCNTY48505N48505 | Zapata County, TX | Zapata County | 42200 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Zapata County | Texas | 0 |
| TX | 4850799999 | 48 | 507 | NCNTY48507N48507 | Zavala County, TX | Zavala County | 34000 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Zavala County | Texas | 0 |
| UT | 4900199999 | 49 | 1 | NCNTY49001N49001 | Beaver County, UT | Beaver County | 67000 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Beaver County | Utah | 0 |
| UT | 4900399999 | 49 | 3 | METRO36260N49003 | Box Elder County, UT HUD Metro FMR Area | Box Elder County | 69200 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Box Elder County | Utah | 1 |
| UT | 4900599999 | 49 | 5 | METRO30860M30860 | Logan, UT-ID MSA | Cache County | 71000 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Cache County | Utah | 1 |
| UT | 4900799999 | 49 | 7 | NCNTY49007N49007 | Carbon County, UT | Carbon County | 63700 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Carbon County | Utah | 0 |
| UT | 4900999999 | 49 | 9 | NCNTY49009N49009 | Daggett County, UT | Daggett County | 88600 | 18100 | 20650 | 23250 | 25800 | 27900 | 29950 | 32000 | 34100 | 9999 | Daggett County | Utah | 0 |
| UT | 4901199999 | 49 | 11 | METRO36260M36260 | Ogden-Clearfield, UT HUD Metro FMR Area | Davis County | 86300 | 18150 | 20750 | 23350 | 25900 | 28000 | 30050 | 32150 | 34200 | 7160 | Davis County | Utah | 1 |
| UT | 4901399999 | 49 | 13 | NCNTY49013N49013 | Duchesne County, UT | Duchesne County | 73700 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Duchesne County | Utah | 0 |
| UT | 4901599999 | 49 | 15 | NCNTY49015N49015 | Emery County, UT | Emery County | 69100 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Emery County | Utah | 0 |
| UT | 4901799999 | 49 | 17 | NCNTY49017N49017 | Garfield County, UT | Garfield County | 67300 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Garfield County | Utah | 0 |
| UT | 4901999999 | 49 | 19 | NCNTY49019N49019 | Grand County, UT | Grand County | 62600 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Grand County | Utah | 0 |
| UT | 4902199999 | 49 | 21 | NCNTY49021N49021 | Iron County, UT | Iron County | 59700 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Iron County | Utah | 0 |
| UT | 4902399999 | 49 | 23 | METRO39340M39340 | Provo-Orem, UT MSA | Juab County | 80400 | 16900 | 19300 | 21700 | 24100 | 26050 | 28000 | 29900 | 31850 | 9999 | Juab County | Utah | 1 |
| UT | 4902599999 | 49 | 25 | NCNTY49025N49025 | Kane County, UT | Kane County | 73700 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 3739 | Kane County | Utah | 0 |
| UT | 4902799999 | 49 | 27 | NCNTY49027N49027 | Millard County, UT | Millard County | 68700 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Millard County | Utah | 0 |
| UT | 4902999999 | 49 | 29 | METRO36260M36260 | Ogden-Clearfield, UT HUD Metro FMR Area | Morgan County | 86300 | 18150 | 20750 | 23350 | 25900 | 28000 | 30050 | 32150 | 34200 | 9999 | Morgan County | Utah | 1 |
| UT | 4903199999 | 49 | 31 | NCNTY49031N49031 | Piute County, UT | Piute County | 54600 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Piute County | Utah | 0 |
| UT | 4903399999 | 49 | 33 | NCNTY49033N49033 | Rich County, UT | Rich County | 67300 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Rich County | Utah | 0 |
| UT | 4903599999 | 49 | 35 | METRO41620M41620 | Salt Lake City, UT HUD Metro FMR Area | Salt Lake County | 87900 | 18450 | 21100 | 23750 | 26350 | 28500 | 30600 | 32700 | 34800 | 7160 | Salt Lake County | Utah | 1 |
| UT | 4903799999 | 49 | 37 | NCNTY49037N49037 | San Juan County, UT | San Juan County | 53900 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | San Juan County | Utah | 0 |
| UT | 4903999999 | 49 | 39 | NCNTY49039N49039 | Sanpete County, UT | Sanpete County | 62200 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Sanpete County | Utah | 0 |
| UT | 4904199999 | 49 | 41 | NCNTY49041N49041 | Sevier County, UT | Sevier County | 62900 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Sevier County | Utah | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UT | 4904399999 | 49 | 43 | NCNTY49043N49043 | Summit County, UT | Summit County | 113900 | 23950 | 27350 | 30750 | 34150 | 36900 | 39650 | 42350 | 45100 | 9999 | Summit County | Utah | 0 |
| UT | 4904599999 | 49 | 45 | METRO41620N49045 | Tooele County, UT HUD Metro FMR Area | Tooele County | 80800 | 16800 | 19200 | 21600 | 24000 | 25950 | 27850 | 29800 | 31700 | 9999 | Tooele County | Utah | 1 |
| UT | 4904799999 | 49 | 47 | NCNTY49047N49047 | Uintah County, UT | Uintah County | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 9999 | Uintah County | Utah | 0 |
| UT | 4904999999 | 49 | 49 | METRO39340M39340 | Provo-Orem, UT MSA | Utah County | 80400 | 16900 | 19300 | 21700 | 24100 | 26050 | 28000 | 29900 | 31850 | 6520 | Utah County | Utah | 1 |
| UT | 4905199999 | 49 | 51 | NCNTY49051N49051 | Wasatch County, UT | Wasatch County | 88400 | 18550 | 21200 | 23850 | 26500 | 28650 | 30750 | 32900 | 35000 | 9999 | Wasatch County | Utah | 0 |
| UT | 4905399999 | 49 | 53 | METRO41100M41100 | St. George, UT MSA | Washington County | 70700 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Washington County | Utah | 1 |
| UT | 4905599999 | 49 | 55 | NCNTY49055N49055 | Wayne County, UT | Wayne County | 62700 | 15600 | 17800 | 20050 | 22250 | 24050 | 25850 | 27600 | 29400 | 9999 | Wayne County | Utah | 0 |
| UT | 4905799999 | 49 | 57 | METRO36260M36260 | Ogden-Clearfield, UT HUD Metro FMR Area | Weber County | 86300 | 18150 | 20750 | 23350 | 25900 | 28000 | 30050 | 32150 | 34200 | 7160 | Weber County | Utah | 1 |
| VT | 5000100325 | 50 | 1 | NCNTY50001N50001 | Addison County, VT | Addison County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Addison town | Vermont | 0 |
| VT | 5000108575 | 50 | 1 | NCNTY50001N50001 | Addison County, VT | Addison County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Bridport town | Vermont | 0 |
| VT | 5000109025 | 50 | 1 | NCNTY50001N50001 | Addison County, VT | Addison County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Bristol town | Vermont | 0 |
| VT | 5000116000 | 50 | 1 | NCNTY50001N50001 | Addison County, VT | Addison County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Cornwall town | Vermont | 0 |
| VT | 5000126300 | 50 | 1 | NCNTY50001N50001 | Addison County, VT | Addison County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Ferrisburgh town | Vermont | 0 |
| VT | 5000128600 | 50 | 1 | NCNTY50001N50001 | Addison County, VT | Addison County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Goshen town | Vermont | 0 |
| VT | 5000129575 | 50 | 1 | NCNTY50001N50001 | Addison County, VT | Addison County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Granville town | Vermont | 0 |
| VT | 5000131525 | 50 | 1 | NCNTY50001N50001 | Addison County, VT | Addison County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Hancock town | Vermont | 0 |
| VT | 5000139325 | 50 | 1 | NCNTY50001N50001 | Addison County, VT | Addison County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Leicester town | Vermont | 0 |
| VT | 5000140075 | 50 | 1 | NCNTY50001N50001 | Addison County, VT | Addison County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Lincoln town | Vermont | 0 |
| VT | 5000144350 | 50 | 1 | NCNTY50001N50001 | Addison County, VT | Addison County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Middlebury town | Vermont | 0 |
| VT | 5000145550 | 50 | 1 | NCNTY50001N50001 | Addison County, VT | Addison County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Monkton town | Vermont | 0 |
| VT | 5000148700 | 50 | 1 | NCNTY50001N50001 | Addison County, VT | Addison County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | New Haven town | Vermont | 0 |
| VT | 5000153725 | 50 | 1 | NCNTY50001N50001 | Addison County, VT | Addison County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Orwell town | Vermont | 0 |
| VT | 5000153950 | 50 | 1 | NCNTY50001N50001 | Addison County, VT | Addison County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Panton town | Vermont | 0 |
| VT | 5000159650 | 50 | 1 | NCNTY50001N50001 | Addison County, VT | Addison County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Ripton town | Vermont | 0 |
| VT | 5000162575 | 50 | 1 | NCNTY50001N50001 | Addison County, VT | Addison County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Salisbury town | Vermont | 0 |
| VT | 5000165050 | 50 | 1 | NCNTY50001N50001 | Addison County, VT | Addison County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Shoreham town | Vermont | 0 |
| VT | 5000170075 | 50 | 1 | NCNTY50001N50001 | Addison County, VT | Addison County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Starksboro town | Vermont | 0 |
| VT | 5000174650 | 50 | 1 | NCNTY50001N50001 | Addison County, VT | Addison County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Vergennes city | Vermont | 0 |
| VT | 5000176075 | 50 | 1 | NCNTY50001N50001 | Addison County, VT | Addison County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Waltham town | Vermont | 0 |
| VT | 5000183275 | 50 | 1 | NCNTY50001N50001 | Addison County, VT | Addison County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Weybridge town | Vermont | 0 |
| VT | 5000183800 | 50 | 1 | NCNTY50001N50001 | Addison County, VT | Addison County | 80700 | 16950 | 19400 | 21800 | 24200 | 26150 | 28100 | 30050 | 31950 | 9999 | Whiting town | Vermont | 0 |
| VT | 5000301450 | 50 | 3 | NCNTY50003N50003 | Bennington County, VT | Bennington County | 69900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Arlington town | Vermont | 0 |
| VT | 5000304825 | 50 | 3 | NCNTY50003N50003 | Bennington County, VT | Bennington County | 69900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Bennington town | Vermont | 0 |
| VT | 5000317725 | 50 | 3 | NCNTY50003N50003 | Bennington County, VT | Bennington County | 69900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Dorset town | Vermont | 0 |
| VT | 5000327962 | 50 | 3 | NCNTY50003N50003 | Bennington County, VT | Bennington County | 69900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Glastenbury town | Vermont | 0 |
| VT | 5000339025 | 50 | 3 | NCNTY50003N50003 | Bennington County, VT | Bennington County | 69900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Landgrove town | Vermont | 0 |
| VT | 5000342850 | 50 | 3 | NCNTY50003N50003 | Bennington County, VT | Bennington County | 69900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Manchester town | Vermont | 0 |
| VT | 5000355000 | 50 | 3 | NCNTY50003N50003 | Bennington County, VT | Bennington County | 69900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Peru town | Vermont | 0 |
| VT | 5000357025 | 50 | 3 | NCNTY50003N50003 | Bennington County, VT | Bennington County | 69900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Pownal town | Vermont | 0 |
| VT | 5000358600 | 50 | 3 | NCNTY50003N50003 | Bennington County, VT | Bennington County | 69900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Readsboro town | Vermont | 0 |
| VT | 5000361000 | 50 | 3 | NCNTY50003N50003 | Bennington County, VT | Bennington County | 69900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Rupert town | Vermont | 0 |
| VT | 5000362875 | 50 | 3 | NCNTY50003N50003 | Bennington County, VT | Bennington County | 69900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Sandgate town | Vermont | 0 |
| VT | 5000363175 | 50 | 3 | NCNTY50003N50003 | Bennington County, VT | Bennington County | 69900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Searsburg town | Vermont | 0 |
| VT | 5000363550 | 50 | 3 | NCNTY50003N50003 | Bennington County, VT | Bennington County | 69900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Shaftsbury town | Vermont | 0 |
| VT | 5000369775 | 50 | 3 | NCNTY50003N50003 | Bennington County, VT | Bennington County | 69900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Stamford town | Vermont | 0 |
| VT | 5000371425 | 50 | 3 | NCNTY50003N50003 | Bennington County, VT | Bennington County | 69900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Sunderland town | Vermont | 0 |
| VT | 5000385075 | 50 | 3 | NCNTY50003N50003 | Bennington County, VT | Bennington County | 69900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Winhall town | Vermont | 0 |
| VT | 5000385675 | 50 | 3 | NCNTY50003N50003 | Bennington County, VT | Bennington County | 69900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Woodford town | Vermont | 0 |
| VT | 5000502875 | 50 | 5 | NCNTY50005N50005 | Caledonia County, VT | Caledonia County | 66600 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Barnet town | Vermont | 0 |
| VT | 5000510450 | 50 | 5 | NCNTY50005N50005 | Caledonia County, VT | Caledonia County | 66600 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Burke town | Vermont | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VT | 5000517125 | 50 | 5 | NCNTY50005N50005 | Caledonia County, VT | Caledonia County | 66600 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Danville town | Vermont | 0 |
| VT | 5000530550 | 50 | 5 | NCNTY50005N50005 | Caledonia County, VT | Caledonia County | 66600 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Groton town | Vermont | 0 |
| VT | 5000531825 | 50 | 5 | NCNTY50005N50005 | Caledonia County, VT | Caledonia County | 66600 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Hardwick town | Vermont | 0 |
| VT | 5000537900 | 50 | 5 | NCNTY50005N50005 | Caledonia County, VT | Caledonia County | 66600 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Kirby town | Vermont | 0 |
| VT | 5000541725 | 50 | 5 | NCNTY50005N50005 | Caledonia County, VT | Caledonia County | 66600 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Lyndon town | Vermont | 0 |
| VT | 5000547725 | 50 | 5 | NCNTY50005N50005 | Caledonia County, VT | Caledonia County | 66600 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Newark town | Vermont | 0 |
| VT | 5000554400 | 50 | 5 | NCNTY50005N50005 | Caledonia County, VT | Caledonia County | 66600 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Peacham town | Vermont | 0 |
| VT | 5000561525 | 50 | 5 | NCNTY50005N50005 | Caledonia County, VT | Caledonia County | 66600 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Ryegate town | Vermont | 0 |
| VT | 5000562200 | 50 | 5 | NCNTY50005N50005 | Caledonia County, VT | Caledonia County | 66600 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | St. Johnsbury town | Vermont | 0 |
| VT | 5000564075 | 50 | 5 | NCNTY50005N50005 | Caledonia County, VT | Caledonia County | 66600 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Sheffield town | Vermont | 0 |
| VT | 5000569925 | 50 | 5 | NCNTY50005N50005 | Caledonia County, VT | Caledonia County | 66600 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Stannard town | Vermont | 0 |
| VT | 5000571575 | 50 | 5 | NCNTY50005N50005 | Caledonia County, VT | Caledonia County | 66600 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Sutton town | Vermont | 0 |
| VT | 5000575700 | 50 | 5 | NCNTY50005N50005 | Caledonia County, VT | Caledonia County | 66600 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Walden town | Vermont | 0 |
| VT | 5000577125 | 50 | 5 | NCNTY50005N50005 | Caledonia County, VT | Caledonia County | 66600 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Waterford town | Vermont | 0 |
| VT | 5000583500 | 50 | 5 | NCNTY50005N50005 | Caledonia County, VT | Caledonia County | 66600 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Wheelock town | Vermont | 0 |
| VT | 5000706550 | 50 | 7 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Chittenden County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 9999 | Bolton town | Vermont | 1 |
| VT | 5000710300 | 50 | 7 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Chittenden County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 9999 | Buels gore | Vermont | 1 |
| VT | 5000710675 | 50 | 7 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Chittenden County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 1305 | Burlington city | Vermont | 1 |
| VT | 5000713300 | 50 | 7 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Chittenden County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 1305 | Charlotte town | Vermont | 1 |
| VT | 5000714875 | 50 | 7 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Chittenden County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 1305 | Colchester town | Vermont | 1 |
| VT | 5000724175 | 50 | 7 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Chittenden County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 1305 | Essex town | Vermont | 1 |
| VT | 5000733475 | 50 | 7 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Chittenden County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 1305 | Hinesburg town | Vermont | 1 |
| VT | 5000734600 | 50 | 7 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Chittenden County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 9999 | Huntington town | Vermont | 1 |
| VT | 5000736700 | 50 | 7 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Chittenden County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 1305 | Jericho town | Vermont | 1 |
| VT | 5000745250 | 50 | 7 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Chittenden County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 1305 | Milton town | Vermont | 1 |
| VT | 5000759275 | 50 | 7 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Chittenden County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 1305 | Richmond town | Vermont | 1 |
| VT | 5000762050 | 50 | 7 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Chittenden County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 1305 | St. George town | Vermont | 1 |
| VT | 5000764300 | 50 | 7 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Chittenden County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 1305 | Shelburne town | Vermont | 1 |
| VT | 5000766175 | 50 | 7 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Chittenden County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 1305 | South Burlington city | Vermont | 1 |
| VT | 5000773975 | 50 | 7 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Chittenden County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 9999 | Underhill town | Vermont | 1 |
| VT | 5000780350 | 50 | 7 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Chittenden County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 9999 | Westford town | Vermont | 1 |
| VT | 5000784475 | 50 | 7 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Chittenden County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 1305 | Williston town | Vermont | 1 |
| VT | 5000785150 | 50 | 7 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Chittenden County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 1305 | Winooski city | Vermont | 1 |
| VT | 5000902125 | 50 | 9 | NCNTY50009N50009 | Essex County, VT | Essex County | 51500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Averill town | Vermont | 0 |
| VT | 5000902162 | 50 | 9 | NCNTY50009N50009 | Essex County, VT | Essex County | 51500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Avery's gore | Vermont | 0 |
| VT | 5000906325 | 50 | 9 | NCNTY50009N50009 | Essex County, VT | Essex County | 51500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Bloomfield town | Vermont | 0 |
| VT | 5000908725 | 50 | 9 | NCNTY50009N50009 | Essex County, VT | Essex County | 51500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Brighton town | Vermont | 0 |
| VT | 5000910075 | 50 | 9 | NCNTY50009N50009 | Essex County, VT | Essex County | 51500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Brunswick town | Vermont | 0 |
| VT | 5000911800 | 50 | 9 | NCNTY50009N50009 | Essex County, VT | Essex County | 51500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Canaan town | Vermont | 0 |
| VT | 5000915250 | 50 | 9 | NCNTY50009N50009 | Essex County, VT | Essex County | 51500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Concord town | Vermont | 0 |
| VT | 5000921250 | 50 | 9 | NCNTY50009N50009 | Essex County, VT | Essex County | 51500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | East Haven town | Vermont | 0 |
| VT | 5000925975 | 50 | 9 | NCNTY50009N50009 | Essex County, VT | Essex County | 51500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Ferdinand town | Vermont | 0 |
| VT | 5000929125 | 50 | 9 | NCNTY50009N50009 | Essex County, VT | Essex County | 51500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Granby town | Vermont | 0 |
| VT | 5000930775 | 50 | 9 | NCNTY50009N50009 | Essex County, VT | Essex County | 51500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Guildhall town | Vermont | 0 |
| VT | 5000939700 | 50 | 9 | NCNTY50009N50009 | Essex County, VT | Essex County | 51500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Lemington town | Vermont | 0 |
| VT | 5000939775 | 50 | 9 | NCNTY50009N50009 | Essex County, VT | Essex County | 51500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Lewis town | Vermont | 0 |
| VT | 5000941425 | 50 | 9 | NCNTY50009N50009 | Essex County, VT | Essex County | 51500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Lunenburg town | Vermont | 0 |
| VT | 5000942475 | 50 | 9 | NCNTY50009N50009 | Essex County, VT | Essex County | 51500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Maidstone town | Vermont | 0 |
| VT | 5000952750 | 50 | 9 | NCNTY50009N50009 | Essex County, VT | Essex County | 51500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Norton town | Vermont | 0 |
| VT | 5000975175 | 50 | 9 | NCNTY50009N50009 | Essex County, VT | Essex County | 51500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Victory town | Vermont | 0 |
| VT | 5000976337 | 50 | 9 | NCNTY50009N50009 | Essex County, VT | Essex County | 51500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Warner's grant | Vermont | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VT | 5000976562 | 50 | 9 | NCNTY50009N50009 | Essex County, VT | Essex County | 51500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Warren's gore | Vermont | 0 |
| VT | 5001102500 | 50 | 11 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Franklin County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 9999 | Bakersfield town | Vermont | 1 |
| VT | 5001105425 | 50 | 11 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Franklin County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 9999 | Berkshire town | Vermont | 1 |
| VT | 5001124050 | 50 | 11 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Franklin County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 9999 | Enosburgh town | Vermont | 1 |
| VT | 5001124925 | 50 | 11 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Franklin County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 1305 | Fairfax town | Vermont | 1 |
| VT | 5001125225 | 50 | 11 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Franklin County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 9999 | Fairfield town | Vermont | 1 |
| VT | 5001126500 | 50 | 11 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Franklin County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 9999 | Fletcher town | Vermont | 1 |
| VT | 5001127100 | 50 | 11 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Franklin County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 9999 | Franklin town | Vermont | 1 |
| VT | 5001127700 | 50 | 11 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Franklin County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 1305 | Georgia town | Vermont | 1 |
| VT | 5001133025 | 50 | 11 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Franklin County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 9999 | Highgate town | Vermont | 1 |
| VT | 5001145850 | 50 | 11 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Franklin County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 9999 | Montgomery town | Vermont | 1 |
| VT | 5001159125 | 50 | 11 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Franklin County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 9999 | Richford town | Vermont | 1 |
| VT | 5001161675 | 50 | 11 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Franklin County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 1305 | St. Albans city | Vermont | 1 |
| VT | 5001161750 | 50 | 11 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Franklin County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 1305 | St. Albans town | Vermont | 1 |
| VT | 5001164600 | 50 | 11 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Franklin County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 9999 | Sheldon town | Vermont | 1 |
| VT | 5001171725 | 50 | 11 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Franklin County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 1305 | Swanton town | Vermont | 1 |
| VT | 5001300860 | 50 | 13 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Grand Isle County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 9999 | Alburgh town | Vermont | 1 |
| VT | 5001329275 | 50 | 13 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Grand Isle County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 1305 | Grand Isle town | Vermont | 1 |
| VT | 5001335875 | 50 | 13 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Grand Isle County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 9999 | Isle La Motte town | Vermont | 1 |
| VT | 5001350650 | 50 | 13 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Grand Isle County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 9999 | North Hero town | Vermont | 1 |
| VT | 5001367000 | 50 | 13 | METRO15540M15540 | Burlington-South Burlington, VT MSA | Grand Isle County | 89700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 1305 | South Hero town | Vermont | 1 |
| VT | 5001504375 | 50 | 15 | NCNTY50015N50015 | Lamoille County, VT | Lamoille County | 71800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Belvidere town | Vermont | 0 |
| VT | 5001511500 | 50 | 15 | NCNTY50015N50015 | Lamoille County, VT | Lamoille County | 71800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Cambridge town | Vermont | 0 |
| VT | 5001523500 | 50 | 15 | NCNTY50015N50015 | Lamoille County, VT | Lamoille County | 71800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Eden town | Vermont | 0 |
| VT | 5001523725 | 50 | 15 | NCNTY50015N50015 | Lamoille County, VT | Lamoille County | 71800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Elmore town | Vermont | 0 |
| VT | 5001535050 | 50 | 15 | NCNTY50015N50015 | Lamoille County, VT | Lamoille County | 71800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Hyde Park town | Vermont | 0 |
| VT | 5001537075 | 50 | 15 | NCNTY50015N50015 | Lamoille County, VT | Lamoille County | 71800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Johnson town | Vermont | 0 |
| VT | 5001546675 | 50 | 15 | NCNTY50015N50015 | Lamoille County, VT | Lamoille County | 71800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Morristown town | Vermont | 0 |
| VT | 5001570525 | 50 | 15 | NCNTY50015N50015 | Lamoille County, VT | Lamoille County | 71800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Stowe town | Vermont | 0 |
| VT | 5001577425 | 50 | 15 | NCNTY50015N50015 | Lamoille County, VT | Lamoille County | 71800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Waterville town | Vermont | 0 |
| VT | 5001585375 | 50 | 15 | NCNTY50015N50015 | Lamoille County, VT | Lamoille County | 71800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Wolcott town | Vermont | 0 |
| VT | 5001707375 | 50 | 17 | NCNTY50017N50017 | Orange County, VT | Orange County | 74400 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Bradford town | Vermont | 0 |
| VT | 5001707600 | 50 | 17 | NCNTY50017N50017 | Orange County, VT | Orange County | 74400 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Braintree town | Vermont | 0 |
| VT | 5001709325 | 50 | 17 | NCNTY50017N50017 | Orange County, VT | Orange County | 74400 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Brookfield town | Vermont | 0 |
| VT | 5001713525 | 50 | 17 | NCNTY50017N50017 | Orange County, VT | Orange County | 74400 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Chelsea town | Vermont | 0 |
| VT | 5001715700 | 50 | 17 | NCNTY50017N50017 | Orange County, VT | Orange County | 74400 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Corinth town | Vermont | 0 |
| VT | 5001725675 | 50 | 17 | NCNTY50017N50017 | Orange County, VT | Orange County | 74400 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Fairlee town | Vermont | 0 |
| VT | 5001748175 | 50 | 17 | NCNTY50017N50017 | Orange County, VT | Orange County | 74400 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Newbury town | Vermont | 0 |
| VT | 5001753425 | 50 | 17 | NCNTY50017N50017 | Orange County, VT | Orange County | 74400 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Orange town | Vermont | 0 |
| VT | 5001758075 | 50 | 17 | NCNTY50017N50017 | Orange County, VT | Orange County | 74400 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Randolph town | Vermont | 0 |
| VT | 5001770675 | 50 | 17 | NCNTY50017N50017 | Orange County, VT | Orange County | 74400 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Strafford town | Vermont | 0 |
| VT | 5001772400 | 50 | 17 | NCNTY50017N50017 | Orange County, VT | Orange County | 74400 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Thetford town | Vermont | 0 |
| VT | 5001773075 | 50 | 17 | NCNTY50017N50017 | Orange County, VT | Orange County | 74400 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Topsham town | Vermont | 0 |
| VT | 5001773675 | 50 | 17 | NCNTY50017N50017 | Orange County, VT | Orange County | 74400 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Tunbridge town | Vermont | 0 |
| VT | 5001774950 | 50 | 17 | NCNTY50017N50017 | Orange County, VT | Orange County | 74400 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Vershire town | Vermont | 0 |
| VT | 5001776750 | 50 | 17 | NCNTY50017N50017 | Orange County, VT | Orange County | 74400 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Washington town | Vermont | 0 |
| VT | 5001779975 | 50 | 17 | NCNTY50017N50017 | Orange County, VT | Orange County | 74400 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | West Fairlee town | Vermont | 0 |
| VT | 5001784175 | 50 | 17 | NCNTY50017N50017 | Orange County, VT | Orange County | 74400 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Williamstown town | Vermont | 0 |
| VT | 5001900475 | 50 | 19 | NCNTY50019N50019 | Orleans County, VT | Orleans County | 59800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Albany town | Vermont | 0 |
| VT | 5001903550 | 50 | 19 | NCNTY50019N50019 | Orleans County, VT | Orleans County | 59800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Barton town | Vermont | 0 |
| VT | 5001909850 | 50 | 19 | NCNTY50019N50019 | Orleans County, VT | Orleans County | 59800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Brownington town | Vermont | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VT | 5001913150 | 50 | 19 | NCNTY50019N50019 | Orleans County, VT | Orleans County | 59800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Charleston town | Vermont | 0 |
| VT | 5001916150 | 50 | 19 | NCNTY50019N50019 | Orleans County, VT | Orleans County | 59800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Coventry town | Vermont | 0 |
| VT | 5001916300 | 50 | 19 | NCNTY50019N50019 | Orleans County, VT | Orleans County | 59800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Craftsbury town | Vermont | 0 |
| VT | 5001917350 | 50 | 19 | NCNTY50019N50019 | Orleans County, VT | Orleans County | 59800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Derby town | Vermont | 0 |
| VT | 5001928075 | 50 | 19 | NCNTY50019N50019 | Orleans County, VT | Orleans County | 59800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Glover town | Vermont | 0 |
| VT | 5001930175 | 50 | 19 | NCNTY50019N50019 | Orleans County, VT | Orleans County | 59800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Greensboro town | Vermont | 0 |
| VT | 5001933775 | 50 | 19 | NCNTY50019N50019 | Orleans County, VT | Orleans County | 59800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Holland town | Vermont | 0 |
| VT | 5001935575 | 50 | 19 | NCNTY50019N50019 | Orleans County, VT | Orleans County | 59800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Irasburg town | Vermont | 0 |
| VT | 5001936325 | 50 | 19 | NCNTY50019N50019 | Orleans County, VT | Orleans County | 59800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Jay town | Vermont | 0 |
| VT | 5001940525 | 50 | 19 | NCNTY50019N50019 | Orleans County, VT | Orleans County | 59800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Lowell town | Vermont | 0 |
| VT | 5001946450 | 50 | 19 | NCNTY50019N50019 | Orleans County, VT | Orleans County | 59800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Morgan town | Vermont | 0 |
| VT | 5001948850 | 50 | 19 | NCNTY50019N50019 | Orleans County, VT | Orleans County | 59800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Newport city | Vermont | 0 |
| VT | 5001948925 | 50 | 19 | NCNTY50019N50019 | Orleans County, VT | Orleans County | 59800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Newport town | Vermont | 0 |
| VT | 5001973525 | 50 | 19 | NCNTY50019N50019 | Orleans County, VT | Orleans County | 59800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Troy town | Vermont | 0 |
| VT | 5001980200 | 50 | 19 | NCNTY50019N50019 | Orleans County, VT | Orleans County | 59800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Westfield town | Vermont | 0 |
| VT | 5001981700 | 50 | 19 | NCNTY50019N50019 | Orleans County, VT | Orleans County | 59800 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Westmore town | Vermont | 0 |
| VT | 5002105200 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Benson town | Vermont | 0 |
| VT | 5002107750 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Brandon town | Vermont | 0 |
| VT | 5002111950 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Castleton town | Vermont | 0 |
| VT | 5002114350 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Chittenden town | Vermont | 0 |
| VT | 5002114500 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Clarendon town | Vermont | 0 |
| VT | 5002116825 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Danby town | Vermont | 0 |
| VT | 5002125375 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Fair Haven town | Vermont | 0 |
| VT | 5002134450 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Hubbardton town | Vermont | 0 |
| VT | 5002135425 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Ira town | Vermont | 0 |
| VT | 5002137685 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Killington town | Vermont | 0 |
| VT | 5002144125 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Mendon town | Vermont | 0 |
| VT | 5002144800 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Middletown Springs town | Vermont | 0 |
| VT | 5002147200 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Mount Holly town | Vermont | 0 |
| VT | 5002147425 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Mount Tabor town | Vermont | 0 |
| VT | 5002154250 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Pawlet town | Vermont | 0 |
| VT | 5002155450 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Pittsfield town | Vermont | 0 |
| VT | 5002155600 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Pittsford town | Vermont | 0 |
| VT | 5002156875 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Poultney town | Vermont | 0 |
| VT | 5002157250 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Proctor town | Vermont | 0 |
| VT | 5002161225 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Rutland city | Vermont | 0 |
| VT | 5002161300 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Rutland town | Vermont | 0 |
| VT | 5002165275 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Shrewsbury town | Vermont | 0 |
| VT | 5002171050 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Sudbury town | Vermont | 0 |
| VT | 5002172925 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Tinmouth town | Vermont | 0 |
| VT | 5002175925 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Wallingford town | Vermont | 0 |
| VT | 5002177950 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Wells town | Vermont | 0 |
| VT | 5002180875 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | West Haven town | Vermont | 0 |
| VT | 5002182300 | 50 | 21 | NCNTY50021N50021 | Rutland County, VT | Rutland County | 71500 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | West Rutland town | Vermont | 0 |
| VT | 5002303175 | 50 | 23 | NCNTY50023N50023 | Washington County, VT | Washington County | 80300 | 16900 | 19300 | 21700 | 24100 | 26050 | 28000 | 29900 | 31850 | 9999 | Barre city | Vermont | 0 |
| VT | 5002303250 | 50 | 23 | NCNTY50023N50023 | Washington County, VT | Washington County | 80300 | 16900 | 19300 | 21700 | 24100 | 26050 | 28000 | 29900 | 31850 | 9999 | Barre town | Vermont | 0 |
| VT | 5002305650 | 50 | 23 | NCNTY50023N50023 | Washington County, VT | Washington County | 80300 | 16900 | 19300 | 21700 | 24100 | 26050 | 28000 | 29900 | 31850 | 9999 | Berlin town | Vermont | 0 |
| VT | 5002311125 | 50 | 23 | NCNTY50023N50023 | Washington County, VT | Washington County | 80300 | 16900 | 19300 | 21700 | 24100 | 26050 | 28000 | 29900 | 31850 | 9999 | Cabot town | Vermont | 0 |
| VT | 5002311350 | 50 | 23 | NCNTY50023N50023 | Washington County, VT | Washington County | 80300 | 16900 | 19300 | 21700 | 24100 | 26050 | 28000 | 29900 | 31850 | 9999 | Calais town | Vermont | 0 |
| VT | 5002318550 | 50 | 23 | NCNTY50023N50023 | Washington County, VT | Washington County | 80300 | 16900 | 19300 | 21700 | 24100 | 26050 | 28000 | 29900 | 31850 | 9999 | Duxbury town | Vermont | 0 |
| VT | 5002321925 | 50 | 23 | NCNTY50023N50023 | Washington County, VT | Washington County | 80300 | 16900 | 19300 | 21700 | 24100 | 26050 | 28000 | 29900 | 31850 | 9999 | East Montpelier town | Vermont | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VT | 5002325825 | 50 | 23 | NCNTY50023N50023 | Washington County, VT | Washington County | 80300 | 16900 | 19300 | 21700 | 24100 | 26050 | 28000 | 29900 | 31850 | 9999 | Fayston town | Vermont | 0 |
| VT | 5002343600 | 50 | 23 | NCNTY50023N50023 | Washington County, VT | Washington County | 80300 | 16900 | 19300 | 21700 | 24100 | 26050 | 28000 | 29900 | 31850 | 9999 | Marshfield town | Vermont | 0 |
| VT | 5002344500 | 50 | 23 | NCNTY50023N50023 | Washington County, VT | Washington County | 80300 | 16900 | 19300 | 21700 | 24100 | 26050 | 28000 | 29900 | 31850 | 9999 | Middlesex town | Vermont | 0 |
| VT | 5002346000 | 50 | 23 | NCNTY50023N50023 | Washington County, VT | Washington County | 80300 | 16900 | 19300 | 21700 | 24100 | 26050 | 28000 | 29900 | 31850 | 9999 | Montpelier city | Vermont | 0 |
| VT | 5002346225 | 50 | 23 | NCNTY50023N50023 | Washington County, VT | Washington County | 80300 | 16900 | 19300 | 21700 | 24100 | 26050 | 28000 | 29900 | 31850 | 9999 | Moretown town | Vermont | 0 |
| VT | 5002350275 | 50 | 23 | NCNTY50023N50023 | Washington County, VT | Washington County | 80300 | 16900 | 19300 | 21700 | 24100 | 26050 | 28000 | 29900 | 31850 | 9999 | Northfield town | Vermont | 0 |
| VT | 5002355825 | 50 | 23 | NCNTY50023N50023 | Washington County, VT | Washington County | 80300 | 16900 | 19300 | 21700 | 24100 | 26050 | 28000 | 29900 | 31850 | 9999 | Plainfield town | Vermont | 0 |
| VT | 5002360625 | 50 | 23 | NCNTY50023N50023 | Washington County, VT | Washington County | 80300 | 16900 | 19300 | 21700 | 24100 | 26050 | 28000 | 29900 | 31850 | 9999 | Roxbury town | Vermont | 0 |
| VT | 5002375325 | 50 | 23 | NCNTY50023N50023 | Washington County, VT | Washington County | 80300 | 16900 | 19300 | 21700 | 24100 | 26050 | 28000 | 29900 | 31850 | 9999 | Waitsfield town | Vermont | 0 |
| VT | 5002376525 | 50 | 23 | NCNTY50023N50023 | Washington County, VT | Washington County | 80300 | 16900 | 19300 | 21700 | 24100 | 26050 | 28000 | 29900 | 31850 | 9999 | Warren town | Vermont | 0 |
| VT | 5002376975 | 50 | 23 | NCNTY50023N50023 | Washington County, VT | Washington County | 80300 | 16900 | 19300 | 21700 | 24100 | 26050 | 28000 | 29900 | 31850 | 9999 | Waterbury town | Vermont | 0 |
| VT | 5002385525 | 50 | 23 | NCNTY50023N50023 | Washington County, VT | Washington County | 80300 | 16900 | 19300 | 21700 | 24100 | 26050 | 28000 | 29900 | 31850 | 9999 | Woodbury town | Vermont | 0 |
| VT | 5002386125 | 50 | 23 | NCNTY50023N50023 | Washington County, VT | Washington County | 80300 | 16900 | 19300 | 21700 | 24100 | 26050 | 28000 | 29900 | 31850 | 9999 | Worcester town | Vermont | 0 |
| VT | 5002501900 | 50 | 25 | NCNTY50025N50025 | Windham County, VT | Windham County | 70900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Athens town | Vermont | 0 |
| VT | 5002507900 | 50 | 25 | NCNTY50025N50025 | Windham County, VT | Windham County | 70900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Brattleboro town | Vermont | 0 |
| VT | 5002509475 | 50 | 25 | NCNTY50025N50025 | Windham County, VT | Windham County | 70900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Brookline town | Vermont | 0 |
| VT | 5002517875 | 50 | 25 | NCNTY50025N50025 | Windham County, VT | Windham County | 70900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Dover town | Vermont | 0 |
| VT | 5002518325 | 50 | 25 | NCNTY50025N50025 | Windham County, VT | Windham County | 70900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Dummerston town | Vermont | 0 |
| VT | 5002528900 | 50 | 25 | NCNTY50025N50025 | Windham County, VT | Windham County | 70900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Grafton town | Vermont | 0 |
| VT | 5002530925 | 50 | 25 | NCNTY50025N50025 | Windham County, VT | Windham County | 70900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Guilford town | Vermont | 0 |
| VT | 5002531150 | 50 | 25 | NCNTY50025N50025 | Windham County, VT | Windham County | 70900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Halifax town | Vermont | 0 |
| VT | 5002536175 | 50 | 25 | NCNTY50025N50025 | Windham County, VT | Windham County | 70900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Jamaica town | Vermont | 0 |
| VT | 5002540225 | 50 | 25 | NCNTY50025N50025 | Windham County, VT | Windham County | 70900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Londonderry town | Vermont | 0 |
| VT | 5002543375 | 50 | 25 | NCNTY50025N50025 | Windham County, VT | Windham County | 70900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Marlboro town | Vermont | 0 |
| VT | 5002548400 | 50 | 25 | NCNTY50025N50025 | Windham County, VT | Windham County | 70900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Newfane town | Vermont | 0 |
| VT | 5002557700 | 50 | 25 | NCNTY50025N50025 | Windham County, VT | Windham County | 70900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Putney town | Vermont | 0 |
| VT | 5002560250 | 50 | 25 | NCNTY50025N50025 | Windham County, VT | Windham County | 70900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Rockingham town | Vermont | 0 |
| VT | 5002565762 | 50 | 25 | NCNTY50025N50025 | Windham County, VT | Windham County | 70900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Somerset town | Vermont | 0 |
| VT | 5002570750 | 50 | 25 | NCNTY50025N50025 | Windham County, VT | Windham County | 70900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Stratton town | Vermont | 0 |
| VT | 5002573300 | 50 | 25 | NCNTY50025N50025 | Windham County, VT | Windham County | 70900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Townshend town | Vermont | 0 |
| VT | 5002574800 | 50 | 25 | NCNTY50025N50025 | Windham County, VT | Windham County | 70900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Vernon town | Vermont | 0 |
| VT | 5002576225 | 50 | 25 | NCNTY50025N50025 | Windham County, VT | Windham County | 70900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Wardsboro town | Vermont | 0 |
| VT | 5002581400 | 50 | 25 | NCNTY50025N50025 | Windham County, VT | Windham County | 70900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Westminster town | Vermont | 0 |
| VT | 5002583950 | 50 | 25 | NCNTY50025N50025 | Windham County, VT | Windham County | 70900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Whitingham town | Vermont | 0 |
| VT | 5002584700 | 50 | 25 | NCNTY50025N50025 | Windham County, VT | Windham County | 70900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Wilmington town | Vermont | 0 |
| VT | 5002584850 | 50 | 25 | NCNTY50025N50025 | Windham County, VT | Windham County | 70900 | 15700 | 17950 | 20200 | 22400 | 24200 | 26000 | 27800 | 29600 | 9999 | Windham town | Vermont | 0 |
| VT | 5002701300 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Andover town | Vermont | 0 |
| VT | 5002702575 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Baltimore town | Vermont | 0 |
| VT | 5002702725 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Barnard town | Vermont | 0 |
| VT | 5002705800 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Bethel town | Vermont | 0 |
| VT | 5002708275 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Bridgewater town | Vermont | 0 |
| VT | 5002712250 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Cavendish town | Vermont | 0 |
| VT | 5002713675 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Chester town | Vermont | 0 |
| VT | 5002732275 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Hartford town | Vermont | 0 |
| VT | 5002732425 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Hartland town | Vermont | 0 |
| VT | 5002741275 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Ludlow town | Vermont | 0 |
| VT | 5002752900 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Norwich town | Vermont | 0 |
| VT | 5002756050 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Plymouth town | Vermont | 0 |
| VT | 5002756350 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Pomfret town | Vermont | 0 |
| VT | 5002758375 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Reading town | Vermont | 0 |
| VT | 5002760100 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Rochester town | Vermont | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VT | 5002760850 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Royalton town | Vermont | 0 |
| VT | 5002763775 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Sharon town | Vermont | 0 |
| VT | 5002769550 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Springfield town | Vermont | 0 |
| VT | 5002770375 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Stockbridge town | Vermont | 0 |
| VT | 5002777500 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Weathersfield town | Vermont | 0 |
| VT | 5002782000 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Weston town | Vermont | 0 |
| VT | 5002783050 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | West Windsor town | Vermont | 0 |
| VT | 5002784925 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Windsor town | Vermont | 0 |
| VT | 5002785975 | 50 | 27 | NCNTY50027N50027 | Windsor County, VT | Windsor County | 79300 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Woodstock town | Vermont | 0 |
| VA | 5100199999 | 51 | 1 | NCNTY51001N51001 | Accomack County, VA | Accomack County | 56400 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Accomack County | Virginia | 0 |
| VA | 5100399999 | 51 | 3 | METRO16820M16820 | Charlottesville, VA HUD Metro FMR Area | Albemarle County | 93900 | 19750 | 22550 | 25350 | 28150 | 30450 | 32700 | 34950 | 37200 | 1540 | Albemarle County | Virginia | 1 |
| VA | 5100599999 | 51 | 5 | NCNTY51005N51005 | Alleghany County-Clifton Forge city-Covington city, VA HUD Nonmet | Alleghany County | 60700 | 12750 | 14600 | 16400 | 18200 | 19700 | 21150 | 22600 | 24050 | 9999 | Alleghany County | Virginia | 0 |
| VA | 5100799999 | 51 | 7 | METRO40060M40060 | Richmond, VA MSA | Amelia County | 89400 | 18800 | 21450 | 24150 | 26800 | 28950 | 31100 | 33250 | 35400 | 9999 | Amelia County | Virginia | 1 |
| VA | 5100999999 | 51 | 9 | METRO31340M31340 | Lynchburg, VA MSA | Amherst County | 72400 | 15200 | 17400 | 19550 | 21700 | 23450 | 25200 | 26950 | 28650 | 4640 | Amherst County | Virginia | 1 |
| VA | 5101199999 | 51 | 11 | METRO31340M31340 | Lynchburg, VA MSA | Appomattox County | 72400 | 15200 | 17400 | 19550 | 21700 | 23450 | 25200 | 26950 | 28650 | 9999 | Appomattox County | Virginia | 1 |
| VA | 5101399999 | 51 | 13 | METRO47900M47900 | Washington-Arlington-Alexandria, DC-VA-MD HUD Metro FMR Area | Arlington County | 126000 | 26500 | 30250 | 34050 | 37800 | 40850 | 43850 | 46900 | 49900 | 8840 | Arlington County | Virginia | 1 |
| VA | 5101599999 | 51 | 15 | METRO44420M44420 | Staunton-Waynesboro, VA MSA | Augusta County | 71400 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Augusta County | Virginia | 1 |
| VA | 5101799999 | 51 | 17 | NCNTY51017N51017 | Bath County, VA | Bath County | 65600 | 13800 | 15800 | 17750 | 19700 | 21300 | 22900 | 24450 | 26050 | 9999 | Bath County | Virginia | 0 |
| VA | 5101999999 | 51 | 19 | METRO31340M31340 | Lynchburg, VA MSA | Bedford County | 72400 | 15200 | 17400 | 19550 | 21700 | 23450 | 25200 | 26950 | 28650 | 4640 | Bedford County | Virginia | 1 |
| VA | 5102199999 | 51 | 21 | NCNTY51021N51021 | Bland County, VA | Bland County | 62200 | 13100 | 14950 | 16800 | 18650 | 20150 | 21650 | 23150 | 24650 | 9999 | Bland County | Virginia | 0 |
| VA | 5102399999 | 51 | 23 | METRO40220M40220 | Roanoke, VA HUD Metro FMR Area | Botetourt County | 76700 | 16100 | 18400 | 20700 | 23000 | 24850 | 26700 | 28550 | 30400 | 6800 | Botetourt County | Virginia | 1 |
| VA | 5102599999 | 51 | 25 | NCNTY51025N51025 | Brunswick County, VA | Brunswick County | 55800 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Brunswick County | Virginia | 0 |
| VA | 5102799999 | 51 | 27 | NCNTY51027N51027 | Buchanan County, VA | Buchanan County | 41700 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Buchanan County | Virginia | 0 |
| VA | 5102999999 | 51 | 29 | METRO16820N51029 | Buckingham County, VA HUD Metro FMR Area | Buckingham County | 61700 | 12950 | 14800 | 16650 | 18500 | 20000 | 21500 | 22950 | 24450 | 9999 | Buckingham County | Virginia | 1 |
| VA | 5103199999 | 51 | 31 | METRO31340M31340 | Lynchburg, VA MSA | Campbell County | 72400 | 15200 | 17400 | 19550 | 21700 | 23450 | 25200 | 26950 | 28650 | 4640 | Campbell County | Virginia | 1 |
| VA | 5103399999 | 51 | 33 | METRO40060M40060 | Richmond, VA MSA | Caroline County | 89400 | 18800 | 21450 | 24150 | 26800 | 28950 | 31100 | 33250 | 35400 | 9999 | Caroline County | Virginia | 1 |
| VA | 5103599999 | 51 | 35 | NCNTY51035N51035 | Carroll County-Galax city, VA HUD Nonmetro FMR Area | Carroll County | 54600 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Carroll County | Virginia | 0 |
| VA | 5103699999 | 51 | 36 | METRO40060M40060 | Richmond, VA MSA | Charles City County | 89400 | 18800 | 21450 | 24150 | 26800 | 28950 | 31100 | 33250 | 35400 | 6760 | Charles City County | Virginia | 1 |
| VA | 5103799999 | 51 | 37 | NCNTY51037N51037 | Charlotte County, VA | Charlotte County | 51100 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Charlotte County | Virginia | 0 |
| VA | 5104199999 | 51 | 41 | METRO40060M40060 | Richmond, VA MSA | Chesterfield County | 89400 | 18800 | 21450 | 24150 | 26800 | 28950 | 31100 | 33250 | 35400 | 6760 | Chesterfield County | Virginia | 1 |
| VA | 5104399999 | 51 | 43 | METRO47900M47900 | Washington-Arlington-Alexandria, DC-VA-MD HUD Metro FMR Area | Clarke County | 126000 | 26500 | 30250 | 34050 | 37800 | 40850 | 43850 | 46900 | 49900 | 1650 | Clarke County | Virginia | 1 |
| VA | 5104599999 | 51 | 45 | METRO40220M40220 | Roanoke, VA HUD Metro FMR Area | Craig County | 76700 | 16100 | 18400 | 20700 | 23000 | 24850 | 26700 | 28550 | 30400 | 9999 | Craig County | Virginia | 1 |
| VA | 5104799999 | 51 | 47 | METRO47900N51047 | Culpeper County, VA HUD Metro FMR Area | Culpeper County | 85200 | 17900 | 20450 | 23000 | 25550 | 27600 | 29650 | 31700 | 33750 | 1891 | Culpeper County | Virginia | 1 |
| VA | 5104999999 | 51 | 49 | NCNTY51049N51049 | Cumberland County, VA | Cumberland County | 63200 | 13300 | 15200 | 17100 | 18950 | 20500 | 22000 | 23500 | 25050 | 9999 | Cumberland County | Virginia | 0 |
| VA | 5105199999 | 51 | 51 | NCNTY51051N51051 | Dickenson County, VA | Dickenson County | 42600 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Dickenson County | Virginia | 0 |
| VA | 5105399999 | 51 | 53 | METRO40060M40060 | Richmond, VA MSA | Dinwiddie County | 89400 | 18800 | 21450 | 24150 | 26800 | 28950 | 31100 | 33250 | 35400 | 6760 | Dinwiddie County | Virginia | 1 |
| VA | 5105799999 | 51 | 57 | NCNTY51057N51057 | Essex County, VA | Essex County | 63600 | 13350 | 15250 | 17150 | 19050 | 20600 | 22100 | 23650 | 25150 | 9999 | Essex County | Virginia | 0 |
| VA | 5105999999 | 51 | 59 | METRO47900M47900 | Washington-Arlington-Alexandria, DC-VA-MD HUD Metro FMR Area | Fairfax County | 126000 | 26500 | 30250 | 34050 | 37800 | 40850 | 43850 | 46900 | 49900 | 8840 | Fairfax County | Virginia | 1 |
| VA | 5106199999 | 51 | 61 | METRO47900M47900 | Washington-Arlington-Alexandria, DC-VA-MD HUD Metro FMR Area | Fauquier County | 126000 | 26500 | 30250 | 34050 | 37800 | 40850 | 43850 | 46900 | 49900 | 8840 | Fauquier County | Virginia | 1 |
| VA | 5106399999 | 51 | 63 | METRO13980N51063 | Floyd County, VA HUD Metro FMR Area | Floyd County | 61600 | 12950 | 14800 | 16650 | 18500 | 20000 | 21500 | 22950 | 24450 | 9999 | Floyd County | Virginia | 1 |
| VA | 5106599999 | 51 | 65 | METRO16820M16820 | Charlottesville, VA HUD Metro FMR Area | Fluvanna County | 93900 | 19750 | 22550 | 25350 | 28150 | 30450 | 32700 | 34950 | 37200 | 1540 | Fluvanna County | Virginia | 1 |
| VA | 5106799999 | 51 | 67 | METRO40220N51067 | Franklin County, VA HUD Metro FMR Area | Franklin County | 67200 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 9999 | Franklin County | Virginia | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VA | 5106999999 | 51 | 69 | METRO49020M49020 | Winchester, VA-WV MSA | Frederick County | 83400 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Frederick County | Virginia | 1 |
| VA | 5107199999 | 51 | 71 | METRO13980N51071 | Giles County, VA HUD Metro FMR Area | Giles County | 61000 | 12850 | 14650 | 16500 | 18300 | 19800 | 21250 | 22700 | 24200 | 9999 | Giles County | Virginia | 1 |
| VA | 5107399999 | 51 | 73 | METRO47260M47260 | Virginia Beach-Norfolk-Newport News, VA-NC HUD Metro FMR Area | Gloucester County | 82500 | 17350 | 19800 | 22300 | 24750 | 26750 | 28750 | 30700 | 32700 | 5720 | Gloucester County | Virginia | 1 |
| VA | 5107599999 | 51 | 75 | METRO40060M40060 | Richmond, VA MSA | Goochland County | 89400 | 18800 | 21450 | 24150 | 26800 | 28950 | 31100 | 33250 | 35400 | 6760 | Goochland County | Virginia | 1 |
| VA | 5107799999 | 51 | 77 | NCNTY51077N51077 | Grayson County, VA | Grayson County | 47900 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Grayson County | Virginia | 0 |
| VA | 5107999999 | 51 | 79 | METRO16820M16820 | Charlottesville, VA HUD Metro FMR Area | Greene County | 93900 | 19750 | 22550 | 25350 | 28150 | 30450 | 32700 | 34950 | 37200 | 1540 | Greene County | Virginia | 1 |
| VA | 5108199999 | 51 | 81 | NCNTY51081N51081 | Greensville County-Emporia city, VA HUD Nonmetro FMR Area | Greensville County | 50400 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Greensville County | Virginia | 0 |
| VA | 5108399999 | 51 | 83 | NCNTY51083N51083 | Halifax County, VA | Halifax County | 58900 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Halifax County | Virginia | 0 |
| VA | 5108599999 | 51 | 85 | METRO40060M40060 | Richmond, VA MSA | Hanover County | 89400 | 18800 | 21450 | 24150 | 26800 | 28950 | 31100 | 33250 | 35400 | 6760 | Hanover County | Virginia | 1 |
| VA | 5108799999 | 51 | 87 | METRO40060M40060 | Richmond, VA MSA | Henrico County | 89400 | 18800 | 21450 | 24150 | 26800 | 28950 | 31100 | 33250 | 35400 | 6760 | Henrico County | Virginia | 1 |
| VA | 5108999999 | 51 | 89 | NCNTY51089N51089 | Henry County-Martinsville city, VA HUD Nonmetro FMR Area | Henry County | 52300 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Henry County | Virginia | 0 |
| VA | 5109199999 | 51 | 91 | NCNTY51091N51091 | Highland County, VA | Highland County | 64000 | 13450 | 15400 | 17300 | 19200 | 20750 | 22300 | 23850 | 25350 | 9999 | Highland County | Virginia | 0 |
| VA | 5109399999 | 51 | 93 | METRO47260M47260 | Virginia Beach-Norfolk-Newport News, VA-NC HUD Metro FMR Area | Isle of Wight County | 82500 | 17350 | 19800 | 22300 | 24750 | 26750 | 28750 | 30700 | 32700 | 5720 | Isle of Wight County | Virginia | 1 |
| VA | 5109599999 | 51 | 95 | METRO47260M47260 | Virginia Beach-Norfolk-Newport News, VA-NC HUD Metro FMR Area | James City County | 82500 | 17350 | 19800 | 22300 | 24750 | 26750 | 28750 | 30700 | 32700 | 5720 | James City County | Virginia | 1 |
| VA | 5109799999 | 51 | 97 | NCNTY51097N51097 | King and Queen County, VA | King and Queen County | 60600 | 12750 | 14600 | 16400 | 18200 | 19700 | 21150 | 22600 | 24050 | 9999 | King and Queen County | Virginia | 0 |
| VA | 5109999999 | 51 | 99 | NCNTY51099N51099 | King George County, VA | King George County | 99800 | 21000 | 24000 | 27000 | 29950 | 32350 | 34750 | 37150 | 39550 | 3830 | King George County | Virginia | 0 |
| VA | 5110199999 | 51 | 101 | METRO40060M40060 | Richmond, VA MSA | King William County | 89400 | 18800 | 21450 | 24150 | 26800 | 28950 | 31100 | 33250 | 35400 | 9999 | King William County | Virginia | 1 |
| VA | 5110399999 | 51 | 103 | NCNTY51103N51103 | Lancaster County, VA | Lancaster County | 71600 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Lancaster County | Virginia | 0 |
| VA | 5110599999 | 51 | 105 | NCNTY51105N51105 | Lee County, VA | Lee County | 49300 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Lee County | Virginia | 0 |
| VA | 5110799999 | 51 | 107 | METRO47900M47900 | Washington-Arlington-Alexandria, DC-VA-MD HUD Metro FMR Area | Loudoun County | 126000 | 26500 | 30250 | 34050 | 37800 | 40850 | 43850 | 46900 | 49900 | 8840 | Loudoun County | Virginia | 1 |
| VA | 5110999999 | 51 | 109 | NCNTY51109N51109 | Louisa County, VA | Louisa County | 74300 | 15650 | 17850 | 20100 | 22300 | 24100 | 25900 | 27700 | 29450 | 9999 | Louisa County | Virginia | 0 |
| VA | 5111199999 | 51 | 111 | NCNTY51111N51111 | Lunenburg County, VA | Lunenburg County | 50200 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Lunenburg County | Virginia | 0 |
| VA | 5111399999 | 51 | 113 | NCNTY51113N51113 | Madison County, VA | Madison County | 61700 | 12950 | 14800 | 16650 | 18500 | 20000 | 21500 | 22950 | 24450 | 9999 | Madison County | Virginia | 0 |
| VA | 5111599999 | 51 | 115 | METRO47260M47260 | Virginia Beach-Norfolk-Newport News, VA-NC HUD Metro FMR Area | Mathews County | 82500 | 17350 | 19800 | 22300 | 24750 | 26750 | 28750 | 30700 | 32700 | 5720 | Mathews County | Virginia | 1 |
| VA | 5111799999 | 51 | 117 | NCNTY51117N51117 | Mecklenburg County, VA | Mecklenburg County | 58000 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Mecklenburg County | Virginia | 0 |
| VA | 5111999999 | 51 | 119 | NCNTY51119N51119 | Middlesex County, VA | Middlesex County | 64100 | 13500 | 15400 | 17350 | 19250 | 20800 | 22350 | 23900 | 25450 | 9999 | Middlesex County | Virginia | 0 |
| VA | 5112199999 | 51 | 121 | METRO13980M13980 | Blacksburg-Christiansburg-Radford, VA HUD Metro FMR Area | Montgomery County | 87800 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 9999 | Montgomery County | Virginia | 1 |
| VA | 5112599999 | 51 | 125 | METRO16820M16820 | Charlottesville, VA HUD Metro FMR Area | Nelson County | 93900 | 19750 | 22550 | 25350 | 28150 | 30450 | 32700 | 34950 | 37200 | 9999 | Nelson County | Virginia | 1 |
| VA | 5112799999 | 51 | 127 | METRO40060M40060 | Richmond, VA MSA | New Kent County | 89400 | 18800 | 21450 | 24150 | 26800 | 28950 | 31100 | 33250 | 35400 | 6760 | New Kent County | Virginia | 1 |
| VA | 5113199999 | 51 | 131 | NCNTY51131N51131 | Northampton County, VA | Northampton County | 58000 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Northampton County | Virginia | 0 |
| VA | 5113399999 | 51 | 133 | NCNTY51133N51133 | Northumberland County, VA | Northumberland County | 69800 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Northumberland County | Virginia | 0 |
| VA | 5113599999 | 51 | 135 | NCNTY51135N51135 | Nottoway County, VA | Nottoway County | 50700 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Nottoway County | Virginia | 0 |
| VA | 5113799999 | 51 | 137 | NCNTY51137N51137 | Orange County, VA | Orange County | 81600 | 17150 | 19600 | 22050 | 24500 | 26500 | 28450 | 30400 | 32350 | 9999 | Orange County | Virginia | 0 |
| VA | 5113999999 | 51 | 139 | NCNTY51139N51139 | Page County, VA | Page County | 57000 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Page County | Virginia | 0 |
| VA | 5114199999 | 51 | 141 | NCNTY51141N51141 | Patrick County, VA | Patrick County | 56300 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Patrick County | Virginia | 0 |
| VA | 5114399999 | 51 | 143 | NCNTY51143N51143 | Pittsylvania County-Danville city, VA HUD Nonmetro FMR Area | Pittsylvania County | 58900 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 1950 | Pittsylvania County | Virginia | 0 |
| VA | 5114599999 | 51 | 145 | METRO40060M40060 | Richmond, VA MSA | Powhatan County | 89400 | 18800 | 21450 | 24150 | 26800 | 28950 | 31100 | 33250 | 35400 | 6760 | Powhatan County | Virginia | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VA | 5114799999 | 51 | 147 | NCNTY51147N51147 | Prince Edward County, VA | Prince Edward County | 59400 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Prince Edward County | Virginia | 0 |
| VA | 5114999999 | 51 | 149 | METRO40060M40060 | Richmond, VA MSA | Prince George County | 89400 | 18800 | 21450 | 24150 | 26800 | 28950 | 31100 | 33250 | 35400 | 6760 | Prince George County | Virginia | 1 |
| VA | 5115399999 | 51 | 153 | METRO47900M47900 | Washington-Arlington-Alexandria, DC-VA-MD HUD Metro FMR Area | Prince William County | 126000 | 26500 | 30250 | 34050 | 37800 | 40850 | 43850 | 46900 | 49900 | 8840 | Prince William County | Virginia | 1 |
| VA | 5115599999 | 51 | 155 | METRO13980N51155 | Pulaski County, VA HUD Metro FMR Area | Pulaski County | 60500 | 12750 | 14550 | 16350 | 18150 | 19650 | 21100 | 22550 | 24000 | 9999 | Pulaski County | Virginia | 1 |
| VA | 5115799999 | 51 | 157 | METRO47900N51157 | Rappahannock County, VA HUD Metro FMR Area | Rappahannock County | 88700 | 17650 | 20150 | 22650 | 25150 | 27200 | 29200 | 31200 | 33200 | 9999 | Rappahannock County | Virginia | 1 |
| VA | 5115999999 | 51 | 159 | NCNTY51159N51159 | Richmond County, VA | Richmond County | 56500 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Richmond County | Virginia | 0 |
| VA | 5116199999 | 51 | 161 | METRO40220M40220 | Roanoke, VA HUD Metro FMR Area | Roanoke County | 76700 | 16100 | 18400 | 20700 | 23000 | 24850 | 26700 | 28550 | 30400 | 6800 | Roanoke County | Virginia | 1 |
| VA | 5116399999 | 51 | 163 | NCNTY51163N51163 | Rockbridge County-Buena Vista city-Lexington city, VA HUD Nonmetr | Rockbridge County | 61200 | 12850 | 14700 | 16550 | 18350 | 19850 | 21300 | 22800 | 24250 | 9999 | Rockbridge County | Virginia | 0 |
| VA | 5116599999 | 51 | 165 | METRO25500M25500 | Harrisonburg, VA MSA | Rockingham County | 71900 | 15100 | 17250 | 19400 | 21550 | 23300 | 25000 | 26750 | 28450 | 9999 | Rockingham County | Virginia | 1 |
| VA | 5116799999 | 51 | 167 | NCNTY51167N51167 | Russell County, VA | Russell County | 56000 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Russell County | Virginia | 0 |
| VA | 5116999999 | 51 | 169 | METRO28700M28700 | Kingsport-Bristol-Bristol, TN-VA MSA | Scott County | 59100 | 12450 | 14200 | 16000 | 17750 | 19200 | 20600 | 22050 | 23450 | 3660 | Scott County | Virginia | 1 |
| VA | 5117199999 | 51 | 171 | NCNTY51171N51171 | Shenandoah County, VA | Shenandoah County | 67900 | 14250 | 16300 | 18350 | 20350 | 22000 | 23650 | 25250 | 26900 | 9999 | Shenandoah County | Virginia | 0 |
| VA | 5117399999 | 51 | 173 | NCNTY51173N51173 | Smyth County, VA | Smyth County | 53500 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Smyth County | Virginia | 0 |
| VA | 5117599999 | 51 | 175 | NCNTY51175N51175 | Southampton County-Franklin city, VA HUD Nonmetro FMR Area | Southampton County | 66300 | 13950 | 15950 | 17950 | 19900 | 21500 | 23100 | 24700 | 26300 | 9999 | Southampton County | Virginia | 0 |
| VA | 5117799999 | 51 | 177 | METRO47900M47900 | Washington-Arlington-Alexandria, DC-VA-MD HUD Metro FMR Area | Spotsylvania County | 126000 | 26500 | 30250 | 34050 | 37800 | 40850 | 43850 | 46900 | 49900 | 8840 | Spotsylvania County | Virginia | 1 |
| VA | 5117999999 | 51 | 179 | METRO47900M47900 | Washington-Arlington-Alexandria, DC-VA-MD HUD Metro FMR Area | Stafford County | 126000 | 26500 | 30250 | 34050 | 37800 | 40850 | 43850 | 46900 | 49900 | 8840 | Stafford County | Virginia | 1 |
| VA | 5118199999 | 51 | 181 | NCNTY51181N51181 | Surry County, VA | Surry County | 65000 | 13650 | 15600 | 17550 | 19500 | 21100 | 22650 | 24200 | 25750 | 9999 | Surry County | Virginia | 0 |
| VA | 5118399999 | 51 | 183 | METRO40060M40060 | Richmond, VA MSA | Sussex County | 89400 | 18800 | 21450 | 24150 | 26800 | 28950 | 31100 | 33250 | 35400 | 9999 | Sussex County | Virginia | 1 |
| VA | 5118599999 | 51 | 185 | NCNTY51185N51185 | Tazewell County, VA | Tazewell County | 55600 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Tazewell County | Virginia | 0 |
| VA | 5118799999 | 51 | 187 | METRO47900MM8820 | Warren County, VA HUD Metro FMR Area | Warren County | 81400 | 17100 | 19550 | 22000 | 24400 | 26400 | 28350 | 30300 | 32250 | 8820 | Warren County | Virginia | 1 |
| VA | 5119199999 | 51 | 191 | METRO28700M28700 | Kingsport-Bristol-Bristol, TN-VA MSA | Washington County | 59100 | 12450 | 14200 | 16000 | 17750 | 19200 | 20600 | 22050 | 23450 | 3660 | Washington County | Virginia | 1 |
| VA | 5119399999 | 51 | 193 | NCNTY51193N51193 | Westmoreland County, VA | Westmoreland County | 76900 | 15400 | 17600 | 19800 | 21950 | 23750 | 25500 | 27250 | 29000 | 9999 | Westmoreland County | Virginia | 0 |
| VA | 5119599999 | 51 | 195 | NCNTY51195N51195 | Wise County-Norton city, VA HUD Nonmetro FMR Area | Wise County | 50600 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Wise County | Virginia | 0 |
| VA | 5119799999 | 51 | 197 | NCNTY51197N51197 | Wythe County, VA | Wythe County | 58600 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Wythe County | Virginia | 0 |
| VA | 5119999999 | 51 | 199 | METRO47260M47260 | Virginia Beach-Norfolk-Newport News, VA-NC HUD Metro FMR Area | York County | 82500 | 17350 | 19800 | 22300 | 24750 | 26750 | 28750 | 30700 | 32700 | 5720 | York County | Virginia | 1 |
| VA | 5151099999 | 51 | 510 | METRO47900M47900 | Washington-Arlington-Alexandria, DC-VA-MD HUD Metro FMR Area | Alexandria city | 126000 | 26500 | 30250 | 34050 | 37800 | 40850 | 43850 | 46900 | 49900 | 8840 | Alexandria city | Virginia | 1 |
| VA | 5152099999 | 51 | 520 | METRO28700M28700 | Kingsport-Bristol-Bristol, TN-VA MSA | Bristol city | 59100 | 12450 | 14200 | 16000 | 17750 | 19200 | 20600 | 22050 | 23450 | 3660 | Bristol city | Virginia | 1 |
| VA | 5153099999 | 51 | 530 | NCNTY51163N51163 | Rockbridge County-Buena Vista city-Lexington city, VA HUD Nonmetr | Buena Vista city | 61200 | 12850 | 14700 | 16550 | 18350 | 19850 | 21300 | 22800 | 24250 | 9999 | Buena Vista city | Virginia | 0 |
| VA | 5154099999 | 51 | 540 | METRO16820M16820 | Charlottesville, VA HUD Metro FMR Area | Charlottesville city | 93900 | 19750 | 22550 | 25350 | 28150 | 30450 | 32700 | 34950 | 37200 | 1540 | Charlottesville city | Virginia | 1 |
| VA | 5155099999 | 51 | 550 | METRO47260M47260 | Virginia Beach-Norfolk-Newport News, VA-NC HUD Metro FMR Area | Chesapeake city | 82500 | 17350 | 19800 | 22300 | 24750 | 26750 | 28750 | 30700 | 32700 | 5720 | Chesapeake city | Virginia | 1 |
| VA | 5157099999 | 51 | 570 | METRO40060M40060 | Richmond, VA MSA | Colonial Heights city | 89400 | 18800 | 21450 | 24150 | 26800 | 28950 | 31100 | 33250 | 35400 | 6760 | Colonial Heights city | Virginia | 1 |
| VA | 5158099999 | 51 | 580 | NCNTY51005N51005 | Alleghany County-Clifton Forge city-Covington city, VA HUD Nonmet | Covington city | 60700 | 12750 | 14600 | 16400 | 18200 | 19700 | 21150 | 22600 | 24050 | 9999 | Covington city | Virginia | 0 |
| VA | 5159099999 | 51 | 590 | NCNTY51143N51143 | Pittsylvania County-Danville city, VA HUD Nonmetro FMR Area | Danville city | 58900 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 1950 | Danville city | Virginia | 0 |
| VA | 5159599999 | 51 | 595 | NCNTY51081N51081 | Greensville County-Emporia city, VA HUD Nonmetro FMR Area | Emporia city | 50400 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Emporia city | Virginia | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VA | 5160099999 | 51 | 600 | METRO47900M47900 | Washington-Arlington-Alexandria, DC-VA-MD HUD Metro FMR Area | Fairfax city | 126000 | 26500 | 30250 | 34050 | 37800 | 40850 | 43850 | 46900 | 49900 | 8840 | Fairfax city | Virginia | 1 |
| VA | 5161099999 | 51 | 610 | METRO47900M47900 | Washington-Arlington-Alexandria, DC-VA-MD HUD Metro FMR Area | Falls Church city | 126000 | 26500 | 30250 | 34050 | 37800 | 40850 | 43850 | 46900 | 49900 | 8840 | Falls Church city | Virginia | 1 |
| VA | 5162099999 | 51 | 620 | NCNTY51175N51175 | Southampton County-Franklin city, VA HUD Nonmetro FMR Area | Franklin city | 66300 | 13950 | 15950 | 17950 | 19900 | 21500 | 23100 | 24700 | 26300 | 9999 | Franklin city | Virginia | 0 |
| VA | 5163099999 | 51 | 630 | METRO47900M47900 | Washington-Arlington-Alexandria, DC-VA-MD HUD Metro FMR Area | Fredericksburg city | 126000 | 26500 | 30250 | 34050 | 37800 | 40850 | 43850 | 46900 | 49900 | 8840 | Fredericksburg city | Virginia | 1 |
| VA | 5164099999 | 51 | 640 | NCNTY51035N51035 | Carroll County-Galax city, VA HUD Nonmetro FMR Area | Galax city | 54600 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Galax city | Virginia | 0 |
| VA | 5165099999 | 51 | 650 | METRO47260M47260 | Virginia Beach-Norfolk-Newport News, VA-NC HUD Metro FMR Area | Hampton city | 82500 | 17350 | 19800 | 22300 | 24750 | 26750 | 28750 | 30700 | 32700 | 5720 | Hampton city | Virginia | 1 |
| VA | 5166099999 | 51 | 660 | METRO25500M25500 | Harrisonburg, VA MSA | Harrisonburg city | 71900 | 15100 | 17250 | 19400 | 21550 | 23300 | 25000 | 26750 | 28450 | 9999 | Harrisonburg city | Virginia | 1 |
| VA | 5167099999 | 51 | 670 | METRO40060M40060 | Richmond, VA MSA | Hopewell city | 89400 | 18800 | 21450 | 24150 | 26800 | 28950 | 31100 | 33250 | 35400 | 6760 | Hopewell city | Virginia | 1 |
| VA | 5167899999 | 51 | 678 | NCNTY51163N51163 | Rockbridge County-Buena Vista city-Lexington city, VA HUD Nonmetr | Lexington city | 61200 | 12850 | 14700 | 16550 | 18350 | 19850 | 21300 | 22800 | 24250 | 9999 | Lexington city | Virginia | 0 |
| VA | 5168099999 | 51 | 680 | METRO31340M31340 | Lynchburg, VA MSA | Lynchburg city | 72400 | 15200 | 17400 | 19550 | 21700 | 23450 | 25200 | 26950 | 28650 | 4640 | Lynchburg city | Virginia | 1 |
| VA | 5168399999 | 51 | 683 | METRO47900M47900 | Washington-Arlington-Alexandria, DC-VA-MD HUD Metro FMR Area | Manassas city | 126000 | 26500 | 30250 | 34050 | 37800 | 40850 | 43850 | 46900 | 49900 | 8840 | Manassas city | Virginia | 1 |
| VA | 5168599999 | 51 | 685 | METRO47900M47900 | Washington-Arlington-Alexandria, DC-VA-MD HUD Metro FMR Area | Manassas Park city | 126000 | 26500 | 30250 | 34050 | 37800 | 40850 | 43850 | 46900 | 49900 | 8840 | Manassas Park city | Virginia | 1 |
| VA | 5169099999 | 51 | 690 | NCNTY51089N51089 | Henry County-Martinsville city, VA HUD Nonmetro FMR Area | Martinsville city | 52300 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Martinsville city | Virginia | 0 |
| VA | 5170099999 | 51 | 700 | METRO47260M47260 | Virginia Beach-Norfolk-Newport News, VA-NC HUD Metro FMR Area | Newport News city | 82500 | 17350 | 19800 | 22300 | 24750 | 26750 | 28750 | 30700 | 32700 | 5720 | Newport News city | Virginia | 1 |
| VA | 5171099999 | 51 | 710 | METRO47260M47260 | Virginia Beach-Norfolk-Newport News, VA-NC HUD Metro FMR Area | Norfolk city | 82500 | 17350 | 19800 | 22300 | 24750 | 26750 | 28750 | 30700 | 32700 | 5720 | Norfolk city | Virginia | 1 |
| VA | 5172099999 | 51 | 720 | NCNTY51195N51195 | Wise County-Norton city, VA HUD Nonmetro FMR Area | Norton city | 50600 | 12700 | 14500 | 16300 | 18100 | 19550 | 21000 | 22450 | 23900 | 9999 | Norton city | Virginia | 0 |
| VA | 5173099999 | 51 | 730 | METRO40060M40060 | Richmond, VA MSA | Petersburg city | 89400 | 18800 | 21450 | 24150 | 26800 | 28950 | 31100 | 33250 | 35400 | 6760 | Petersburg city | Virginia | 1 |
| VA | 5173599999 | 51 | 735 | METRO47260M47260 | Virginia Beach-Norfolk-Newport News, VA-NC HUD Metro FMR Area | Poquoson city | 82500 | 17350 | 19800 | 22300 | 24750 | 26750 | 28750 | 30700 | 32700 | 5720 | Poquoson city | Virginia | 1 |
| VA | 5174099999 | 51 | 740 | METRO47260M47260 | Virginia Beach-Norfolk-Newport News, VA-NC HUD Metro FMR Area | Portsmouth city | 82500 | 17350 | 19800 | 22300 | 24750 | 26750 | 28750 | 30700 | 32700 | 5720 | Portsmouth city | Virginia | 1 |
| VA | 5175099999 | 51 | 750 | METRO13980M13980 | Blacksburg-Christiansburg-Radford, VA HUD Metro FMR Area | Radford city | 87800 | 17400 | 19850 | 22350 | 24800 | 26800 | 28800 | 30800 | 32750 | 9999 | Radford city | Virginia | 1 |
| VA | 5176099999 | 51 | 760 | METRO40060M40060 | Richmond, VA MSA | Richmond city | 89400 | 18800 | 21450 | 24150 | 26800 | 28950 | 31100 | 33250 | 35400 | 6760 | Richmond city | Virginia | 1 |
| VA | 5177099999 | 51 | 770 | METRO40220M40220 | Roanoke, VA HUD Metro FMR Area | Roanoke city | 76700 | 16100 | 18400 | 20700 | 23000 | 24850 | 26700 | 28550 | 30400 | 6800 | Roanoke city | Virginia | 1 |
| VA | 5177599999 | 51 | 775 | METRO40220M40220 | Roanoke, VA HUD Metro FMR Area | Salem city | 76700 | 16100 | 18400 | 20700 | 23000 | 24850 | 26700 | 28550 | 30400 | 6800 | Salem city | Virginia | 1 |
| VA | 5179099999 | 51 | 790 | METRO44420M44420 | Staunton-Waynesboro, VA MSA | Staunton city | 71400 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Staunton city | Virginia | 1 |
| VA | 5180099999 | 51 | 800 | METRO47260M47260 | Virginia Beach-Norfolk-Newport News, VA-NC HUD Metro FMR Area | Suffolk city | 82500 | 17350 | 19800 | 22300 | 24750 | 26750 | 28750 | 30700 | 32700 | 5720 | Suffolk city | Virginia | 1 |
| VA | 5181099999 | 51 | 810 | METRO47260M47260 | Virginia Beach-Norfolk-Newport News, VA-NC HUD Metro FMR Area | Virginia Beach city | 82500 | 17350 | 19800 | 22300 | 24750 | 26750 | 28750 | 30700 | 32700 | 5720 | Virginia Beach city | Virginia | 1 |
| VA | 5182099999 | 51 | 820 | METRO44420M44420 | Staunton-Waynesboro, VA MSA | Waynesboro city | 71400 | 15000 | 17150 | 19300 | 21400 | 23150 | 24850 | 26550 | 28250 | 9999 | Waynesboro city | Virginia | 1 |
| VA | 5183099999 | 51 | 830 | METRO47260M47260 | Virginia Beach-Norfolk-Newport News, VA-NC HUD Metro FMR Area | Williamsburg city | 82500 | 17350 | 19800 | 22300 | 24750 | 26750 | 28750 | 30700 | 32700 | 5720 | Williamsburg city | Virginia | 1 |
| VA | 5184099999 | 51 | 840 | METRO49020M49020 | Winchester, VA-WV MSA | Winchester city | 83400 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Winchester city | Virginia | 1 |
| WA | 5300199999 | 53 | 1 | NCNTY53001N53001 | Adams County, WA | Adams County | 58000 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Adams County | Washington | 0 |
| WA | 5300399999 | 53 | 3 | METRO30300M30300 | Lewiston, ID-WA MSA | Asotin County | 73900 | 14350 | 16400 | 18450 | 20450 | 22100 | 23750 | 25400 | 27000 | 9999 | Asotin County | Washington | 1 |
| WA | 5300599999 | 53 | 5 | METRO28420M28420 | Kennewick-Richland, WA MSA | Benton County | 77500 | 16300 | 18600 | 20950 | 23250 | 25150 | 27000 | 28850 | 30700 | 6740 | Benton County | Washington | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WA | 5300799999 | 53 | 7 | METRO48300M48300 | Wenatchee, WA MSA | Chelan County | 69400 | 14600 | 16650 | 18750 | 20800 | 22500 | 24150 | 25800 | 27500 | 9999 | Chelan County | Washington | 1 |
| WA | 5300999999 | 53 | 9 | NCNTY53009N53009 | Clallam County, WA | Clallam County | 66300 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Clallam County | Washington | 0 |
| WA | 5301199999 | 53 | 11 | METRO38900M38900 | Portland-Vancouver-Hillsboro, OR-WA MSA | Clark County | 92100 | 19400 | 22150 | 24900 | 27650 | 29900 | 32100 | 34300 | 36500 | 6440 | Clark County | Washington | 1 |
| WA | 5301399999 | 53 | 13 | METRO47460N53013 | Columbia County, WA HUD Metro FMR Area | Columbia County | 66300 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Columbia County | Washington | 1 |
| WA | 5301599999 | 53 | 15 | METRO31020M31020 | Longview, WA MSA | Cowlitz County | 69200 | 14550 | 16600 | 18700 | 20750 | 22450 | 24100 | 25750 | 27400 | 9999 | Cowlitz County | Washington | 1 |
| WA | 5301799999 | 53 | 17 | METRO48300M48300 | Wenatchee, WA MSA | Douglas County | 69400 | 14600 | 16650 | 18750 | 20800 | 22500 | 24150 | 25800 | 27500 | 9999 | Douglas County | Washington | 1 |
| WA | 5301999999 | 53 | 19 | NCNTY53019N53019 | Ferry County, WA | Ferry County | 55100 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Ferry County | Washington | 0 |
| WA | 5302199999 | 53 | 21 | METRO28420M28420 | Kennewick-Richland, WA MSA | Franklin County | 77500 | 16300 | 18600 | 20950 | 23250 | 25150 | 27000 | 28850 | 30700 | 6740 | Franklin County | Washington | 1 |
| WA | 5302399999 | 53 | 23 | NCNTY53023N53023 | Garfield County, WA | Garfield County | 64600 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Garfield County | Washington | 0 |
| WA | 5302599999 | 53 | 25 | NCNTY53025N53025 | Grant County, WA | Grant County | 74600 | 14600 | 16650 | 18750 | 20800 | 22500 | 24150 | 25800 | 27500 | 9999 | Grant County | Washington | 0 |
| WA | 5302799999 | 53 | 27 | NCNTY53027N53027 | Grays Harbor County, WA | Grays Harbor County | 65300 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Grays Harbor County | Washington | 0 |
| WA | 5302999999 | 53 | 29 | NCNTY53029N53029 | Island County, WA | Island County | 76000 | 16000 | 18250 | 20550 | 22800 | 24650 | 26450 | 28300 | 30100 | 7600 | Island County | Washington | 0 |
| WA | 5303199999 | 53 | 31 | NCNTY53031N53031 | Jefferson County, WA | Jefferson County | 68600 | 14450 | 16500 | 18550 | 20600 | 22250 | 23900 | 25550 | 27200 | 9999 | Jefferson County | Washington | 0 |
| WA | 5303399999 | 53 | 33 | METRO42660MM7600 | Seattle-Bellevue, WA HUD Metro FMR Area | King County | 113300 | 25100 | 28650 | 32250 | 35800 | 38700 | 41550 | 44400 | 47300 | 7600 | King County | Washington | 1 |
| WA | 5303599999 | 53 | 35 | METRO14740M14740 | Bremerton-Silverdale, WA MSA | Kitsap County | 91700 | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36300 | 1150 | Kitsap County | Washington | 1 |
| WA | 5303799999 | 53 | 37 | NCNTY53037N53037 | Kittitas County, WA | Kittitas County | 74900 | 15750 | 18000 | 20250 | 22450 | 24250 | 26050 | 27850 | 29650 | 9999 | Kittitas County | Washington | 0 |
| WA | 5303999999 | 53 | 39 | NCNTY53039N53039 | Klickitat County, WA | Klickitat County | 65600 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Klickitat County | Washington | 0 |
| WA | 5304199999 | 53 | 41 | NCNTY53041N53041 | Lewis County, WA | Lewis County | 63400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Lewis County | Washington | 0 |
| WA | 5304399999 | 53 | 43 | NCNTY53043N53043 | Lincoln County, WA | Lincoln County | 65400 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Lincoln County | Washington | 0 |
| WA | 5304599999 | 53 | 45 | NCNTY53045N53045 | Mason County, WA | Mason County | 65900 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Mason County | Washington | 0 |
| WA | 5304799999 | 53 | 47 | NCNTY53047N53047 | Okanogan County, WA | Okanogan County | 53900 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Okanogan County | Washington | 0 |
| WA | 5304999999 | 53 | 49 | NCNTY53049N53049 | Pacific County, WA | Pacific County | 57600 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Pacific County | Washington | 0 |
| WA | 5305199999 | 53 | 51 | METRO44060N53051 | Pend Oreille County, WA HUD Metro FMR Area | Pend Oreille County | 60700 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Pend Oreille County | Washington | 1 |
| WA | 5305399999 | 53 | 53 | METRO42660MM8200 | Tacoma, WA HUD Metro FMR Area | Pierce County | 87300 | 18200 | 20800 | 23400 | 25950 | 28050 | 30150 | 32200 | 34300 | 8200 | Pierce County | Washington | 1 |
| WA | 5305599999 | 53 | 55 | NCNTY53055N53055 | San Juan County, WA | San Juan County | 78400 | 16450 | 18800 | 21150 | 23500 | 25400 | 27300 | 29150 | 31050 | 9999 | San Juan County | Washington | 0 |
| WA | 5305799999 | 53 | 57 | METRO34580M34580 | Mount Vernon-Anacortes, WA MSA | Skagit County | 78400 | 16450 | 18800 | 21150 | 23500 | 25400 | 27300 | 29150 | 31050 | 9999 | Skagit County | Washington | 1 |
| WA | 5305999999 | 53 | 59 | METRO38900M38900 | Portland-Vancouver-Hillsboro, OR-WA MSA | Skamania County | 92100 | 19400 | 22150 | 24900 | 27650 | 29900 | 32100 | 34300 | 36500 | 9999 | Skamania County | Washington | 1 |
| WA | 5306199999 | 53 | 61 | METRO42660MM7600 | Seattle-Bellevue, WA HUD Metro FMR Area | Snohomish County | 113300 | 25100 | 28650 | 32250 | 35800 | 38700 | 41550 | 44400 | 47300 | 7600 | Snohomish County | Washington | 1 |
| WA | 5306399999 | 53 | 63 | METRO44060M44060 | Spokane, WA HUD Metro FMR Area | Spokane County | 78500 | 16250 | 18600 | 20900 | 23200 | 25100 | 26950 | 28800 | 30650 | 7840 | Spokane County | Washington | 1 |
| WA | 5306599999 | 53 | 65 | METRO44060N53065 | Stevens County, WA HUD Metro FMR Area | Stevens County | 63500 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Stevens County | Washington | 1 |
| WA | 5306799999 | 53 | 67 | METRO36500M36500 | Olympia-Tumwater, WA MSA | Thurston County | 86700 | 18200 | 20800 | 23400 | 26000 | 28100 | 30200 | 32250 | 34350 | 5910 | Thurston County | Washington | 1 |
| WA | 5306999999 | 53 | 69 | NCNTY53069N53069 | Wahkiakum County, WA | Wahkiakum County | 61800 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9999 | Wahkiakum County | Washington | 0 |
| WA | 5307199999 | 53 | 71 | METRO47460N53071 | Walla Walla County, WA HUD Metro FMR Area | Walla Walla County | 69900 | 14700 | 16800 | 18900 | 20950 | 22650 | 24350 | 26000 | 27700 | 9999 | Walla Walla County | Washington | 1 |
| WA | 5307399999 | 53 | 73 | METRO13380M13380 | Bellingham, WA MSA | Whatcom County | 86300 | 17950 | 20500 | 23050 | 25600 | 27650 | 29700 | 31750 | 33800 | 860 | Whatcom County | Washington | 1 |
| WA | 5307599999 | 53 | 75 | NCNTY53075N53075 | Whitman County, WA | Whitman County | 72300 | 15200 | 17400 | 19550 | 21700 | 23450 | 25200 | 26950 | 28650 | 9999 | Whitman County | Washington | 0 |
| WA | 5307799999 | 53 | 77 | METRO49420M49420 | Yakima, WA MSA | Yakima County | 57200 | 14150 | 16200 | 18200 | 20200 | 21850 | 23450 | 25050 | 26700 | 9260 | Yakima County | Washington | 1 |
| WV | 5400199999 | 54 | 1 | NCNTY54001N54001 | Barbour County, WV | Barbour County | 50000 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Barbour County | West Virginia | 0 |
| WV | 5400399999 | 54 | 3 | METRO25180MM0877 | Martinsburg, WV HUD Metro FMR Area | Berkeley County | 74300 | 15650 | 17850 | 20100 | 22300 | 24100 | 25900 | 27700 | 29450 | 877 | Berkeley County | West Virginia | 1 |
| WV | 5400599999 | 54 | 5 | METRO16620N54005 | Boone County, WV HUD Metro FMR Area | Boone County | 50300 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Boone County | West Virginia | 1 |
| WV | 5400799999 | 54 | 7 | NCNTY54007N54007 | Braxton County, WV | Braxton County | 55900 | 11750 | 13400 | 15100 | 16750 | 18100 | 19450 | 20800 | 22150 | 9999 | Braxton County | West Virginia | 0 |
| WV | 5400999999 | 54 | 9 | METRO48260M48260 | Weirton-Steubenville, WV-OH MSA | Brooke County | 62400 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 8080 | Brooke County | West Virginia | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WV | 5401199999 | 54 | 11 | METRO26580M26580 | Huntington-Ashland, WV-KY-OH HUD Metro FMR Area | Cabell County | 59100 | 12450 | 14200 | 16000 | 17750 | 19200 | 20600 | 22050 | 23450 | 3400 | Cabell County | West Virginia | 1 |
| WV | 5401399999 | 54 | 13 | NCNTY54013N54013 | Calhoun County, WV | Calhoun County | 51000 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Calhoun County | West Virginia | 0 |
| WV | 5401599999 | 54 | 15 | METRO16620M16620 | Charleston, WV HUD Metro FMR Area | Clay County | 55700 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 9999 | Clay County | West Virginia | 1 |
| WV | 5401799999 | 54 | 17 | NCNTY54017N54017 | Doddridge County, WV | Doddridge County | 62100 | 12300 | 14050 | 15800 | 17550 | 19000 | 20400 | 21800 | 23200 | 9999 | Doddridge County | West Virginia | 0 |
| WV | 5401999999 | 54 | 19 | METRO13220N54019 | Fayette County, WV HUD Metro FMR Area | Fayette County | 50600 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Fayette County | West Virginia | 1 |
| WV | 5402199999 | 54 | 21 | NCNTY54021N54021 | Gilmer County, WV | Gilmer County | 52300 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Gilmer County | West Virginia | 0 |
| WV | 5402399999 | 54 | 23 | NCNTY54023N54023 | Grant County, WV | Grant County | 54000 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Grant County | West Virginia | 0 |
| WV | 5402599999 | 54 | 25 | NCNTY54025N54025 | Greenbrier County, WV | Greenbrier County | 54400 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Greenbrier County | West Virginia | 0 |
| WV | 5402799999 | 54 | 27 | METRO49020M49020 | Winchester, VA-WV MSA | Hampshire County | 83400 | 16700 | 19050 | 21450 | 23800 | 25750 | 27650 | 29550 | 31450 | 9999 | Hampshire County | West Virginia | 1 |
| WV | 5402999999 | 54 | 29 | METRO48260M48260 | Weirton-Steubenville, WV-OH MSA | Hancock County | 62400 | 13700 | 15650 | 17600 | 19550 | 21150 | 22700 | 24250 | 25850 | 8080 | Hancock County | West Virginia | 1 |
| WV | 5403199999 | 54 | 31 | NCNTY54031N54031 | Hardy County, WV | Hardy County | 49500 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Hardy County | West Virginia | 0 |
| WV | 5403399999 | 54 | 33 | NCNTY54033N54033 | Harrison County, WV | Harrison County | 77600 | 15650 | 17850 | 20100 | 22300 | 24100 | 25900 | 27700 | 29450 | 9999 | Harrison County | West Virginia | 0 |
| WV | 5403599999 | 54 | 35 | NCNTY54035N54035 | Jackson County, WV | Jackson County | 58800 | 12400 | 14150 | 15900 | 17650 | 19100 | 20500 | 21900 | 23300 | 9999 | Jackson County | West Virginia | 0 |
| WV | 5403799999 | 54 | 37 | METRO47900MM3630 | Jefferson County, WV HUD Metro FMR Area | Jefferson County | 94700 | 19900 | 22750 | 25600 | 28400 | 30700 | 32950 | 35250 | 37500 | 3630 | Jefferson County | West Virginia | 1 |
| WV | 5403999999 | 54 | 39 | METRO16620M16620 | Charleston, WV HUD Metro FMR Area | Kanawha County | 55700 | 12800 | 14600 | 16450 | 18250 | 19750 | 21200 | 22650 | 24100 | 1480 | Kanawha County | West Virginia | 1 |
| WV | 5404199999 | 54 | 41 | NCNTY54041N54041 | Lewis County, WV | Lewis County | 51600 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Lewis County | West Virginia | 0 |
| WV | 5404399999 | 54 | 43 | METRO26580M54043 | Lincoln County, WV HUD Metro FMR Area | Lincoln County | 48700 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Lincoln County | West Virginia | 1 |
| WV | 5404599999 | 54 | 45 | NCNTY54045N54045 | Logan County, WV | Logan County | 53300 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Logan County | West Virginia | 0 |
| WV | 5404799999 | 54 | 47 | NCNTY54047N54047 | McDowell County, WV | McDowell County | 34000 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | McDowell County | West Virginia | 0 |
| WV | 5404999999 | 54 | 49 | NCNTY54049N54049 | Marion County, WV | Marion County | 63600 | 13400 | 15300 | 17200 | 19100 | 20650 | 22200 | 23700 | 25250 | 9999 | Marion County | West Virginia | 0 |
| WV | 5405199999 | 54 | 51 | METRO48540M48540 | Wheeling, WV-OH MSA | Marshall County | 68900 | 14500 | 16550 | 18600 | 20650 | 22350 | 24000 | 25650 | 27300 | 9000 | Marshall County | West Virginia | 1 |
| WV | 5405399999 | 54 | 53 | NCNTY54053N54053 | Mason County, WV | Mason County | 52900 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Mason County | West Virginia | 0 |
| WV | 5405599999 | 54 | 55 | NCNTY54055N54055 | Mercer County, WV | Mercer County | 53200 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Mercer County | West Virginia | 0 |
| WV | 5405799999 | 54 | 57 | METRO19060M19060 | Cumberland, MD-WV MSA | Mineral County | 61900 | 15300 | 17500 | 19700 | 21850 | 23600 | 25350 | 27100 | 28850 | 1900 | Mineral County | West Virginia | 1 |
| WV | 5405999999 | 54 | 59 | NCNTY54059N54059 | Mingo County, WV | Mingo County | 43100 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Mingo County | West Virginia | 0 |
| WV | 5406199999 | 54 | 61 | METRO34060M34060 | Morgantown, WV MSA | Monongalia County | 73900 | 15550 | 17750 | 19950 | 22150 | 23950 | 25700 | 27500 | 29250 | 9999 | Monongalia County | West Virginia | 1 |
| WV | 5406399999 | 54 | 63 | NCNTY54063N54063 | Monroe County, WV | Monroe County | 48200 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Monroe County | West Virginia | 0 |
| WV | 5406599999 | 54 | 65 | NCNTY54065N54065 | Morgan County, WV | Morgan County | 63600 | 13400 | 15300 | 17200 | 19100 | 20650 | 22200 | 23700 | 25250 | 9999 | Morgan County | West Virginia | 0 |
| WV | 5406799999 | 54 | 67 | NCNTY54067N54067 | Nicholas County, WV | Nicholas County | 53700 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Nicholas County | West Virginia | 0 |
| WV | 5406999999 | 54 | 69 | METRO48540M48540 | Wheeling, WV-OH MSA | Ohio County | 68900 | 14500 | 16550 | 18600 | 20650 | 22350 | 24000 | 25650 | 27300 | 9000 | Ohio County | West Virginia | 1 |
| WV | 5407199999 | 54 | 71 | NCNTY54071N54071 | Pendleton County, WV | Pendleton County | 50100 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Pendleton County | West Virginia | 0 |
| WV | 5407399999 | 54 | 73 | NCNTY54073N54073 | Pleasants County, WV | Pleasants County | 59700 | 12550 | 14350 | 16150 | 17900 | 19350 | 20800 | 22200 | 23650 | 9999 | Pleasants County | West Virginia | 0 |
| WV | 5407599999 | 54 | 75 | NCNTY54075N54075 | Pocahontas County, WV | Pocahontas County | 58200 | 12250 | 14000 | 15750 | 17450 | 18850 | 20250 | 21650 | 23050 | 9999 | Pocahontas County | West Virginia | 0 |
| WV | 5407799999 | 54 | 77 | METRO34060M34060 | Morgantown, WV MSA | Preston County | 73900 | 15550 | 17750 | 19950 | 22150 | 23950 | 25700 | 27500 | 29250 | 9999 | Preston County | West Virginia | 1 |
| WV | 5407999999 | 54 | 79 | METRO26580M54079 | Putnam County, WV HUD Metro FMR Area | Putnam County | 77100 | 16250 | 18550 | 20850 | 23150 | 25050 | 26900 | 28750 | 30600 | 1480 | Putnam County | West Virginia | 1 |
| WV | 5408199999 | 54 | 81 | METRO13220N54081 | Raleigh County, WV HUD Metro FMR Area | Raleigh County | 54300 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Raleigh County | West Virginia | 1 |
| WV | 5408399999 | 54 | 83 | NCNTY54083N54083 | Randolph County, WV | Randolph County | 55800 | 11750 | 13400 | 15100 | 16750 | 18100 | 19450 | 20800 | 22150 | 9999 | Randolph County | West Virginia | 0 |
| WV | 5408599999 | 54 | 85 | NCNTY54085N54085 | Ritchie County, WV | Ritchie County | 55000 | 11550 | 13200 | 14850 | 16500 | 17850 | 19150 | 20500 | 21800 | 9999 | Ritchie County | West Virginia | 0 |
| WV | 5408799999 | 54 | 87 | NCNTY54087N54087 | Roane County, WV | Roane County | 48700 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Roane County | West Virginia | 0 |
| WV | 5408999999 | 54 | 89 | NCNTY54089N54089 | Summers County, WV | Summers County | 45400 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Summers County | West Virginia | 0 |
| WV | 5409199999 | 54 | 91 | NCNTY54091N54091 | Taylor County, WV | Taylor County | 61300 | 12900 | 14750 | 16600 | 18400 | 19900 | 21350 | 22850 | 24300 | 9999 | Taylor County | West Virginia | 0 |
| WV | 5409399999 | 54 | 93 | NCNTY54093N54093 | Tucker County, WV | Tucker County | 57900 | 12150 | 13900 | 15650 | 17350 | 18750 | 20150 | 21550 | 22950 | 9999 | Tucker County | West Virginia | 0 |
| WV | 5409599999 | 54 | 95 | NCNTY54095N54095 | Tyler County, WV | Tyler County | 56800 | 11950 | 13650 | 15350 | 17050 | 18450 | 19800 | 21150 | 22550 | 9999 | Tyler County | West Virginia | 0 |
| WV | 5409799999 | 54 | 97 | NCNTY54097N54097 | Upshur County, WV | Upshur County | 55300 | 11650 | 13300 | 14950 | 16600 | 17950 | 19300 | 20600 | 21950 | 9999 | Upshur County | West Virginia | 0 |
| WV | 5409999999 | 54 | 99 | METRO26580M26580 | Huntington-Ashland, WV-KY-OH HUD Metro FMR Area | Wayne County | 59100 | 12450 | 14200 | 16000 | 17750 | 19200 | 20600 | 22050 | 23450 | 3400 | Wayne County | West Virginia | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WV | 5410199999 | 54 | 101 | NCNTY54101N54101 | Webster County, WV | Webster County | 44600 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Webster County | West Virginia | 0 |
| WV | 5410399999 | 54 | 103 | NCNTY54103N54103 | Wetzel County, WV | Wetzel County | 51700 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Wetzel County | West Virginia | 0 |
| WV | 5410599999 | 54 | 105 | METRO37620M37620 | Parkersburg-Vienna, WV MSA | Wirt County | 64300 | 13300 | 15200 | 17100 | 19000 | 20550 | 22050 | 23600 | 25100 | 9999 | Wirt County | West Virginia | 1 |
| WV | 5410799999 | 54 | 107 | METRO37620M37620 | Parkersburg-Vienna, WV MSA | Wood County | 64300 | 13300 | 15200 | 17100 | 19000 | 20550 | 22050 | 23600 | 25100 | 6020 | Wood County | West Virginia | 1 |
| WV | 5410999999 | 54 | 109 | NCNTY54109N54109 | Wyoming County, WV | Wyoming County | 51900 | 11550 | 13200 | 14850 | 16450 | 17800 | 19100 | 20400 | 21750 | 9999 | Wyoming County | West Virginia | 0 |
| WI | 5500199999 | 55 | 1 | NCNTY55001N55001 | Adams County, WI | Adams County | 55600 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Adams County | Wisconsin | 0 |
| WI | 5500399999 | 55 | 3 | NCNTY55003N55003 | Ashland County, WI | Ashland County | 59000 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Ashland County | Wisconsin | 0 |
| WI | 5500599999 | 55 | 5 | NCNTY55005N55005 | Barron County, WI | Barron County | 65000 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Barron County | Wisconsin | 0 |
| WI | 5500799999 | 55 | 7 | NCNTY55007N55007 | Bayfield County, WI | Bayfield County | 64500 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Bayfield County | Wisconsin | 0 |
| WI | 5500999999 | 55 | 9 | METRO24580M24580 | Green Bay, WI HUD Metro FMR Area | Brown County | 82300 | 17300 | 19800 | 22250 | 24700 | 26700 | 28700 | 30650 | 32650 | 3080 | Brown County | Wisconsin | 1 |
| WI | 5501199999 | 55 | 11 | NCNTY55011N55011 | Buffalo County, WI | Buffalo County | 68500 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Buffalo County | Wisconsin | 0 |
| WI | 5501399999 | 55 | 13 | NCNTY55013N55013 | Burnett County, WI | Burnett County | 59800 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Burnett County | Wisconsin | 0 |
| WI | 5501599999 | 55 | 15 | METRO11540M11540 | Appleton, WI MSA | Calumet County | 86400 | 18150 | 20750 | 23350 | 25900 | 28000 | 30050 | 32150 | 34200 | 460 | Calumet County | Wisconsin | 1 |
| WI | 5501799999 | 55 | 17 | METRO20740M20740 | Eau Claire, WI MSA | Chippewa County | 76700 | 16100 | 18400 | 20700 | 23000 | 24850 | 26700 | 28550 | 30400 | 2290 | Chippewa County | Wisconsin | 1 |
| WI | 5501999999 | 55 | 19 | NCNTY55019N55019 | Clark County, WI | Clark County | 62900 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Clark County | Wisconsin | 0 |
| WI | 5502199999 | 55 | 21 | METRO31540N55021 | Columbia County, WI HUD Metro FMR Area | Columbia County | 81800 | 17200 | 19650 | 22100 | 24550 | 26550 | 28500 | 30450 | 32450 | 9999 | Columbia County | Wisconsin | 1 |
| WI | 5502399999 | 55 | 23 | NCNTY55023N55023 | Crawford County, WI | Crawford County | 64300 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Crawford County | Wisconsin | 0 |
| WI | 5502599999 | 55 | 25 | METRO31540M31540 | Madison, WI HUD Metro FMR Area | Dane County | 100100 | 21050 | 24050 | 27050 | 30050 | 32500 | 34900 | 37300 | 39700 | 4720 | Dane County | Wisconsin | 1 |
| WI | 5502799999 | 55 | 27 | NCNTY55027N55027 | Dodge County, WI | Dodge County | 77500 | 16300 | 18600 | 20950 | 23250 | 25150 | 27000 | 28850 | 30700 | 9999 | Dodge County | Wisconsin | 0 |
| WI | 5502999999 | 55 | 29 | NCNTY55029N55029 | Door County, WI | Door County | 74500 | 15650 | 17900 | 20150 | 22350 | 24150 | 25950 | 27750 | 29550 | 9999 | Door County | Wisconsin | 0 |
| WI | 5503199999 | 55 | 31 | METRO20260M20260 | Duluth, MN-WI MSA | Douglas County | 76800 | 16150 | 18450 | 20750 | 23050 | 24900 | 26750 | 28600 | 30450 | 2240 | Douglas County | Wisconsin | 1 |
| WI | 5503399999 | 55 | 33 | NCNTY55033N55033 | Dunn County, WI | Dunn County | 71500 | 15050 | 17200 | 19350 | 21450 | 23200 | 24900 | 26600 | 28350 | 9999 | Dunn County | Wisconsin | 0 |
| WI | 5503599999 | 55 | 35 | METRO20740M20740 | Eau Claire, WI MSA | Eau Claire County | 76700 | 16100 | 18400 | 20700 | 23000 | 24850 | 26700 | 28550 | 30400 | 2290 | Eau Claire County | Wisconsin | 1 |
| WI | 5503799999 | 55 | 37 | NCNTY55037N55037 | Florence County, WI | Florence County | 61000 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Florence County | Wisconsin | 0 |
| WI | 5503999999 | 55 | 39 | METRO22540M22540 | Fond du Lac, WI MSA | Fond du Lac County | 79200 | 16650 | 19000 | 21400 | 23750 | 25650 | 27550 | 29450 | 31350 | 9999 | Fond du Lac County | Wisconsin | 1 |
| WI | 5504199999 | 55 | 41 | NCNTY55041N55041 | Forest County, WI | Forest County | 56000 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Forest County | Wisconsin | 0 |
| WI | 5504399999 | 55 | 43 | NCNTY55043N55043 | Grant County, WI | Grant County | 68500 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Grant County | Wisconsin | 0 |
| WI | 5504599999 | 55 | 45 | METRO31540N55045 | Green County, WI HUD Metro FMR Area | Green County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 9999 | Green County | Wisconsin | 1 |
| WI | 5504799999 | 55 | 47 | NCNTY55047N55047 | Green Lake County, WI | Green Lake County | 69900 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Green Lake County | Wisconsin | 0 |
| WI | 5504999999 | 55 | 49 | METRO31540N55049 | Iowa County, WI HUD Metro FMR Area | Iowa County | 78500 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 9999 | Iowa County | Wisconsin | 1 |
| WI | 5505199999 | 55 | 51 | NCNTY55051N55051 | Iron County, WI | Iron County | 57200 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Iron County | Wisconsin | 0 |
| WI | 5505399999 | 55 | 53 | NCNTY55053N55053 | Jackson County, WI | Jackson County | 66100 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Jackson County | Wisconsin | 0 |
| WI | 5505599999 | 55 | 55 | NCNTY55055N55055 | Jefferson County, WI | Jefferson County | 76600 | 16100 | 18400 | 20700 | 23000 | 24850 | 26700 | 28550 | 30400 | 9999 | Jefferson County | Wisconsin | 0 |
| WI | 5505799999 | 55 | 57 | NCNTY55057N55057 | Juneau County, WI | Juneau County | 63400 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Juneau County | Wisconsin | 0 |
| WI | 5505999999 | 55 | 59 | METRO16980MM3800 | Kenosha County, WI HUD Metro FMR Area | Kenosha County | 77700 | 16350 | 18650 | 21000 | 23300 | 25200 | 27050 | 28900 | 30800 | 3800 | Kenosha County | Wisconsin | 1 |
| WI | 5506199999 | 55 | 61 | METRO24580M24580 | Green Bay, WI HUD Metro FMR Area | Kewaunee County | 82300 | 17300 | 19800 | 22250 | 24700 | 26700 | 28700 | 30650 | 32650 | 9999 | Kewaunee County | Wisconsin | 1 |
| WI | 5506399999 | 55 | 63 | METRO29100M29100 | La Crosse-Onalaska, WI-MN MSA | La Crosse County | 76800 | 16150 | 18450 | 20750 | 23050 | 24900 | 26750 | 28600 | 30450 | 3870 | La Crosse County | Wisconsin | 1 |
| WI | 5506599999 | 55 | 65 | NCNTY55065N55065 | Lafayette County, WI | Lafayette County | 69400 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Lafayette County | Wisconsin | 0 |
| WI | 5506799999 | 55 | 67 | NCNTY55067N55067 | Langlade County, WI | Langlade County | 60300 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Langlade County | Wisconsin | 0 |
| WI | 5506999999 | 55 | 69 | NCNTY55069N55069 | Lincoln County, WI | Lincoln County | 71700 | 15050 | 17200 | 19350 | 21500 | 23250 | 24950 | 26700 | 28400 | 9999 | Lincoln County | Wisconsin | 0 |
| WI | 5507199999 | 55 | 71 | NCNTY55071N55071 | Manitowoc County, WI | Manitowoc County | 76000 | 15650 | 17850 | 20100 | 22300 | 24100 | 25900 | 27700 | 29450 | 9999 | Manitowoc County | Wisconsin | 0 |
| WI | 5507399999 | 55 | 73 | METRO48140M48140 | Wausau, WI MSA | Marathon County | 79900 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 8940 | Marathon County | Wisconsin | 1 |
| WI | 5507599999 | 55 | 75 | NCNTY55075N55075 | Marinette County, WI | Marinette County | 59200 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Marinette County | Wisconsin | 0 |
| WI | 5507799999 | 55 | 77 | NCNTY55077N55077 | Marquette County, WI | Marquette County | 64300 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Marquette County | Wisconsin | 0 |
| WI | 5507899999 | 55 | 78 | NCNTY55078N55078 | Menominee County, WI | Menominee County | 41000 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Menominee County | Wisconsin | 0 |
| WI | 5507999999 | 55 | 79 | METRO33340M33340 | Milwaukee-Waukesha-West Allis, WI MSA | Milwaukee County | 83800 | 17650 | 20150 | 22650 | 25150 | 27200 | 29200 | 31200 | 33200 | 5080 | Milwaukee County | Wisconsin | 1 |
| WI | 5508199999 | 55 | 81 | NCNTY55081N55081 | Monroe County, WI | Monroe County | 72100 | 15200 | 17350 | 19500 | 21650 | 23400 | 25150 | 26850 | 28600 | 9999 | Monroe County | Wisconsin | 0 |
| WI | 5508399999 | 55 | 83 | METRO24580N55083 | Oconto County, WI HUD Metro FMR Area | Oconto County | 70700 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Oconto County | Wisconsin | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WI | 5508599999 | 55 | 85 | NCNTY55085N55085 | Oneida County, WI | Oneida County | 70400 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Oneida County | Wisconsin | 0 |
| WI | 5508799999 | 55 | 87 | METRO11540M11540 | Appleton, WI MSA | Outagamie County | 86400 | 18150 | 20750 | 23350 | 25900 | 28000 | 30050 | 32150 | 34200 | 460 | Outagamie County | Wisconsin | 1 |
| WI | 5508999999 | 55 | 89 | METRO33340M33340 | Milwaukee-Waukesha-West Allis, WI MSA | Ozaukee County | 83800 | 17650 | 20150 | 22650 | 25150 | 27200 | 29200 | 31200 | 33200 | 5080 | Ozaukee County | Wisconsin | 1 |
| WI | 5509199999 | 55 | 91 | NCNTY55091N55091 | Pepin County, WI | Pepin County | 68500 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Pepin County | Wisconsin | 0 |
| WI | 5509399999 | 55 | 93 | METRO33460M33460 | Minneapolis-St. Paul-Bloomington, MN-WI HUD Metro FMR Area | Pierce County | 103400 | 21700 | 24800 | 27900 | 31000 | 33500 | 36000 | 38450 | 40950 | 5120 | Pierce County | Wisconsin | 1 |
| WI | 5509599999 | 55 | 95 | NCNTY55095N55095 | Polk County, WI | Polk County | 69200 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Polk County | Wisconsin | 0 |
| WI | 5509799999 | 55 | 97 | NCNTY55097N55097 | Portage County, WI | Portage County | 79100 | 16500 | 18850 | 21200 | 23550 | 25450 | 27350 | 29250 | 31100 | 9999 | Portage County | Wisconsin | 0 |
| WI | 5509999999 | 55 | 99 | NCNTY55099N55099 | Price County, WI | Price County | 60500 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Price County | Wisconsin | 0 |
| WI | 5510199999 | 55 | 101 | METRO39540M39540 | Racine, WI MSA | Racine County | 84600 | 16150 | 18450 | 20750 | 23050 | 24900 | 26750 | 28600 | 30450 | 6600 | Racine County | Wisconsin | 1 |
| WI | 5510399999 | 55 | 103 | NCNTY55103N55103 | Richland County, WI | Richland County | 63200 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Richland County | Wisconsin | 0 |
| WI | 5510599999 | 55 | 105 | METRO27500M27500 | Janesville-Beloit, WI MSA | Rock County | 70300 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 3620 | Rock County | Wisconsin | 1 |
| WI | 5510799999 | 55 | 107 | NCNTY55107N55107 | Rusk County, WI | Rusk County | 53700 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Rusk County | Wisconsin | 0 |
| WI | 5510999999 | 55 | 109 | METRO33460M33460 | Minneapolis-St. Paul-Bloomington, MN-WI HUD Metro FMR Area | St. Croix County | 103400 | 21700 | 24800 | 27900 | 31000 | 33500 | 36000 | 38450 | 40950 | 5120 | St. Croix County | Wisconsin | 1 |
| WI | 5511199999 | 55 | 111 | NCNTY55111N55111 | Sauk County, WI | Sauk County | 72500 | 15250 | 17400 | 19600 | 21750 | 23500 | 25250 | 27000 | 28750 | 9999 | Sauk County | Wisconsin | 0 |
| WI | 5511399999 | 55 | 113 | NCNTY55113N55113 | Sawyer County, WI | Sawyer County | 55400 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Sawyer County | Wisconsin | 0 |
| WI | 5511599999 | 55 | 115 | NCNTY55115N55115 | Shawano County, WI | Shawano County | 66400 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Shawano County | Wisconsin | 0 |
| WI | 5511799999 | 55 | 117 | METRO43100M43100 | Sheboygan, WI MSA | Sheboygan County | 73400 | 15400 | 17600 | 19800 | 22000 | 23800 | 25550 | 27300 | 29050 | 7620 | Sheboygan County | Wisconsin | 1 |
| WI | 5511999999 | 55 | 119 | NCNTY55119N55119 | Taylor County, WI | Taylor County | 63900 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Taylor County | Wisconsin | 0 |
| WI | 5512199999 | 55 | 121 | NCNTY55121N55121 | Trempealeau County, WI | Trempealeau County | 71900 | 15100 | 17250 | 19400 | 21550 | 23300 | 25000 | 26750 | 28450 | 9999 | Trempealeau County | Wisconsin | 0 |
| WI | 5512399999 | 55 | 123 | NCNTY55123N55123 | Vernon County, WI | Vernon County | 63600 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Vernon County | Wisconsin | 0 |
| WI | 5512599999 | 55 | 125 | NCNTY55125N55125 | Vilas County, WI | Vilas County | 57500 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Vilas County | Wisconsin | 0 |
| WI | 5512799999 | 55 | 127 | NCNTY55127N55127 | Walworth County, WI | Walworth County | 79000 | 16600 | 19000 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 | 9999 | Walworth County | Wisconsin | 0 |
| WI | 5512999999 | 55 | 129 | NCNTY55129N55129 | Washburn County, WI | Washburn County | 63800 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Washburn County | Wisconsin | 0 |
| WI | 5513199999 | 55 | 131 | METRO33340M33340 | Milwaukee-Waukesha-West Allis, WI MSA | Washington County | 83800 | 17650 | 20150 | 22650 | 25150 | 27200 | 29200 | 31200 | 33200 | 5080 | Washington County | Wisconsin | 1 |
| WI | 5513399999 | 55 | 133 | METRO33340M33340 | Milwaukee-Waukesha-West Allis, WI MSA | Waukesha County | 83800 | 17650 | 20150 | 22650 | 25150 | 27200 | 29200 | 31200 | 33200 | 5080 | Waukesha County | Wisconsin | 1 |
| WI | 5513599999 | 55 | 135 | NCNTY55135N55135 | Waupaca County, WI | Waupaca County | 71800 | 15100 | 17250 | 19400 | 21550 | 23300 | 25000 | 26750 | 28450 | 9999 | Waupaca County | Wisconsin | 0 |
| WI | 5513799999 | 55 | 137 | NCNTY55137N55137 | Waushara County, WI | Waushara County | 63700 | 14900 | 17000 | 19150 | 21250 | 22950 | 24650 | 26350 | 28050 | 9999 | Waushara County | Wisconsin | 0 |
| WI | 5513999999 | 55 | 139 | METRO36780M36780 | Oshkosh-Neenah, WI MSA | Winnebago County | 80800 | 17000 | 19400 | 21850 | 24250 | 26200 | 28150 | 30100 | 32050 | 460 | Winnebago County | Wisconsin | 1 |
| WI | 5514199999 | 55 | 141 | NCNTY55141N55141 | Wood County, WI | Wood County | 73600 | 15500 | 17700 | 19900 | 22100 | 23900 | 25650 | 27450 | 29200 | 9999 | Wood County | Wisconsin | 0 |
| WY | 5600199999 | 56 | 1 | NCNTY56001N56001 | Albany County, WY | Albany County | 78900 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 9999 | Albany County | Wyoming | 0 |
| WY | 5600399999 | 56 | 3 | NCNTY56003N56003 | Big Horn County, WY | Big Horn County | 66400 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 9999 | Big Horn County | Wyoming | 0 |
| WY | 5600599999 | 56 | 5 | NCNTY56005N56005 | Campbell County, WY | Campbell County | 93900 | 19750 | 22550 | 25350 | 28150 | 30450 | 32700 | 34950 | 37200 | 9999 | Campbell County | Wyoming | 0 |
| WY | 5600799999 | 56 | 7 | NCNTY56007N56007 | Carbon County, WY | Carbon County | 77600 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 9999 | Carbon County | Wyoming | 0 |
| WY | 5600999999 | 56 | 9 | NCNTY56009N56009 | Converse County, WY | Converse County | 84300 | 17750 | 20250 | 22800 | 25300 | 27350 | 29350 | 31400 | 33400 | 9999 | Converse County | Wyoming | 0 |
| WY | 5601199999 | 56 | 11 | NCNTY56011N56011 | Crook County, WY | Crook County | 84000 | 17650 | 20200 | 22700 | 25200 | 27250 | 29250 | 31250 | 33300 | 9999 | Crook County | Wyoming | 0 |
| WY | 5601399999 | 56 | 13 | NCNTY56013N56013 | Fremont County, WY | Fremont County | 71200 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 9999 | Fremont County | Wyoming | 0 |
| WY | 5601599999 | 56 | 15 | NCNTY56015N56015 | Goshen County, WY | Goshen County | 68100 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 9999 | Goshen County | Wyoming | 0 |
| WY | 5601799999 | 56 | 17 | NCNTY56017N56017 | Hot Springs County, WY | Hot Springs County | 72500 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 9999 | Hot Springs County | Wyoming | 0 |
| WY | 5601999999 | 56 | 19 | NCNTY56019N56019 | Johnson County, WY | Johnson County | 62700 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 9999 | Johnson County | Wyoming | 0 |
| WY | 5602199999 | 56 | 21 | METRO16940M16940 | Cheyenne, WY MSA | Laramie County | 78100 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 1580 | Laramie County | Wyoming | 1 |
| WY | 5602399999 | 56 | 23 | NCNTY56023N56023 | Lincoln County, WY | Lincoln County | 77200 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 9999 | Lincoln County | Wyoming | 0 |
| WY | 5602599999 | 56 | 25 | METRO16220M16220 | Casper, WY MSA | Natrona County | 79300 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 1350 | Natrona County | Wyoming | 1 |
| WY | 5602799999 | 56 | 27 | NCNTY56027N56027 | Niobrara County, WY | Niobrara County | 65200 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 9999 | Niobrara County | Wyoming | 0 |
| WY | 5602999999 | 56 | 29 | NCNTY56029N56029 | Park County, WY | Park County | 76600 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 9999 | Park County | Wyoming | 0 |
| WY | 5603199999 | 56 | 31 | NCNTY56031N56031 | Platte County, WY | Platte County | 69300 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 9999 | Platte County | Wyoming | 0 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WY | 5603399999 | 56 | 33 | NCNTY56033N56033 | Sheridan County, WY | Sheridan County | 78700 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 9999 | Sheridan County | Wyoming | 0 |
| WY | 5603599999 | 56 | 35 | NCNTY56035N56035 | Sublette County, WY | Sublette County | 96800 | 20350 | 23250 | 26150 | 29050 | 31400 | 33700 | 36050 | 38350 | 9999 | Sublette County | Wyoming | 0 |
| WY | 5603799999 | 56 | 37 | NCNTY56037N56037 | Sweetwater County, WY | Sweetwater County | 90200 | 18950 | 21650 | 24350 | 27050 | 29250 | 31400 | 33550 | 35750 | 9999 | Sweetwater County | Wyoming | 0 |
| WY | 5603999999 | 56 | 39 | NCNTY56039N56039 | Teton County, WY | Teton County | 110700 | 23200 | 26500 | 29800 | 33100 | 35750 | 38400 | 41050 | 43700 | 9999 | Teton County | Wyoming | 0 |
| WY | 5604199999 | 56 | 41 | NCNTY56041N56041 | Uinta County, WY | Uinta County | 69500 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 9999 | Uinta County | Wyoming | 0 |
| WY | 5604399999 | 56 | 43 | NCNTY56043N56043 | Washakie County, WY | Washakie County | 70200 | 16750 | 19150 | 21550 | 23900 | 25850 | 27750 | 29650 | 31550 | 9999 | Washakie County | Wyoming | 0 |
| WY | 5604599999 | 56 | 45 | NCNTY56045N56045 | Weston County, WY | Weston County | 85500 | 18000 | 20550 | 23100 | 25650 | 27750 | 29800 | 31850 | 33900 | 9999 | Weston County | Wyoming | 0 |
| AS | 6099999999 | 60 | 999 | NCNTY60999N60999 | American Samoa | American Samoa | 31700 | 10150 | 11600 | 13050 | 14450 | 15650 | 16800 | 17950 | 19100 | | American Samoa | American Samoa | 0 |
| GU | 6601099999 | 66 | 10 | NCNTY66010N66010 | Guam | Guam | 65000 | 13650 | 15600 | 17550 | 19500 | 21100 | 22650 | 24200 | 25750 | 9999 | Guam | Guam | 0 |
| MP | 6999999999 | 69 | 999 | NCNTY69999N69999 | Northern Mariana Islands | Northern Mariana Islands | 28800 | 10150 | 11600 | 13050 | 14450 | 15650 | 16800 | 17950 | 19100 | | Northern Mariana Islands | Northern Mariana Isl | 0 |
| PR | 7200199999 | 72 | 1 | NCNTY72923N72923 | Puerto Rico HUD Nonmetro Area | Adjuntas Municipio | 20300 | 5050 | 5750 | 6450 | 7150 | 7750 | 8300 | 8900 | 9450 | 9999 | Adjuntas Municipio | Puerto Rico | 0 |
| PR | 7200399999 | 72 | 3 | METRO10380M10380 | Aguadilla-Isabela, PR HUD Metro FMR Area | Aguada Municipio | 21500 | 5200 | 5950 | 6700 | 7400 | 8000 | 8600 | 9200 | 9800 | 60 | Aguada Municipio | Puerto Rico | 1 |
| PR | 7200599999 | 72 | 5 | METRO10380M10380 | Aguadilla-Isabela, PR HUD Metro FMR Area | Aguadilla Municipio | 21500 | 5200 | 5950 | 6700 | 7400 | 8000 | 8600 | 9200 | 9800 | 60 | Aguadilla Municipio | Puerto Rico | 1 |
| PR | 7200799999 | 72 | 7 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Aguas Buenas Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Aguas Buenas Municipio | Puerto Rico | 1 |
| PR | 7200999999 | 72 | 9 | METRO41980N72923 | Barranquitas-Aibonito, PR HUD Metro FMR Area | Aibonito Municipio | 19700 | 5050 | 5750 | 6450 | 7150 | 7750 | 8300 | 8900 | 9450 | 9999 | Aibonito Municipio | Puerto Rico | 1 |
| PR | 7201199999 | 72 | 11 | METRO10380M10380 | Aguadilla-Isabela, PR HUD Metro FMR Area | Añasco Municipio | 21500 | 5200 | 5950 | 6700 | 7400 | 8000 | 8600 | 9200 | 9800 | 4840 | Añasco Municipio | Puerto Rico | 1 |
| PR | 7201399999 | 72 | 13 | METRO11640MM0470 | Arecibo, PR HUD Metro FMR Area | Arecibo Municipio | 21900 | 5400 | 6200 | 6950 | 7700 | 8350 | 8950 | 9550 | 10200 | 470 | Arecibo Municipio | Puerto Rico | 1 |
| PR | 7201599999 | 72 | 15 | METRO25020M25020 | Guayama, PR MSA | Arroyo Municipio | 18800 | 5150 | 5900 | 6650 | 7350 | 7950 | 8550 | 9150 | 9750 | 9999 | Arroyo Municipio | Puerto Rico | 1 |
| PR | 7201799999 | 72 | 17 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Barceloneta Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Barceloneta Municipio | Puerto Rico | 1 |
| PR | 7201999999 | 72 | 19 | METRO41980N72923 | Barranquitas-Aibonito, PR HUD Metro FMR Area | Barranquitas Municipio | 19700 | 5050 | 5750 | 6450 | 7150 | 7750 | 8300 | 8900 | 9450 | 9999 | Barranquitas Municipio | Puerto Rico | 1 |
| PR | 7202199999 | 72 | 21 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Bayamón Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Bayamón Municipio | Puerto Rico | 1 |
| PR | 7202399999 | 72 | 23 | METRO41900M41900 | San German, PR MSA | Cabo Rojo Municipio | 18200 | 5150 | 5850 | 6600 | 7300 | 7900 | 8500 | 9100 | 9650 | 4840 | Cabo Rojo Municipio | Puerto Rico | 1 |
| PR | 7202599999 | 72 | 25 | METRO41980MM1310 | Caguas, PR HUD Metro FMR Area | Caguas Municipio | 25700 | 6200 | 7050 | 7950 | 8800 | 9550 | 10250 | 10950 | 11650 | 1310 | Caguas Municipio | Puerto Rico | 1 |
| PR | 7202799999 | 72 | 27 | METRO11640MM0470 | Arecibo, PR HUD Metro FMR Area | Camuy Municipio | 21900 | 5400 | 6200 | 6950 | 7700 | 8350 | 8950 | 9550 | 10200 | 470 | Camuy Municipio | Puerto Rico | 1 |
| PR | 7202999999 | 72 | 29 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Canóvanas Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Canóvanas Municipio | Puerto Rico | 1 |
| PR | 7203199999 | 72 | 31 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Carolina Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Carolina Municipio | Puerto Rico | 1 |
| PR | 7203399999 | 72 | 33 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Cataño Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Cataño Municipio | Puerto Rico | 1 |
| PR | 7203599999 | 72 | 35 | METRO41980MM1310 | Caguas, PR HUD Metro FMR Area | Cayey Municipio | 25700 | 6200 | 7050 | 7950 | 8800 | 9550 | 10250 | 10950 | 11650 | 1310 | Cayey Municipio | Puerto Rico | 1 |
| PR | 7203799999 | 72 | 37 | METRO41980M21940 | Fajardo, PR HUD Metro FMR Area | Ceiba Municipio | 26000 | 6200 | 7050 | 7950 | 8800 | 9550 | 10250 | 10950 | 11650 | 7440 | Ceiba Municipio | Puerto Rico | 1 |
| PR | 7203999999 | 72 | 39 | METRO41980N72923 | Barranquitas-Aibonito, PR HUD Metro FMR Area | Ciales Municipio | 19700 | 5050 | 5750 | 6450 | 7150 | 7750 | 8300 | 8900 | 9450 | 9999 | Ciales Municipio | Puerto Rico | 1 |
| PR | 7204199999 | 72 | 41 | METRO41980MM1310 | Caguas, PR HUD Metro FMR Area | Cidra Municipio | 25700 | 6200 | 7050 | 7950 | 8800 | 9550 | 10250 | 10950 | 11650 | 1310 | Cidra Municipio | Puerto Rico | 1 |
| PR | 7204399999 | 72 | 43 | NCNTY72923N72923 | Puerto Rico HUD Nonmetro Area | Coamo Municipio | 20300 | 5050 | 5750 | 6450 | 7150 | 7750 | 8300 | 8900 | 9450 | 9999 | Coamo Municipio | Puerto Rico | 0 |
| PR | 7204599999 | 72 | 45 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Comerío Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Comerío Municipio | Puerto Rico | 1 |
| PR | 7204799999 | 72 | 47 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Corozal Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Corozal Municipio | Puerto Rico | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PR | 7204999999 | 72 | 49 | NCNTY72923N72923 | Puerto Rico HUD Nonmetro Area | Culebra Municipio | 20300 | 5050 | 5750 | 6450 | 7150 | 7750 | 8300 | 8900 | 9450 | 9999 | Culebra Municipio | Puerto Rico | 0 |
| PR | 7205199999 | 72 | 51 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Dorado Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Dorado Municipio | Puerto Rico | 1 |
| PR | 7205399999 | 72 | 53 | METRO41980M21940 | Fajardo, PR HUD Metro FMR Area | Fajardo Municipio | 26000 | 6200 | 7050 | 7950 | 8800 | 9550 | 10250 | 10950 | 11650 | 7440 | Fajardo Municipio | Puerto Rico | 1 |
| PR | 7205499999 | 72 | 54 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Florida Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Florida Municipio | Puerto Rico | 1 |
| PR | 7205599999 | 72 | 55 | METRO38660M49500 | Yauco, PR HUD Metro FMR Area | Guánica Municipio | 18800 | 5050 | 5750 | 6450 | 7150 | 7750 | 8300 | 8900 | 9450 | 9999 | Guánica Municipio | Puerto Rico | 1 |
| PR | 7205799999 | 72 | 57 | METRO25020M25020 | Guayama, PR MSA | Guayama Municipio | 18800 | 5150 | 5900 | 6650 | 7350 | 7950 | 8550 | 9150 | 9750 | 9999 | Guayama Municipio | Puerto Rico | 1 |
| PR | 7205999999 | 72 | 59 | METRO38660M49500 | Yauco, PR HUD Metro FMR Area | Guayanilla Municipio | 18800 | 5050 | 5750 | 6450 | 7150 | 7750 | 8300 | 8900 | 9450 | 6360 | Guayanilla Municipio | Puerto Rico | 1 |
| PR | 7206199999 | 72 | 61 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Guaynabo Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Guaynabo Municipio | Puerto Rico | 1 |
| PR | 7206399999 | 72 | 63 | METRO41980MM1310 | Caguas, PR HUD Metro FMR Area | Gurabo Municipio | 25700 | 6200 | 7050 | 7950 | 8800 | 9550 | 10250 | 10950 | 11650 | 1310 | Gurabo Municipio | Puerto Rico | 1 |
| PR | 7206599999 | 72 | 65 | METRO11640MM0470 | Arecibo, PR HUD Metro FMR Area | Hatillo Municipio | 21900 | 5400 | 6200 | 6950 | 7700 | 8350 | 8950 | 9550 | 10200 | 470 | Hatillo Municipio | Puerto Rico | 1 |
| PR | 7206799999 | 72 | 67 | METRO32420M32420 | Mayagüez, PR MSA | Hormigueros Municipio | 22700 | 5800 | 6600 | 7450 | 8250 | 8950 | 9600 | 10250 | 10900 | 4840 | Hormigueros Municipio | Puerto Rico | 1 |
| PR | 7206999999 | 72 | 69 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Humacao Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Humacao Municipio | Puerto Rico | 1 |
| PR | 7207199999 | 72 | 71 | METRO10380M10380 | Aguadilla-Isabela, PR HUD Metro FMR Area | Isabela Municipio | 21500 | 5200 | 5950 | 6700 | 7400 | 8000 | 8600 | 9200 | 9800 | 9999 | Isabela Municipio | Puerto Rico | 1 |
| PR | 7207399999 | 72 | 73 | NCNTY72923N72923 | Puerto Rico HUD Nonmetro Area | Jayuya Municipio | 20300 | 5050 | 5750 | 6450 | 7150 | 7750 | 8300 | 8900 | 9450 | 9999 | Jayuya Municipio | Puerto Rico | 0 |
| PR | 7207599999 | 72 | 75 | METRO38660M38660 | Ponce, PR HUD Metro FMR Area | Juana Díaz Municipio | 20500 | 5450 | 6200 | 7000 | 7750 | 8400 | 9000 | 9650 | 10250 | 6360 | Juana Díaz Municipio | Puerto Rico | 1 |
| PR | 7207799999 | 72 | 77 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Juncos Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Juncos Municipio | Puerto Rico | 1 |
| PR | 7207999999 | 72 | 79 | METRO41900M41900 | San German, PR MSA | Lajas Municipio | 18200 | 5150 | 5850 | 6600 | 7300 | 7900 | 8500 | 9100 | 9650 | 9999 | Lajas Municipio | Puerto Rico | 1 |
| PR | 7208199999 | 72 | 81 | METRO10380M10380 | Aguadilla-Isabela, PR HUD Metro FMR Area | Lares Municipio | 21500 | 5200 | 5950 | 6700 | 7400 | 8000 | 8600 | 9200 | 9800 | 9999 | Lares Municipio | Puerto Rico | 1 |
| PR | 7208399999 | 72 | 83 | NCNTY72923N72923 | Puerto Rico HUD Nonmetro Area | Las Marías Municipio | 20300 | 5050 | 5750 | 6450 | 7150 | 7750 | 8300 | 8900 | 9450 | 9999 | Las Marías Municipio | Puerto Rico | 0 |
| PR | 7208599999 | 72 | 85 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Las Piedras Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Las Piedras Municipio | Puerto Rico | 1 |
| PR | 7208799999 | 72 | 87 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Loíza Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Loíza Municipio | Puerto Rico | 1 |
| PR | 7208999999 | 72 | 89 | METRO41980M21940 | Fajardo, PR HUD Metro FMR Area | Luquillo Municipio | 26000 | 6200 | 7050 | 7950 | 8800 | 9550 | 10250 | 10950 | 11650 | 7440 | Luquillo Municipio | Puerto Rico | 1 |
| PR | 7209199999 | 72 | 91 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Manatí Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Manatí Municipio | Puerto Rico | 1 |
| PR | 7209399999 | 72 | 93 | NCNTY72923N72923 | Puerto Rico HUD Nonmetro Area | Maricao Municipio | 20300 | 5050 | 5750 | 6450 | 7150 | 7750 | 8300 | 8900 | 9450 | 9999 | Maricao Municipio | Puerto Rico | 0 |
| PR | 7209599999 | 72 | 95 | METRO41980N72923 | Barranquitas-Aibonito, PR HUD Metro FMR Area | Maunabo Municipio | 19700 | 5050 | 5750 | 6450 | 7150 | 7750 | 8300 | 8900 | 9450 | 9999 | Maunabo Municipio | Puerto Rico | 1 |
| PR | 7209799999 | 72 | 97 | METRO32420M32420 | Mayagüez, PR MSA | Mayagüez Municipio | 22700 | 5800 | 6600 | 7450 | 8250 | 8950 | 9600 | 10250 | 10900 | 4840 | Mayagüez Municipio | Puerto Rico | 1 |
| PR | 7209999999 | 72 | 99 | METRO10380M10380 | Aguadilla-Isabela, PR HUD Metro FMR Area | Moca Municipio | 21500 | 5200 | 5950 | 6700 | 7400 | 8000 | 8600 | 9200 | 9800 | 60 | Moca Municipio | Puerto Rico | 1 |
| PR | 7210199999 | 72 | 101 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Morovis Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Morovis Municipio | Puerto Rico | 1 |
| PR | 7210399999 | 72 | 103 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Naguabo Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Naguabo Municipio | Puerto Rico | 1 |
| PR | 7210599999 | 72 | 105 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Naranjito Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Naranjito Municipio | Puerto Rico | 1 |

| State_Alpha | fips2010 | State | County | cbsasub | Metro_Area_Name | County_Name | median2020 | l30_1 | l30_2 | l30_3 | l30_4 | l30_5 | l30_6 | l30_7 | l30_8 | MSA | county_town_name | state_name | metro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PR | 7210799999 | 72 | 107 | METRO41980N72923 | Barranquitas-Aibonito, PR HUD Metro FMR Area | Orocovis Municipio | 19700 | 5050 | 5750 | 6450 | 7150 | 7750 | 8300 | 8900 | 9450 | 9999 | Orocovis Municipio | Puerto Rico | 1 |
| PR | 7210999999 | 72 | 109 | METRO25020M25020 | Guayama, PR MSA | Patillas Municipio | 18800 | 5150 | 5900 | 6650 | 7350 | 7950 | 8550 | 9150 | 9750 | 9999 | Patillas Municipio | Puerto Rico | 1 |
| PR | 7211199999 | 72 | 111 | METRO38660M49500 | Yauco, PR HUD Metro FMR Area | Peñuelas Municipio | 18800 | 5050 | 5750 | 6450 | 7150 | 7750 | 8300 | 8900 | 9450 | 6360 | Peñuelas Municipio | Puerto Rico | 1 |
| PR | 7211399999 | 72 | 113 | METRO38660M38660 | Ponce, PR HUD Metro FMR Area | Ponce Municipio | 20500 | 5450 | 6200 | 7000 | 7750 | 8400 | 9000 | 9650 | 10250 | 6360 | Ponce Municipio | Puerto Rico | 1 |
| PR | 7211599999 | 72 | 115 | METRO11640N72923 | Quebradillas Municipio, PR HUD Metro FMR Area | Quebradillas Municipio | 20300 | 5150 | 5900 | 6650 | 7350 | 7950 | 8550 | 9150 | 9750 | 9999 | Quebradillas Municipio | Puerto Rico | 1 |
| PR | 7211799999 | 72 | 117 | METRO10380M10380 | Aguadilla-Isabela, PR HUD Metro FMR Area | Rincón Municipio | 21500 | 5200 | 5950 | 6700 | 7400 | 8000 | 8600 | 9200 | 9800 | 9999 | Rincón Municipio | Puerto Rico | 1 |
| PR | 7211999999 | 72 | 119 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Río Grande Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Río Grande Municipio | Puerto Rico | 1 |
| PR | 7212199999 | 72 | 121 | METRO41900M41900 | San German, PR MSA | Sabana Grande Municipio | 18200 | 5150 | 5850 | 6600 | 7300 | 7900 | 8500 | 9100 | 9650 | 4840 | Sabana Grande Municipio | Puerto Rico | 1 |
| PR | 7212399999 | 72 | 123 | NCNTY72923N72923 | Puerto Rico HUD Nonmetro Area | Salinas Municipio | 20300 | 5050 | 5750 | 6450 | 7150 | 7750 | 8300 | 8900 | 9450 | 9999 | Salinas Municipio | Puerto Rico | 0 |
| PR | 7212599999 | 72 | 125 | METRO41900M41900 | San German, PR MSA | San Germán Municipio | 18200 | 5150 | 5850 | 6600 | 7300 | 7900 | 8500 | 9100 | 9650 | 4840 | San Germán Municipio | Puerto Rico | 1 |
| PR | 7212799999 | 72 | 127 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | San Juan Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | San Juan Municipio | Puerto Rico | 1 |
| PR | 7212999999 | 72 | 129 | METRO41980MM1310 | Caguas, PR HUD Metro FMR Area | San Lorenzo Municipio | 25700 | 6200 | 7050 | 7950 | 8800 | 9550 | 10250 | 10950 | 11650 | 1310 | San Lorenzo Municipio | Puerto Rico | 1 |
| PR | 7213199999 | 72 | 131 | METRO10380M10380 | Aguadilla-Isabela, PR HUD Metro FMR Area | San Sebastián Municipio | 21500 | 5200 | 5950 | 6700 | 7400 | 8000 | 8600 | 9200 | 9800 | 9999 | San Sebastián Municipio | Puerto Rico | 1 |
| PR | 7213399999 | 72 | 133 | NCNTY72923N72923 | Puerto Rico HUD Nonmetro Area | Santa Isabel Municipio | 20300 | 5050 | 5750 | 6450 | 7150 | 7750 | 8300 | 8900 | 9450 | 9999 | Santa Isabel Municipio | Puerto Rico | 0 |
| PR | 7213599999 | 72 | 135 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Toa Alta Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Toa Alta Municipio | Puerto Rico | 1 |
| PR | 7213799999 | 72 | 137 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Toa Baja Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Toa Baja Municipio | Puerto Rico | 1 |
| PR | 7213999999 | 72 | 139 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Trujillo Alto Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Trujillo Alto Municipio | Puerto Rico | 1 |
| PR | 7214199999 | 72 | 141 | METRO10380N72141 | Utuado Municipio, PR HUD Metro FMR Area | Utuado Municipio | 21100 | 5250 | 6000 | 6750 | 7450 | 8050 | 8650 | 9250 | 9850 | 9999 | Utuado Municipio | Puerto Rico | 1 |
| PR | 7214399999 | 72 | 143 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Vega Alta Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Vega Alta Municipio | Puerto Rico | 1 |
| PR | 7214599999 | 72 | 145 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Vega Baja Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Vega Baja Municipio | Puerto Rico | 1 |
| PR | 7214799999 | 72 | 147 | NCNTY72923N72923 | Puerto Rico HUD Nonmetro Area | Vieques Municipio | 20300 | 5050 | 5750 | 6450 | 7150 | 7750 | 8300 | 8900 | 9450 | 9999 | Vieques Municipio | Puerto Rico | 0 |
| PR | 7214999999 | 72 | 149 | METRO38660M38660 | Ponce, PR HUD Metro FMR Area | Villalba Municipio | 20500 | 5450 | 6200 | 7000 | 7750 | 8400 | 9000 | 9650 | 10250 | 6360 | Villalba Municipio | Puerto Rico | 1 |
| PR | 7215199999 | 72 | 151 | METRO41980MM7440 | San Juan-Guaynabo, PR HUD Metro FMR Area | Yabucoa Municipio | 28800 | 6500 | 7400 | 8350 | 9250 | 10000 | 10750 | 11500 | 12250 | 7440 | Yabucoa Municipio | Puerto Rico | 1 |
| PR | 7215399999 | 72 | 153 | METRO38660M49500 | Yauco, PR HUD Metro FMR Area | Yauco Municipio | 18800 | 5050 | 5750 | 6450 | 7150 | 7750 | 8300 | 8900 | 9450 | 6360 | Yauco Municipio | Puerto Rico | 1 |
| VI | 7801099999 | 78 | 10 | NCNTY78010N78010 | St. Croix Island, VI | St. Croix | 53900 | 12200 | 13950 | 15700 | 17400 | 18800 | 20200 | 21600 | 23000 | 9999 | St. Croix | Virgin Islands | 0 |
| VI | 7802099999 | 78 | 20 | NCNTY78020N78020 | St. John Island, VI | St. John | 65000 | 19100 | 21800 | 24550 | 27250 | 29450 | 31650 | 33800 | 36000 | 9999 | St. John | Virgin Islands | 0 |
| VI | 7803099999 | 78 | 30 | NCNTY78030N78030 | St. Thomas Island, VI | St. Thomas | 60500 | 14150 | 16150 | 18150 | 20150 | 21800 | 23400 | 25000 | 26600 | 9999 | St. Thomas | Virgin Islands | 0 |

*Attach. 11*

| STATE | | PROGRAM | 1 PERSON | 2 PERSON | 3 PERSON | 4 PERSON | 5 PERSON | 6 PERSON | 7 PERSON | 8 PERSON |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | INCOME LIMITS | | | | | | | |
| ALABAMA | | | | | | | | | | |
| FY 2020 MFI: | 65300 | 30% OF MEDIAN | 13700 | 15650 | 17650 | 19600 | 21150 | 22700 | 24300 | 25850 |
| | | VERY LOW INCOME | 22850 | 26100 | 29400 | 32650 | 35250 | 37850 | 40500 | 43100 |
| | | LOW-INCOME | 36550 | 41800 | 47000 | 52250 | 56400 | 60600 | 64800 | 68950 |
| ALASKA | | | | | | | | | | |
| FY 2020 MFI: | 92200 | 30% OF MEDIAN | 19350 | 22150 | 24900 | 27650 | 29850 | 32100 | 34300 | 36500 |
| | | VERY LOW INCOME | 32250 | 36900 | 41500 | 46100 | 49800 | 53500 | 57150 | 60850 |
| | | LOW-INCOME | 51650 | 59000 | 66400 | 73750 | 79650 | 85550 | 91450 | 97350 |
| ARIZONA | | | | | | | | | | |
| FY 2020 MFI: | 72100 | 30% OF MEDIAN | 15150 | 17300 | 19450 | 21650 | 23350 | 25100 | 26800 | 28550 |
| | | VERY LOW INCOME | 25250 | 28850 | 32450 | 36050 | 38950 | 41800 | 44700 | 47600 |
| | | LOW-INCOME | 40400 | 46150 | 51900 | 57700 | 62300 | 66900 | 71500 | 76150 |
| ARKANSAS | | | | | | | | | | |
| FY 2020 MFI: | 61000 | 30% OF MEDIAN | 12800 | 14650 | 16450 | 18300 | 19750 | 21250 | 22700 | 24150 |
| | | VERY LOW INCOME | 21350 | 24400 | 27450 | 30500 | 32950 | 35400 | 37800 | 40250 |
| | | LOW-INCOME | 34150 | 39050 | 43900 | 48800 | 52700 | 56600 | 60500 | 64400 |
| CALIFORNIA | | | | | | | | | | |
| FY 2020 MFI: | 87100 | 30% OF MEDIAN | 18300 | 20900 | 23500 | 26150 | 28200 | 30300 | 32400 | 34500 |
| | | VERY LOW INCOME | 30500 | 34850 | 39200 | 43550 | 47050 | 50500 | 54000 | 57500 |
| | | LOW-INCOME | 48800 | 55750 | 62700 | 69700 | 75250 | 80850 | 86400 | 92000 |
| COLORADO | | | | | | | | | | |
| FY 2020 MFI: | 90200 | 30% OF MEDIAN | 18950 | 21650 | 24350 | 27050 | 29200 | 31400 | 33550 | 35700 |
| | | VERY LOW INCOME | 31550 | 36100 | 40600 | 45100 | 48700 | 52300 | 55900 | 59550 |
| | | LOW-INCOME | 50500 | 57750 | 64950 | 72150 | 77950 | 83700 | 89500 | 95250 |
| CONNECTICUT | | | | | | | | | | |
| FY 2020 MFI: | 99700 | 30% OF MEDIAN | 21550 | 24600 | 27700 | 30800 | 33250 | 35700 | 38150 | 40650 |
| | | VERY LOW INCOME | 35900 | 41050 | 46150 | 51300 | 55400 | 59500 | 63600 | 67700 |
| | | LOW-INCOME | 54950 | 62800 | 70650 | 78500 | 84800 | 91050 | 97350 | 103600 |
| DELAWARE | | | | | | | | | | |
| FY 2020 MFI: | 81900 | 30% OF MEDIAN | 17200 | 19650 | 22100 | 24550 | 26550 | 28500 | 30450 | 32450 |
| | | VERY LOW INCOME | 28650 | 32750 | 36850 | 40950 | 44250 | 47500 | 50800 | 54050 |
| | | LOW-INCOME | 45850 | 52400 | 58950 | 65500 | 70750 | 76000 | 81250 | 86500 |
| FLORIDA | | | | | | | | | | |
| FY 2020 MFI: | 68000 | 30% OF MEDIAN | 14300 | 16300 | 18350 | 20400 | 22050 | 23650 | 25300 | 26950 |
| | | VERY LOW INCOME | 23800 | 27200 | 30600 | 34000 | 36700 | 39450 | 42150 | 44900 |
| | | LOW-INCOME | 38100 | 43500 | 48950 | 54400 | 58750 | 63100 | 67450 | 71800 |
| GEORGIA | | | | | | | | | | |
| FY 2020 MFI: | 72200 | 30% OF MEDIAN | 15150 | 17350 | 19500 | 21650 | 23400 | 25150 | 26850 | 28600 |
| | | VERY LOW INCOME | 25250 | 28900 | 32500 | 36100 | 39000 | 41900 | 44750 | 47650 |
| | | LOW-INCOME | 40450 | 46200 | 52000 | 57750 | 62400 | 67000 | 71600 | 76250 |
| HAWAII | | | | | | | | | | |
| FY 2020 MFI: | 97100 | 30% OF MEDIAN | 20400 | 23300 | 26200 | 29150 | 31450 | 33800 | 36100 | 38450 |
| | | VERY LOW INCOME | 34000 | 38850 | 43700 | 48550 | 52450 | 56300 | 60200 | 64100 |
| | | LOW-INCOME | 54400 | 62150 | 69900 | 77700 | 83900 | 90100 | 96300 | 102550 |

| STATE | | PROGRAM | 1 PERSON | 2 PERSON | 3 PERSON | 4 PERSON | 5 PERSON | 6 PERSON | 7 PERSON | 8 PERSON |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | INCOME LIMITS | | | | | | | |
| IDAHO | | | | | | | | | | |
| FY 2020 MFI: | 68200 | 30% OF MEDIAN | 14300 | 16350 | 18400 | 20450 | 22100 | 23750 | 25350 | 27000 |
| | | VERY LOW INCOME | 23850 | 27300 | 30700 | 34100 | 36850 | 39550 | 42300 | 45000 |
| | | LOW-INCOME | 38200 | 43650 | 49100 | 54550 | 58900 | 63300 | 67650 | 72000 |
| ILLINOIS | | | | | | | | | | |
| FY 2020 MFI: | 84100 | 30% OF MEDIAN | 17650 | 20200 | 22700 | 25250 | 27250 | 29250 | 31300 | 33300 |
| | | VERY LOW INCOME | 29450 | 33650 | 37850 | 42050 | 45400 | 48800 | 52150 | 55500 |
| | | LOW-INCOME | 47100 | 53800 | 60550 | 67300 | 72650 | 78050 | 83450 | 88800 |
| INDIANA | | | | | | | | | | |
| FY 2020 MFI: | 72300 | 30% OF MEDIAN | 15200 | 17350 | 19500 | 21700 | 23450 | 25150 | 26900 | 28650 |
| | | VERY LOW INCOME | 25300 | 28900 | 32550 | 36150 | 39050 | 41950 | 44850 | 47700 |
| | | LOW-INCOME | 40500 | 46250 | 52050 | 57850 | 62450 | 67100 | 71700 | 76350 |
| IOWA | | | | | | | | | | |
| FY 2020 MFI: | 79700 | 30% OF MEDIAN | 16750 | 19150 | 21500 | 23900 | 25800 | 27750 | 29650 | 31550 |
| | | VERY LOW INCOME | 27900 | 31900 | 35850 | 39850 | 43050 | 46250 | 49400 | 52600 |
| | | LOW-INCOME | 44650 | 51000 | 57400 | 63750 | 68850 | 73950 | 79050 | 84150 |
| KANSAS | | | | | | | | | | |
| FY 2020 MFI: | 76500 | 30% OF MEDIAN | 16050 | 18350 | 20650 | 22950 | 24800 | 26600 | 28450 | 30300 |
| | | VERY LOW INCOME | 26800 | 30600 | 34450 | 38250 | 41300 | 44350 | 47450 | 50500 |
| | | LOW-INCOME | 42850 | 48950 | 55100 | 61200 | 66100 | 71000 | 75900 | 80800 |
| KENTUCKY | | | | | | | | | | |
| FY 2020 MFI: | 65400 | 30% OF MEDIAN | 13750 | 15700 | 17650 | 19600 | 21200 | 22750 | 24350 | 25900 |
| | | VERY LOW INCOME | 22900 | 26150 | 29450 | 32700 | 35300 | 37950 | 40550 | 43150 |
| | | LOW-INCOME | 36600 | 41850 | 47100 | 52300 | 56500 | 60700 | 64900 | 69050 |
| LOUISIANA | | | | | | | | | | |
| FY 2020 MFI: | 64300 | 30% OF MEDIAN | 13500 | 15450 | 17350 | 19300 | 20850 | 22400 | 23900 | 25450 |
| | | VERY LOW INCOME | 22500 | 25700 | 28950 | 32150 | 34700 | 37300 | 39850 | 42450 |
| | | LOW-INCOME | 36000 | 41150 | 46300 | 51450 | 55550 | 59650 | 63800 | 67900 |
| MAINE | | | | | | | | | | |
| FY 2020 MFI: | 76600 | 30% OF MEDIAN | 16100 | 18400 | 20700 | 23000 | 24800 | 26650 | 28500 | 30350 |
| | | VERY LOW INCOME | 26800 | 30650 | 34450 | 38300 | 41350 | 44450 | 47500 | 50550 |
| | | LOW-INCOME | 42900 | 49000 | 55150 | 61300 | 66200 | 71100 | 76000 | 80900 |
| MARYLAND | | | | | | | | | | |
| FY 2020 MFI: | 104500 | 30% OF MEDIAN | 21950 | 25100 | 28200 | 31350 | 33850 | 36350 | 38850 | 41400 |
| | | VERY LOW INCOME | 36600 | 41800 | 47050 | 52250 | 56450 | 60600 | 64800 | 68950 |
| | | LOW-INCOME | 54950 | 62800 | 70650 | 78500 | 84800 | 91050 | 97350 | 103600 |
| MASSACHUSETTS | | | | | | | | | | |
| FY 2020 MFI: | 104900 | 30% OF MEDIAN | 22050 | 25200 | 28300 | 31450 | 34000 | 36500 | 39000 | 41550 |
| | | VERY LOW INCOME | 36700 | 41950 | 47200 | 52450 | 56650 | 60850 | 65050 | 69250 |
| | | LOW-INCOME | 54950 | 62800 | 70650 | 78500 | 84800 | 91050 | 97350 | 103600 |
| MICHIGAN | | | | | | | | | | |
| FY 2020 MFI: | 74000 | 30% OF MEDIAN | 15550 | 17750 | 20000 | 22200 | 24000 | 25750 | 27550 | 29300 |
| | | VERY LOW INCOME | 25900 | 29600 | 33300 | 37000 | 39950 | 42900 | 45900 | 48850 |
| | | LOW-INCOME | 41450 | 47350 | 53300 | 59200 | 63950 | 68650 | 73400 | 78150 |

| STATE | | PROGRAM | 1 PERSON | 2 PERSON | 3 PERSON | 4 PERSON | 5 PERSON | 6 PERSON | 7 PERSON | 8 PERSON |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | INCOME LIMITS | | | | | | | |
| MINNESOTA | | | | | | | | | | |
| FY 2020 MFI: | 91800 | 30% OF MEDIAN | 19300 | 22050 | 24800 | 27550 | 29750 | 31950 | 34150 | 36350 |
| | | VERY LOW INCOME | 32150 | 36700 | 41300 | 45900 | 49550 | 53250 | 56900 | 60600 |
| | | LOW-INCOME | 51400 | 58750 | 66100 | 73450 | 79300 | 85200 | 91050 | 96950 |
| MISSISSIPPI | | | | | | | | | | |
| FY 2020 MFI: | 59400 | 30% OF MEDIAN | 12450 | 14250 | 16050 | 17800 | 19250 | 20650 | 22100 | 23500 |
| | | VERY LOW INCOME | 20800 | 23750 | 26750 | 29700 | 32100 | 34450 | 36850 | 39200 |
| | | LOW-INCOME | 33250 | 38000 | 42750 | 47500 | 51300 | 55100 | 58900 | 62750 |
| MISSOURI | | | | | | | | | | |
| FY 2020 MFI: | 71500 | 30% OF MEDIAN | 15000 | 17150 | 19300 | 21450 | 23150 | 24900 | 26600 | 28300 |
| | | VERY LOW INCOME | 25050 | 28600 | 32200 | 35750 | 38600 | 41450 | 44350 | 47200 |
| | | LOW-INCOME | 40050 | 45750 | 51500 | 57200 | 61800 | 66350 | 70950 | 75500 |
| MONTANA | | | | | | | | | | |
| FY 2020 MFI: | 73300 | 30% OF MEDIAN | 15400 | 17600 | 19800 | 22000 | 23750 | 25500 | 27250 | 29050 |
| | | VERY LOW INCOME | 25650 | 29300 | 33000 | 36650 | 39600 | 42500 | 45450 | 48400 |
| | | LOW-INCOME | 41050 | 46900 | 52800 | 58650 | 63350 | 68000 | 72700 | 77400 |
| NEBRASKA | | | | | | | | | | |
| FY 2020 MFI: | 79800 | 30% OF MEDIAN | 16750 | 19150 | 21550 | 23950 | 25850 | 27750 | 29700 | 31600 |
| | | VERY LOW INCOME | 27950 | 31900 | 35900 | 39900 | 43100 | 46300 | 49500 | 52650 |
| | | LOW-INCOME | 44700 | 51050 | 57450 | 63850 | 68950 | 74050 | 79150 | 84250 |
| NEVADA | | | | | | | | | | |
| FY 2020 MFI: | 72500 | 30% OF MEDIAN | 15750 | 18000 | 20250 | 22500 | 24300 | 26100 | 27900 | 29700 |
| | | VERY LOW INCOME | 26250 | 30000 | 33750 | 37500 | 40500 | 43500 | 46500 | 49500 |
| | | LOW-INCOME | 42000 | 48000 | 54000 | 60000 | 64800 | 69600 | 74400 | 79200 |
| NEW HAMPSHIRE | | | | | | | | | | |
| FY 2020 MFI: | 96700 | 30% OF MEDIAN | 20300 | 23200 | 26100 | 29000 | 31350 | 33650 | 35950 | 38300 |
| | | VERY LOW INCOME | 33850 | 38700 | 43500 | 48350 | 52200 | 56100 | 59950 | 63800 |
| | | LOW-INCOME | 54150 | 61900 | 69600 | 77350 | 83550 | 89750 | 95950 | 102100 |
| NEW JERSEY | | | | | | | | | | |
| FY 2020 MFI: | 103300 | 30% OF MEDIAN | 21700 | 24800 | 27900 | 31000 | 33450 | 35950 | 38450 | 40900 |
| | | VERY LOW INCOME | 36150 | 41300 | 46500 | 51650 | 55800 | 59900 | 64050 | 68200 |
| | | LOW-INCOME | 54950 | 62800 | 70650 | 78500 | 84800 | 91050 | 97350 | 103600 |
| NEW MEXICO | | | | | | | | | | |
| FY 2020 MFI: | 61900 | 30% OF MEDIAN | 13000 | 14850 | 16700 | 18550 | 20050 | 21550 | 23050 | 24500 |
| | | VERY LOW INCOME | 21650 | 24750 | 27850 | 30950 | 33450 | 35900 | 38400 | 40850 |
| | | LOW-INCOME | 34650 | 39600 | 44550 | 49500 | 53500 | 57450 | 61400 | 65350 |
| NEW YORK | | | | | | | | | | |
| FY 2020 MFI: | 85100 | 30% OF MEDIAN | 17850 | 20400 | 23000 | 25550 | 27550 | 29600 | 31650 | 33700 |
| | | VERY LOW INCOME | 29800 | 34050 | 38300 | 42550 | 45950 | 49350 | 52750 | 56150 |
| | | LOW-INCOME | 47650 | 54450 | 61250 | 68100 | 73550 | 78950 | 84400 | 89850 |
| NORTH CAROLINA | | | | | | | | | | |
| FY 2020 MFI: | 70000 | 30% OF MEDIAN | 14700 | 16800 | 18900 | 21000 | 22700 | 24350 | 26050 | 27700 |
| | | VERY LOW INCOME | 24500 | 28000 | 31500 | 35000 | 37800 | 40600 | 43400 | 46200 |
| | | LOW-INCOME | 39200 | 44800 | 50400 | 56000 | 60500 | 64950 | 69450 | 73900 |

| STATE | | PROGRAM | 1 PERSON | 2 PERSON | 3 PERSON | 4 PERSON | 5 PERSON | 6 PERSON | 7 PERSON | 8 PERSON |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | INCOME LIMITS | | | | | | | |
| NORTH DAKOTA | | | | | | | | | | |
| FY 2020 MFI: | 86900 | 30% OF MEDIAN | 18250 | 20850 | 23450 | 26050 | 28150 | 30250 | 32350 | 34400 |
| | | VERY LOW INCOME | 30400 | 34750 | 39100 | 43450 | 46950 | 50400 | 53900 | 57350 |
| | | LOW-INCOME | 48650 | 55600 | 62550 | 69500 | 75100 | 80650 | 86200 | 91750 |
| OHIO | | | | | | | | | | |
| FY 2020 MFI: | 73900 | 30% OF MEDIAN | 15500 | 17750 | 19950 | 22150 | 23950 | 25700 | 27500 | 29250 |
| | | VERY LOW INCOME | 25850 | 29550 | 33250 | 36950 | 39900 | 42850 | 45800 | 48750 |
| | | LOW-INCOME | 41400 | 47300 | 53200 | 59100 | 63850 | 68600 | 73300 | 78050 |
| OKLAHOMA | | | | | | | | | | |
| FY 2020 MFI: | 65300 | 30% OF MEDIAN | 13700 | 15650 | 17650 | 19600 | 21150 | 22700 | 24300 | 25850 |
| | | VERY LOW INCOME | 22850 | 26100 | 29400 | 32650 | 35250 | 37850 | 40500 | 43100 |
| | | LOW-INCOME | 36550 | 41800 | 47000 | 52250 | 56400 | 60600 | 64800 | 68950 |
| OREGON | | | | | | | | | | |
| FY 2020 MFI: | 77700 | 30% OF MEDIAN | 16300 | 18650 | 21000 | 23300 | 25150 | 27050 | 28900 | 30750 |
| | | VERY LOW INCOME | 27200 | 31100 | 34950 | 38850 | 41950 | 45050 | 48150 | 51300 |
| | | LOW-INCOME | 43500 | 49750 | 55950 | 62150 | 67150 | 72100 | 77100 | 82050 |
| PENNSYLVANIA | | | | | | | | | | |
| FY 2020 MFI: | 80700 | 30% OF MEDIAN | 16950 | 19350 | 21800 | 24200 | 26150 | 28100 | 30000 | 31950 |
| | | VERY LOW INCOME | 28250 | 32300 | 36300 | 40350 | 43600 | 46800 | 50050 | 53250 |
| | | LOW-INCOME | 45200 | 51650 | 58100 | 64550 | 69700 | 74900 | 80050 | 85200 |
| RHODE ISLAND | | | | | | | | | | |
| FY 2020 MFI: | 89800 | 30% OF MEDIAN | 18850 | 21550 | 24250 | 26950 | 29100 | 31250 | 33400 | 35550 |
| | | VERY LOW INCOME | 31450 | 35900 | 40400 | 44900 | 48500 | 52100 | 55700 | 59250 |
| | | LOW-INCOME | 50300 | 57450 | 64650 | 71850 | 77600 | 83350 | 89100 | 94850 |
| SOUTH CAROLINA | | | | | | | | | | |
| FY 2020 MFI: | 66300 | 30% OF MEDIAN | 13900 | 15900 | 17900 | 19900 | 21500 | 23050 | 24650 | 26250 |
| | | VERY LOW INCOME | 23200 | 26500 | 29850 | 33150 | 35800 | 38450 | 41100 | 43750 |
| | | LOW-INCOME | 37150 | 42450 | 47750 | 53050 | 57300 | 61550 | 65750 | 70000 |
| SOUTH DAKOTA | | | | | | | | | | |
| FY 2020 MFI: | 77800 | 30% OF MEDIAN | 16350 | 18650 | 21000 | 23350 | 25200 | 27050 | 28950 | 30800 |
| | | VERY LOW INCOME | 27250 | 31100 | 35000 | 38900 | 42000 | 45100 | 48250 | 51350 |
| | | LOW-INCOME | 43550 | 49800 | 56000 | 62250 | 67200 | 72200 | 77200 | 82150 |
| TENNESSEE | | | | | | | | | | |
| FY 2020 MFI: | 66800 | 30% OF MEDIAN | 14050 | 16050 | 18050 | 20050 | 21650 | 23250 | 24850 | 26450 |
| | | VERY LOW INCOME | 23400 | 26700 | 30050 | 33400 | 36050 | 38750 | 41400 | 44100 |
| | | LOW-INCOME | 37400 | 42750 | 48100 | 53450 | 57700 | 62000 | 66250 | 70550 |
| TEXAS | | | | | | | | | | |
| FY 2020 MFI: | 74500 | 30% OF MEDIAN | 15650 | 17900 | 20100 | 22350 | 24150 | 25950 | 27700 | 29500 |
| | | VERY LOW INCOME | 26100 | 29800 | 33550 | 37250 | 40250 | 43200 | 46200 | 49150 |
| | | LOW-INCOME | 41700 | 47700 | 53650 | 59600 | 64350 | 69150 | 73900 | 78650 |
| UTAH | | | | | | | | | | |
| FY 2020 MFI: | 82800 | 30% OF MEDIAN | 17400 | 19850 | 22350 | 24850 | 26850 | 28800 | 30800 | 32800 |
| | | VERY LOW INCOME | 29000 | 33100 | 37250 | 41400 | 44700 | 48000 | 51350 | 54650 |
| | | LOW-INCOME | 46350 | 53000 | 59600 | 66250 | 71550 | 76850 | 82150 | 87450 |

| STATE | | PROGRAM | 1 PERSON | 2 PERSON | 3 PERSON | 4 PERSON | 5 PERSON | 6 PERSON | 7 PERSON | 8 PERSON |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | INCOME LIMITS | | | | | | | |
| VERMONT | | | | | | | | | | |
| FY 2020 MFI: | 79000 | 30% OF MEDIAN | 16600 | 18950 | 21350 | 23700 | 25600 | 27500 | 29400 | 31300 |
| | | VERY LOW INCOME | 27650 | 31600 | 35550 | 39500 | 42650 | 45800 | 49000 | 52150 |
| | | LOW-INCOME | 44250 | 50550 | 56900 | 63200 | 68250 | 73300 | 78350 | 83400 |
| VIRGINIA | | | | | | | | | | |
| FY 2020 MFI: | 91600 | 30% OF MEDIAN | 19250 | 22000 | 24750 | 27500 | 29700 | 31900 | 34100 | 36250 |
| | | VERY LOW INCOME | 32050 | 36650 | 41200 | 45800 | 49450 | 53150 | 56800 | 60450 |
| | | LOW-INCOME | 51300 | 58600 | 65950 | 73300 | 79150 | 85000 | 90850 | 96750 |
| WASHINGTON | | | | | | | | | | |
| FY 2020 MFI: | 89800 | 30% OF MEDIAN | 18850 | 21550 | 24250 | 26950 | 29100 | 31250 | 33400 | 35550 |
| | | VERY LOW INCOME | 31450 | 35900 | 40400 | 44900 | 48500 | 52100 | 55700 | 59250 |
| | | LOW-INCOME | 50300 | 57450 | 64650 | 71850 | 77600 | 83350 | 89100 | 94850 |
| WEST VIRGINIA | | | | | | | | | | |
| FY 2020 MFI: | 59600 | 30% OF MEDIAN | 12500 | 14300 | 16100 | 17900 | 19300 | 20750 | 22150 | 23600 |
| | | VERY LOW INCOME | 20850 | 23850 | 26800 | 29800 | 32200 | 34550 | 36950 | 39350 |
| | | LOW-INCOME | 33400 | 38150 | 42900 | 47700 | 51500 | 55300 | 59100 | 62950 |
| WISCONSIN | | | | | | | | | | |
| FY 2020 MFI: | 80100 | 30% OF MEDIAN | 16800 | 19200 | 21650 | 24050 | 25950 | 27850 | 29800 | 31700 |
| | | VERY LOW INCOME | 28050 | 32050 | 36050 | 40050 | 43250 | 46450 | 49650 | 52850 |
| | | LOW-INCOME | 44850 | 51250 | 57650 | 64100 | 69200 | 74350 | 79450 | 84600 |
| WYOMING | | | | | | | | | | |
| FY 2020 MFI: | 79500 | 30% OF MEDIAN | 16750 | 19150 | 21500 | 23900 | 25800 | 27750 | 29650 | 31550 |
| | | VERY LOW INCOME | 27900 | 31900 | 35850 | 39850 | 43050 | 46250 | 49400 | 52600 |
| | | LOW-INCOME | 44650 | 51000 | 57400 | 63750 | 68850 | 73950 | 79050 | 84150 |
| US | | | | | | | | | | |
| FY 2020 MFI: | 78500 | 30% OF MEDIAN | 16500 | 18850 | 21200 | 23550 | 25450 | 27300 | 29200 | 31100 |
| | | VERY LOW INCOME | 27500 | 31400 | 35350 | 39250 | 42400 | 45550 | 48650 | 51800 |
| | | LOW-INCOME | 43950 | 50250 | 56500 | 62800 | 67800 | 72850 | 77850 | 82900 |

*Attach. 12*

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# QuickFacts

## California

QuickFacts provides statistics for all states and counties, and for cities and towns with a ***population of 5,000 or more***.

## Table

| All Topics | California |
|---|---|
| **Foreign born persons, percent, 2015-2019** | **26.8%** |
| **PEOPLE** | |
| **Population** | |
| Population Estimates, July 1 2021, (V2021) | ⚠ 39,237,836 |
| Population estimates base, April 1, 2020, (V2021) | ⚠ 39,538,223 |
| Population, percent change - April 1, 2020 (estimates base) to July 1, 2021, (V2021) | ⚠ -0.8% |
| Population, Census, April 1, 2020 | 39,538,223 |
| Population, Census, April 1, 2010 | 37,253,956 |
| **Age and Sex** | |
| Persons under 5 years, percent | ⚠ 6.0% |
| Persons under 18 years, percent | ⚠ 22.5% |
| Persons 65 years and over, percent | ⚠ 14.8% |
| Female persons, percent | ⚠ 50.3% |
| **Race and Hispanic Origin** | |
| White alone, percent | ⚠ 71.9% |
| Black or African American alone, percent (a) | ⚠ 6.5% |
| American Indian and Alaska Native alone, percent (a) | ⚠ 1.6% |
| Asian alone, percent (a) | ⚠ 15.5% |
| Native Hawaiian and Other Pacific Islander alone, percent (a) | ⚠ 0.5% |
| Two or More Races, percent | ⚠ 4.0% |
| Hispanic or Latino, percent (b) | ⚠ 39.4% |
| White alone, not Hispanic or Latino, percent | ⚠ 36.5% |
| **Population Characteristics** | |
| Veterans, 2015-2019 | 1,574,531 |
| **Foreign born persons, percent, 2015-2019** | **26.8%** |
| **Housing** | |
| Housing units, July 1, 2019, (V2019) | 14,366,336 |
| Owner-occupied housing unit rate, 2015-2019 | 54.8% |
| Median value of owner-occupied housing units, 2015-2019 | $505,000 |
| Median selected monthly owner costs -with a mortgage, 2015-2019 | $2,357 |
| Median selected monthly owner costs -without a mortgage, 2015-2019 | $594 |
| Median gross rent, 2015-2019 | $1,503 |
| Building permits, 2020 | 106,075 |
| **Families & Living Arrangements** | |
| Households, 2015-2019 | 13,044,266 |
| Persons per household, 2015-2019 | 2.95 |
| Living in same house 1 year ago, percent of persons age 1 year+, 2015-2019 | 87.1% |
| Language other than English spoken at home, percent of persons age 5 years+, 2015-2019 | 44.2% |
| **Computer and Internet Use** | |
| Households with a computer, percent, 2015-2019 | 93.0% |
| Households with a broadband Internet subscription, percent, 2015-2019 | 86.7% |
| **Education** | |
| High school graduate or higher, percent of persons age 25 years+, 2015-2019 | 83.3% |
| Bachelor's degree or higher, percent of persons age 25 years+, 2015-2019 | 33.9% |
| **Health** | |
| With a disability, under age 65 years, percent, 2015-2019 | 6.7% |
| Persons without health insurance, under age 65 years, percent | ⚠ 8.9% |
| **Economy** | |
| In civilian labor force, total, percent of population age 16 years+, 2015-2019 | 63.3% |

| | |
|---|---|
| In civilian labor force, female, percent of population age 16 years+, 2015-2019 | 57.5% |
| Total accommodation and food services sales, 2012 ($1,000) (c) | 90,830,372 |
| Total health care and social assistance receipts/revenue, 2012 ($1,000) (c) | 248,953,592 |
| Total manufacturers shipments, 2012 ($1,000) (c) | 512,303,164 |
| Total retail sales, 2012 ($1,000) (c) | 481,800,461 |
| Total retail sales per capita, 2012 (c) | $12,665 |
| **Transportation** | |
| Mean travel time to work (minutes), workers age 16 years+, 2015-2019 | 29.8 |
| **Income & Poverty** | |
| Median household income (in 2019 dollars), 2015-2019 | $75,235 |
| Per capita income in past 12 months (in 2019 dollars), 2015-2019 | $36,955 |
| Persons in poverty, percent | ⚠ 11.5% |

## BUSINESSES

| | |
|---|---|
| **Businesses** | |
| Total employer establishments, 2019 | 966,224 |
| Total employment, 2019 | 15,516,824 |
| Total annual payroll, 2019 ($1,000) | 1,077,175,621 |
| Total employment, percent change, 2018-2019 | 1.9% |
| Total nonemployer establishments, 2018 | 3,453,769 |
| All firms, 2012 | 3,548,449 |
| Men-owned firms, 2012 | 1,852,580 |
| Women-owned firms, 2012 | 1,320,085 |
| Minority-owned firms, 2012 | 1,619,857 |
| Nonminority-owned firms, 2012 | 1,819,107 |
| Veteran-owned firms, 2012 | 252,377 |
| Nonveteran-owned firms, 2012 | 3,176,341 |

## GEOGRAPHY

| | |
|---|---|
| **Geography** | |
| Population per square mile, 2010 | 239.1 |
| Land area in square miles, 2010 | 155,779.22 |
| FIPS Code | 06 |

About datasets used in this table

**Value Notes**

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**Fact Notes**

**(a)** Includes persons reporting only one race
**(c)** Economic Census - Puerto Rico data are not comparable to U.S. Economic Census data
**(b)** Hispanics may be of any race, so also are included in applicable race categories

**Value Flags**

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**F** Fewer than 25 firms
**D** Suppressed to avoid disclosure of confidential information
**N** Data for this geographic area cannot be displayed because the number of sample cases is too small.
**FN** Footnote on this item in place of data
**X** Not applicable
**S** Suppressed; does not meet publication standards
**NA** Not available
**Z** Value greater than zero but less than half unit of measure shown

QuickFacts data are derived from: Population Estimates, American Community Survey, Census of Population and Housing, Current Population Survey, Small Area Health Insurance Estimates, Small Area Income and P Estimates, State and County Housing Unit Estimates, County Business Patterns, Nonemployer Statistics, Economic Census, Survey of Business Owners, Building Permits.

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# QuickFacts

## Fresno County, California; Tulare County, California; Kings County, California; Kern County, California

QuickFacts provides statistics for all states and counties, and for cities and towns with a ***population of 5,000 or more***.

## Table

| All Topics | Fresno County, California | Tulare County, California | Kings County, California | Kern County, California |
|---|---|---|---|---|
| **Foreign born persons, percent, 2015-2019** | **21.2%** | **21.8%** | **18.9%** | **19.9%** |
| **PEOPLE** | | | | |
| **Population** | | | | |
| Population Estimates, July 1 2021, (V2021) | NA | NA | NA | NA |
| Population estimates base, April 1, 2020, (V2021) | NA | NA | NA | NA |
| Population, percent change - April 1, 2020 (estimates base) to July 1, 2021, (V2021) | NA | NA | NA | NA |
| Population, Census, April 1, 2020 | 1,008,654 | 473,117 | 152,486 | 909,235 |
| Population, Census, April 1, 2010 | 930,450 | 442,179 | 152,982 | 839,631 |
| **Age and Sex** | | | | |
| Persons under 5 years, percent | 7.6% | 7.8% | 7.6% | 7.6% |
| Persons under 18 years, percent | 28.2% | 30.5% | 27.0% | 28.8% |
| Persons 65 years and over, percent | 12.6% | 11.6% | 10.5% | 11.2% |
| Female persons, percent | 50.1% | 50.0% | 44.9% | 48.8% |
| **Race and Hispanic Origin** | | | | |
| White alone, percent | 76.6% | 88.2% | 80.8% | 82.3% |
| Black or African American alone, percent (a) | 5.8% | 2.2% | 7.5% | 6.3% |
| American Indian and Alaska Native alone, percent (a) | 3.0% | 2.8% | 3.2% | 2.6% |
| Asian alone, percent (a) | 11.1% | 4.0% | 4.4% | 5.4% |
| Native Hawaiian and Other Pacific Islander alone, percent (a) | 0.3% | 0.2% | 0.4% | 0.3% |
| Two or More Races, percent | 3.2% | 2.7% | 3.7% | 3.2% |
| Hispanic or Latino, percent (b) | 53.8% | 65.6% | 55.3% | 54.6% |
| White alone, not Hispanic or Latino, percent | 28.6% | 27.7% | 31.3% | 32.8% |
| **Population Characteristics** | | | | |
| Veterans, 2015-2019 | 36,125 | 14,633 | 9,684 | 35,594 |
| **Foreign born persons, percent, 2015-2019** | **21.2%** | **21.8%** | **18.9%** | **19.9%** |
| **Housing** | | | | |
| Housing units, July 1, 2019, (V2019) | 336,473 | 151,603 | 46,965 | 302,898 |
| Owner-occupied housing unit rate, 2015-2019 | 53.3% | 57.1% | 52.3% | 58.3% |
| Median value of owner-occupied housing units, 2015-2019 | $255,000 | $205,000 | $215,900 | $213,900 |
| Median selected monthly owner costs -with a mortgage, 2015-2019 | $1,631 | $1,420 | $1,459 | $1,527 |
| Median selected monthly owner costs -without a mortgage, 2015-2019 | $484 | $421 | $446 | $452 |
| Median gross rent, 2015-2019 | $998 | $942 | $990 | $978 |
| Building permits, 2020 | 3,130 | 1,575 | 306 | 2,502 |
| **Families & Living Arrangements** | | | | |
| Households, 2015-2019 | 307,906 | 138,238 | 43,452 | 270,282 |
| Persons per household, 2015-2019 | 3.14 | 3.30 | 3.13 | 3.17 |
| Living in same house 1 year ago, percent of persons age 1 year+, 2015-2019 | 85.8% | 88.6% | 81.9% | 86.1% |
| Language other than English spoken at home, percent of persons age 5 years+, 2015-2019 | 44.6% | 51.3% | 41.5% | 44.2% |
| **Computer and Internet Use** | | | | |
| Households with a computer, percent, 2015-2019 | 89.2% | 87.6% | 90.5% | 87.5% |
| Households with a broadband Internet subscription, percent, 2015-2019 | 80.2% | 77.7% | 80.4% | 79.7% |
| **Education** | | | | |
| High school graduate or higher, percent of persons age 25 years+, 2015-2019 | 76.0% | 70.8% | 73.4% | 74.1% |
| Bachelor's degree or higher, percent of persons age 25 years+, 2015-2019 | 21.2% | 14.6% | 14.7% | 16.4% |

| | | | | |
|---|---|---|---|---|
| **Health** | | | | |
| With a disability, under age 65 years, percent, 2015-2019 | 9.2% | 8.2% | 8.6% | 7.8% |
| Persons without health insurance, under age 65 years, percent | ⚠ 9.7% | ⚠ 9.5% | ⚠ 9.4% | ⚠ 9.3% |
| **Economy** | | | | |
| In civilian labor force, total, percent of population age 16 years+, 2015-2019 | 60.9% | 59.0% | 51.8% | 58.0% |
| In civilian labor force, female, percent of population age 16 years+, 2015-2019 | 55.2% | 51.1% | 51.5% | 52.4% |
| Total accommodation and food services sales, 2012 ($1,000) (c) | 1,226,169 | 451,880 | 378,595 | 1,092,151 |
| Total health care and social assistance receipts/revenue, 2012 ($1,000) (c) | 5,325,615 | 1,610,236 | 587,818 | 3,675,000 |
| Total manufacturers shipments, 2012 ($1,000) (c) | 8,658,325 | 8,362,447 | 2,904,014 | 6,890,714 |
| Total retail sales, 2012 ($1,000) (c) | 9,117,752 | 3,903,527 | 1,031,953 | 8,640,550 |
| Total retail sales per capita, 2012 (c) | $9,619 | $8,637 | $6,818 | $10,092 |
| **Transportation** | | | | |
| Mean travel time to work (minutes), workers age 16 years+, 2015-2019 | 23.1 | 22.6 | 22.8 | 23.3 |
| **Income & Poverty** | | | | |
| Median household income (in 2019 dollars), 2015-2019 | $53,969 | $49,687 | $57,848 | $53,350 |
| Per capita income in past 12 months (in 2019 dollars), 2015-2019 | $24,422 | $21,380 | $22,373 | $23,326 |
| Persons in poverty, percent | ⚠ 17.1% | ⚠ 17.1% | ⚠ 14.5% | ⚠ 18.3% |
| **BUSINESSES** | | | | |
| **Businesses** | | | | |
| Total employer establishments, 2019 | 17,351 | 6,531 | 1,682 | 13,197 |
| Total employment, 2019 | 277,632 | 99,961 | 25,541 | 199,982 |
| Total annual payroll, 2019 ($1,000) | 12,530,805 | 4,148,897 | 1,065,825 | 9,521,255 |
| Total employment, percent change, 2018-2019 | 2.6% | 2.3% | -2.9% | 1.5% |
| Total nonemployer establishments, 2018 | 55,668 | 21,098 | 5,119 | 49,553 |
| All firms, 2012 | 59,569 | 23,310 | 6,091 | 51,393 |
| Men-owned firms, 2012 | 30,341 | 12,168 | 3,083 | 25,177 |
| Women-owned firms, 2012 | 22,727 | 8,115 | 2,112 | 20,004 |
| Minority-owned firms, 2012 | 30,912 | 11,023 | 2,862 | 26,610 |
| Nonminority-owned firms, 2012 | 26,343 | 11,406 | 2,876 | 23,006 |
| Veteran-owned firms, 2012 | 4,556 | 1,677 | 691 | 3,770 |
| Nonveteran-owned firms, 2012 | 51,988 | 20,452 | 5,039 | 45,383 |
| **GEOGRAPHY** | | | | |
| **Geography** | | | | |
| Population per square mile, 2010 | 156.2 | 91.7 | 110.1 | 103.3 |
| Land area in square miles, 2010 | 5,957.99 | 4,824.22 | 1,389.42 | 8,131.92 |
| FIPS Code | 06019 | 06107 | 06031 | 06029 |

About datasets used in this table

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**Fact Notes**

**(a)** Includes persons reporting only one race
**(c)** Economic Census - Puerto Rico data are not comparable to U.S. Economic Census data
**(b)** Hispanics may be of any race, so also are included in applicable race categories

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**FN** Footnote on this item in place of data
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**S** Suppressed; does not meet publication standards
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# QuickFacts

## San Joaquin County, California; Stanislaus County, California; Merced County, California; Madera County, California

QuickFacts provides statistics for all states and counties, and for cities and towns with a ***population of 5,000 or more***.

## Table

| All Topics | San Joaquin County, California | Stanislaus County, California | Merced County, California | Madera County, California |
|---|---|---|---|---|
| **Foreign born persons, percent, 2015-2019** | **23.3%** | **20.3%** | **26.3%** | **20.2%** |
| **PEOPLE** | | | | |
| **Population** | | | | |
| Population Estimates, July 1 2021, (V2021) | NA | NA | NA | NA |
| Population estimates base, April 1, 2020, (V2021) | NA | NA | NA | NA |
| Population, percent change - April 1, 2020 (estimates base) to July 1, 2021, (V2021) | NA | NA | NA | NA |
| Population, Census, April 1, 2020 | 779,233 | 552,878 | 281,202 | 156,255 |
| Population, Census, April 1, 2010 | 685,306 | 514,453 | 255,793 | 150,865 |
| **Age and Sex** | | | | |
| Persons under 5 years, percent | 6.9% | 7.1% | 7.7% | 7.3% |
| Persons under 18 years, percent | 26.8% | 27.0% | 29.3% | 27.4% |
| Persons 65 years and over, percent | 13.1% | 13.4% | 11.4% | 14.3% |
| Female persons, percent | 50.1% | 50.4% | 49.5% | 51.8% |
| **Race and Hispanic Origin** | | | | |
| White alone, percent | 66.1% | 83.3% | 82.2% | 85.9% |
| Black or African American alone, percent (a) | 8.3% | 3.5% | 3.9% | 4.2% |
| American Indian and Alaska Native alone, percent (a) | 2.0% | 2.0% | 2.5% | 4.4% |
| Asian alone, percent (a) | 17.4% | 6.1% | 7.8% | 2.6% |
| Native Hawaiian and Other Pacific Islander alone, percent (a) | 0.8% | 0.9% | 0.4% | 0.3% |
| Two or More Races, percent | 5.5% | 4.2% | 3.2% | 2.6% |
| Hispanic or Latino, percent (b) | 42.0% | 47.6% | 61.0% | 58.8% |
| White alone, not Hispanic or Latino, percent | 30.5% | 40.4% | 26.5% | 33.2% |
| **Population Characteristics** | | | | |
| Veterans, 2015-2019 | 29,013 | 21,051 | 9,225 | 6,317 |
| **Foreign born persons, percent, 2015-2019** | **23.3%** | **20.3%** | **26.3%** | **20.2%** |
| **Housing** | | | | |
| Housing units, July 1, 2019, (V2019) | 248,636 | 182,978 | 86,388 | 51,438 |
| Owner-occupied housing unit rate, 2015-2019 | 56.6% | 57.8% | 52.2% | 64.1% |
| Median value of owner-occupied housing units, 2015-2019 | $342,100 | $291,600 | $252,700 | $251,200 |
| Median selected monthly owner costs -with a mortgage, 2015-2019 | $1,907 | $1,702 | $1,493 | $1,551 |
| Median selected monthly owner costs -without a mortgage, 2015-2019 | $523 | $503 | $460 | $478 |
| Median gross rent, 2015-2019 | $1,208 | $1,155 | $1,021 | $1,014 |
| Building permits, 2020 | 3,914 | 552 | 1,019 | 852 |
| **Families & Living Arrangements** | | | | |
| Households, 2015-2019 | 228,567 | 173,898 | 80,008 | 44,881 |
| Persons per household, 2015-2019 | 3.17 | 3.09 | 3.32 | 3.28 |
| Living in same house 1 year ago, percent of persons age 1 year+, 2015-2019 | 86.8% | 87.9% | 86.6% | 87.9% |
| Language other than English spoken at home, percent of persons age 5 years+, 2015-2019 | 40.9% | 42.9% | 53.3% | 45.3% |
| **Computer and Internet Use** | | | | |
| Households with a computer, percent, 2015-2019 | 91.0% | 91.6% | 91.1% | 89.8% |
| Households with a broadband Internet subscription, percent, 2015-2019 | 82.9% | 84.8% | 83.9% | 79.9% |
| **Education** | | | | |
| High school graduate or higher, percent of persons age 25 years+, 2015-2019 | 79.3% | 78.9% | 69.1% | 71.9% |
| Bachelor's degree or higher, percent of persons age 25 years+, 2015-2019 | 18.8% | 17.1% | 13.8% | 14.6% |

| | | | | |
|---|---|---|---|---|
| **Health** | | | | |
| With a disability, under age 65 years, percent, 2015-2019 | 8.7% | 9.0% | 9.1% | 8.7% |
| Persons without health insurance, under age 65 years, percent | ⚠ 8.2% | ⚠ 8.4% | ⚠ 11.4% | ⚠ 11.0% |
| **Economy** | | | | |
| In civilian labor force, total, percent of population age 16 years+, 2015-2019 | 60.3% | 60.9% | 59.6% | 54.3% |
| In civilian labor force, female, percent of population age 16 years+, 2015-2019 | 53.6% | 53.4% | 51.0% | 47.9% |
| Total accommodation and food services sales, 2012 ($1,000) (c) | 808,606 | 705,698 | 232,910 | 150,065 |
| Total health care and social assistance receipts/revenue, 2012 ($1,000) (c) | 3,447,722 | 3,634,960 | 788,114 | 760,956 |
| Total manufacturers shipments, 2012 ($1,000) (c) | 9,212,428 | 11,703,620 | 4,435,633 | 1,441,125 |
| Total retail sales, 2012 ($1,000) (c) | 7,059,491 | 5,933,581 | 1,959,473 | 1,012,856 |
| Total retail sales per capita, 2012 (c) | $10,047 | $11,373 | $7,470 | $6,654 |
| **Transportation** | | | | |
| Mean travel time to work (minutes), workers age 16 years+, 2015-2019 | 34.2 | 29.9 | 28.6 | 28.3 |
| **Income & Poverty** | | | | |
| Median household income (in 2019 dollars), 2015-2019 | $64,432 | $60,704 | $53,672 | $57,585 |
| Per capita income in past 12 months (in 2019 dollars), 2015-2019 | $27,521 | $26,258 | $23,011 | $22,853 |
| Persons in poverty, percent | ⚠ 13.9% | ⚠ 13.0% | ⚠ 16.3% | ⚠ 14.1% |
| **BUSINESSES** | | | | |
| **Businesses** | | | | |
| Total employer establishments, 2019 | 11,989 | 9,279 | 3,177 | 2,039 |
| Total employment, 2019 | 195,234 | 145,805 | 46,799 | 27,690 |
| Total annual payroll, 2019 ($1,000) | 9,144,028 | 7,026,189 | 1,883,107 | 1,308,125 |
| Total employment, percent change, 2018-2019 | 0.2% | 0.5% | 1.6% | 2.0% |
| Total nonemployer establishments, 2018 | 42,899 | 30,181 | 11,717 | 7,504 |
| All firms, 2012 | 41,940 | 33,036 | 12,848 | 8,094 |
| Men-owned firms, 2012 | 21,962 | 16,930 | 7,163 | 3,888 |
| Women-owned firms, 2012 | 14,941 | 11,455 | 4,071 | 3,202 |
| Minority-owned firms, 2012 | 20,472 | 13,341 | 6,912 | 3,203 |
| Nonminority-owned firms, 2012 | 19,915 | 18,348 | 5,448 | 4,524 |
| Veteran-owned firms, 2012 | 3,449 | 2,914 | 1,060 | 618 |
| Nonveteran-owned firms, 2012 | 36,663 | 28,584 | 11,149 | 7,044 |
| **GEOGRAPHY** | | | | |
| **Geography** | | | | |
| Population per square mile, 2010 | 492.6 | 344.2 | 132.2 | 70.6 |
| Land area in square miles, 2010 | 1,391.32 | 1,494.83 | 1,934.97 | 2,137.07 |
| FIPS Code | 06077 | 06099 | 06047 | 06039 |

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**D** Suppressed to avoid disclosure of confidential information
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**NA** Not available
**Z** Value greater than zero but less than half unit of measure shown

QuickFacts data are derived from: Population Estimates, American Community Survey, Census of Population and Housing, Current Population Survey, Small Area Health Insurance Estimates, Small Area Income and P Estimates, State and County Housing Unit Estimates, County Business Patterns, Nonemployer Statistics, Economic Census, Survey of Business Owners, Building Permits.

*Attach. 13*

| | NOx | SOx | PM10 | CO | VOC | PM2.5 | MW/hour | % of Avenal Electricity |
|---|---|---|---|---|---|---|---|---|
| **One Digester (lbs/year)** | 9,166 | 2,268 | 3,970 | 101,636 | 6,370 | 3970 | 1.059 | |
| **One Digester (tons/year)** | 4.58 | 1.13 | 1.99 | 50.82 | 3.19 | 1.99 | | |
| **25 Digesters (lbs/year)** | 229,150 | 56,700 | 99,250 | 2,540,900 | 159,250 | 99,250 | 26.475 | 4.41% |
| **25 Digesters (tons/year)** | 114.58 | 28.35 | 49.63 | 1,270.45 | 79.63 | 49.63 | | |
| **Avenal (lbs/year)** | 198,840 | 33,521 | 161,550 | 197,928 | 69,222 | 161550 | 600 | |
| **Avenal (tons/year)** | 99.42 | 16.76 | 80.78 | 98.96 | 34.61 | 80.775 | | |
| **Pollution Difference Digesters vs. Avenal (tons/year)** | 15.16 | 11.59 | -31.15 | 1,171.49 | 45.01 | -31.15 | | |

Source: Lakeview Dairy Biogas digester Authority to Construct Permit March 22, 2016, Post-Project Stationary Source Potential to Emit (SSPE2) at 14, 20

Source: Avenal Power Center Authority to Construct Permit No. December 17, 2010, Post-Project Stationary Source Potential to Emit (SSPE2) at 27.

*Attach. 14*

San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

HEALTHY AIR LIVING™

DEC 17 2010

Jim Rexroad
Avenal Power Center LLC
500 Dallas Street, Level 31
Houston, TX 77002

**Re: Notice of Final Determination of Compliance (FDOC)**
**Project Number: C-1100751 – Avenal Power Center LLC (08-AFC-01)**

Dear Mr. Rexroad:

Enclosed is the District's final determination of compliance (FDOC) for the installation of a nominal 600 MW combined cycle power plant, located at NE¼ Section 19, T21S, R18E – Mount Diablo Base Meridian on Assessor's Parcel Number 36-170-035 in Avenal, CA.

Notice of the District's preliminary decision was published on July 27, 2010. All comments received following the District's preliminary decision on this project were considered. A summary of the comments received and the District responses to those comments can be found in Attachments J, K, L, and M of the enclosed FDOC package.

The changes made to the PDOC were in direct response to comments received from the oversight agencies and other interested parties. It is District practice to require an additional 30-day comment period for a project if changes received during the initial 30-day comment period result in a significant emissions increase that affects or modifies the original basis for approval. The changes made were minor and did not increase permitted emission levels or trigger additional public notification requirements. Therefore, publication of the PDOC for an additional 30-day comment period is not required.

Also enclosed is an invoice for the engineering evaluation fees pursuant to District Rule 3010. Please remit the amount owed, along with a copy of the attached invoice, within 60 days.

**Seyed Sadredin**
Executive Director/Air Pollution Control Officer

**Northern Region**
4800 Enterprise Way
Modesto, CA 95356-8718
Tel: (209) 557-6400 FAX: (209) 557-6475

**Central Region (Main Office)**
1990 E. Gettysburg Avenue
Fresno, CA 93726-0244
Tel: (559) 230-6000 FAX: (559) 230-6061

**Southern Region**
34946 Flyover Court
Bakersfield, CA 93308-9725
Tel: 661-392-5500 FAX: 661-392-5585

www.valleyair.org www.healthyairliving.com

Printed on recycled paper.

Thank you for your cooperation in this matter. If you have any questions, please contact Mr. Jim Swaney of the Permit Services Division at (559) 230-5900.

Sincerely,

David Warner
Director of Permit Services

DW:df

Enclosures

cc: Gary Rubenstein, Sierra Research

San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

HEALTHY AIR LIVING™

DEC 17 2010

Mike Tollstrup, Chief
Project Assessment Branch
Stationary Source Division
California Air Resources Board
PO Box 2815
Sacramento, CA 95812-2815

**Re: Notice of Final Determination of Compliance (FDOC)**
**Project Number: C-1100751 – Avenal Power Center LLC (08-AFC-01)**

Dear Mr. Tollstrup:

Enclosed is the District's Final Determination of Compliance (FDOC) for the installation of a nominal 600 MW combined cycle power plant, located at NE¼ Section 19, T21S, R18E – Mount Diablo Base Meridian on Assessor's Parcel Number 36-170-035 in Avenal, CA.

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Thank you for your cooperation in this matter. If you have any questions, please contact Mr. Jim Swaney of the Permit Services Division at (559) 230-5900.

Sincerely,

David Warner
Director of Permit Services

DW:df

Enclosures

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Executive Director/Air Pollution Control Officer

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San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

HEALTHY AIR LIVING™

DEC 17 2010

Gerardo C. Rios (AIR 3)
Chief, Permits Office
Air Division
U.S. E.P.A. - Region IX
75 Hawthorne Street
San Francisco, CA 94105

**Re: Notice of Final Determination of Compliance (FDOC)**
**Project Number: C-1100751 – Avenal Power Center LLC (08-AFC-01)**

Dear Mr. Rios:

Enclosed is the District's Final Determination of Compliance (FDOC) for the installation of a nominal 600 MW combined cycle power plant, located at NE¼ Section 19, T21S, R18E – Mount Diablo Base Meridian on Assessor's Parcel Number 36-170-035 in Avenal, CA.

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The changes made to the Preliminary Determination of Compliance (PDOC) were in direct response to comments received from the oversight agencies and other interested parties. It is District practice to require an additional 30-day comment period for a project if changes received during the initial 30-day comment period result in a significant emissions increase that affects or modifies the original basis for approval. The changes made were minor and did not increase permitted emission levels or trigger additional public notification requirements. Therefore, publication of the PDOC for an additional 30-day comment period is not required.

Thank you for your cooperation in this matter. If you have any questions, please contact Mr. Jim Swaney of the Permit Services Division at (559) 230-5900.

Sincerely,

David Warner
Director of Permit Services

DW:df

Enclosures

**Seyed Sadredin**
Executive Director/Air Pollution Control Officer

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San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

HEALTHY AIR LIVING™

DEC 17 2010

Joseph Douglas
Project Manager
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814

**Re: Notice of Final Determination of Compliance (FDOC)**
**Project Number: C-1100751 – Avenal Power Center LLC (08-AFC-01)**

Dear Mr. Douglas:

Enclosed is the District's Final Determination of Compliance (FDOC) for the installation of a nominal 600 MW combined cycle power plant, located at NE¼ Section 19, T21S, R18E – Mount Diablo Base Meridian on Assessor's Parcel Number 36-170-035 in Avenal, CA.

Notice of the District's preliminary decision was published on July 27, 2010. All comments received following the District's preliminary decision on this project were considered. A summary of the comments received and the District responses to those comments can be found in Attachments J, K, L, and M of the enclosed FDOC package.

The changes made to the Preliminary Determination of Compliance (PDOC) were in direct response to comments received from the oversight agencies and other interested parties. It is District practice to require an additional 30-day comment period for a project if changes received during the initial 30-day comment period result in a significant emissions increase that affects or modifies the original basis for approval. The changes made were minor and did not significantly increase permitted emission levels or trigger additional public notification requirements. Therefore, publication of the PDOC for an additional 30-day comment period is not required.

Thank you for your cooperation in this matter. If you have any questions, please contact Mr. Jim Swaney of the Permit Services Division at (559) 230-5900.

Sincerely,

David Warner
Director of Permit Services

DW:df

Enclosures

**Seyed Sadredin**
Executive Director/Air Pollution Control Officer

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4800 Enterprise Way
Modesto, CA 95356-8718
Tel: (209) 557-6400 FAX: (209) 557-6475

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Fresno, CA 93726-0244
Tel: (559) 230-6000 FAX: (559) 230-6061

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Tel: 661-392-5500 FAX: 661-392-5585

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Fresno Bee

**NOTICE OF FINAL DETERMINATION OF COMPLIANCE**

NOTICE IS HEREBY GIVEN that the San Joaquin Valley Unified Air Pollution Control District has issued a Final Determination of Compliance (FDOC) to Avenal Power Center LLC for the installation of a nominal 600 MW combined cycle power plant, located at NE¼ Section 19, T21S, R18E – Mount Diablo Base Meridian on Assessor's Parcel Number 36-170-035 in Avenal, CA.

All comments received following the District's preliminary decision on this project were considered. Changes were made to the DOC in direct response to comments received from the oversight agencies and other interested parties. The changes made were minor and did not increase permitted emission levels or trigger additional public notification requirements.

The application review for project C-1100751 is available for public inspection at http://www.valleyair.org/notices/public_notices_idx.htm and the **SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT, 1990 EAST GETTYSBURG AVENUE, FRESNO, CA 93726.**

# FINAL DETERMINATION OF COMPLIANCE EVALUATION

**Avenal Power Center Project**
**California Energy Commission**
**Application for Certification Docket #: 08-AFC-01**

| | |
|---|---|
| **Facility Name:** | Avenal Power Center, LLC |
| **Mailing Address:** | 500 Dallas Street, Level 31<br>Houston, TX 77002 |
| **Contact Name:** | Jim Rexroad |
| **Telephone:** | (713) 275-6147 |
| **Fax:** | (713) 275-6115 |
| **Cell:** | (832) 748-1060 |
| **E-Mail:** | jim.Rexroad@macquarie.com |
| **Alternate Contact:** | Eric Walther |
| **Telephone:** | (916) 444-6666 |
| **Fax:** | (916) 444-8373 |
| **Cell:** | (916) 883-8774 |
| **E-Mail:** | ewalther@sierraresearch.com |
| **Alternate Contact:** | Tracey Gilliland |
| **Telephone:** | (713) 275-6148 |
| **Cell:** | (512) 217-3002 |
| **E-Mail:** | tracey.gilliland@macquarie.com |
| **Engineer:** | Derek Fukuda, Air Quality Engineer |
| **Lead Engineer:** | Joven Refuerzo, Supervising Air Quality Engineer |
| **Project #:** | C-1100751 |
| **Application #'s:** | C-3953-10-1, C-3953-11-1, C-3953-12-1, C-3953-13-1, and C-3953-14-1 |
| **Submitted:** | March 3, 2010 |

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| ATTACHMENT A | - | FDOC Conditions |
| ATTACHMENT B | - | Project Location and Site Plan |
| ATTACHMENT C | - | CTG Commissioning Period Emissions Data |
| ATTACHMENT D | - | CTG Emissions Data |
| ATTACHMENT E | - | SJVAPCD BACT Guidelines 1.1.2, 3.1.4, 3.1.8, and 3.4.2 |
| ATTACHMENT F | - | Top Down BACT Analysis (C-3953-10-1, -11-1, -12-1, -13-1, and –14-1) |
| ATTACHMENT G | - | Health Risk Assessment and Ambient Air Quality Analysis |
| ATTACHMENT H | - | $SO_X$ for $PM_{10}$ Interpollutant Offset Analysis |
| ATTACHMENT I | - | Additional Supplemental Information |
| ATTACHMENT J | - | EPA Comments and District Responses |
| ATTACHMENT K | - | Green Action Comments and District Responses |
| ATTACHMENT L | - | NRDC and CRPE Comments and District Responses |
| ATTACHMENT M | - | Rob Simpson Comments and District Responses |

## I. PROPOSAL:

Avenal Power Center, LLC is seeking approval from the San Joaquin Valley Air Pollution Control District (the "District") for the installation of a "merchant" electrical power generation facility (Avenal Energy Project). The Avenal Energy Project will be a combined-cycle power generation facility consisting of two natural gas-fired combustion turbine generators (CTGs) each with a heat recovery steam generator (HRSG) and a 564 MMBtu/hr duct burner. Also proposed are a 300 MW steam turbine, a 37.4 MMBtu/hr auxiliary boiler, a 288 hp diesel-fired emergency IC engine powering a water pump, a 860 hp natural gas-fired emergency IC engine powering a 550 kW generator and associated facilities. The plant will have a nominal rating of 600 MW.

While Avenal Power Center, LLC has already received a Determination of Compliance for the above described facility, they are now proposing to limit the annual facility wide $NO_X$ emissions from 288,618 lb/year to 198,840 lb/year, and the annual facility wide CO emissions from 1,205,418 lb/year to 197,928 lb/year. The effect of these limits will be two-fold: one, should the facility operate to its full permitted extent, it will have the lowest annual average permitted emissions of $NO_X$ (0.045 lb-NOx/MWh) and CO (0.044 lb-CO/MWh) of any natural gas fired power plant known to the District; and two, the facility will be limited to less than the 100 tons/year major source thresholds of the federal prevention of significant deterioration program.

The Avenal Energy Project is subject to approval by the California Energy Commission (CEC). Pursuant to SJVAPCD Rule 2201, Section 5.8, the Determination of Compliance (DOC) review is functionally equivalent to an Authority to Construct (ATC) review. The Determination of Compliance (DOC) will be issued and submitted to the CEC contingent upon SJVAPCD approval of the project.

The California Energy Commission (CEC) is the lead agency for this project for the requirements of the California Environmental Quality Act (CEQA).

The facility submitted an application to revise their existing DOC issued under Project C-1080386. This revision consists of limiting the annual facility wide $NO_X$ emissions to 198,840 lb/year, and the annual facility wide CO emissions to 197,928 lb/year. The equipment the DOC was issued for in project C-1080386 has not been implemented. All units in this project will be treated as new emissions units.

## II. APPLICABLE RULES:

**Rule 1080** Stack Monitoring (12/17/92)
**Rule 1081** Source Sampling (12/16/93)
**Rule 1100** Equipment Breakdown (12/17/92)
**Rule 2010** Permits Required (12/17/92)
**Rule 2201** New and Modified Stationary Source Review Rule (9/21/06)
**Rule 2520** Federally Mandated Operating Permits (6/21/01)
**Rule 2540** Acid Rain Program (11/13/97)

**Rule 2550** Federally Mandated Preconstruction Review for Major Sources of Air Toxics (6/18/98)

**Rule 4001** New Source Performance Standards (4/14/99)
Subpart Dc - Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units
Subpart GG - Standards of Performance for Stationary Gas Turbines
Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines
Subpart JJJJ -Standards of Performance for Stationary Spark Ignition Internal Combustion Engines
Subpart KKKK – Standards of Performance for Stationary Combustion Turbines

**Rule 4002** National Emissions Standards for Hazardous Air Pollutants (5/20/2004)
Subpart ZZZZ - National Emission Standard for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines

**Rule 4101** Visible Emissions (2/17/05)
**Rule 4102** Nuisance (12/17/92)
**Rule 4201** Particulate Matter Concentration (12/17/92)
**Rule 4202** Particulate Matter Emission Rate (12/17/92)
**Rule 4301** Fuel Burning Equipment (12/17/92)
**Rule 4305** Boilers, Steam Generators and Process Heaters – Phase 2 (8/21/03)
**Rule 4306** Boilers, Steam Generators and Process Heaters – Phase 3 (10/16/08)
**Rule 4351** Boilers, Steam Generators and Process Heaters – Phase 1 (8/21/03)
**Rule 4701** Stationary Internal Combustion Engines – Phase 1 (8/21/03)
**Rule 4702** Stationary Internal Combustion Engines – Phase 2 (1/18/07)
**Rule 4703** Stationary Gas Turbines (9/20/07)
**Rule 4801** Sulfur Compounds (12/17/92)
**Rule 8011** General Requirements (8/19/04)
**Rule 8021** Construction, Demolition, Excavation, Extraction and Other Earthmoving Activities (8/19/04)
**Rule 8031** Bulk Materials (8/19/04)
**Rule 8041** Carryout and Trackout (8/19/04)
**Rule 8051** Open Areas (8/19/04)
**Rule 8061** Paved and Unpaved Roads (8/19/04)
**Rule 8071** Unpaved Vehicle/Equipment Traffic Areas (9/16/04)
**Rule 8081** Agricultural Sources (9/16/04)

**California Environmental Quality Act (CEQA)**

**California Code of Regulations (CCR)**, Section 2423 (Exhaust Emission Standards and Test Procedures, Off-Road Compression-Ignition Engines and Equipment)

**California Health & Safety Code (CH&S)**, Sections 2423 (Exhaust Emission Standards and Test Procedures, Off-Road Compression-Ignition Engines and Equipment) 41700 (Health Risk Analysis), 42301.6 (School Notice), 44300 (Air Toxic "Hot Spots"), and 93115 (Airborne Toxic Control Measure (ATCM) for Stationary Compression-Ignition (CI) Engines)

## III. PROJECT LOCATION:

The proposed equipment will be located within NE¼ Section 19, Township 21 South, Range 18 East – Mount Diablo Base Meridian on Assessor's Parcel Number 36-170-035 (See Attachment B). The closest population center is the residential district of Avenal approximately 6 miles to the southwest. The City of Huron is located approximately 8 miles to the north, and the City of Coalinga is located approximately 16 miles to the west.

The site is located northeast of the city of Avenal, in Kings County. The proposed location is not within 1,000' of a K-12 school.

## IV. PROCESS DESCRIPTION:

**Combined-Cycle Combustion Turbine Generators**
Each natural gas-fired General Electric Frame 7 Model PG7241FA combined-cycle combustion turbine generator (CTG) will be equipped with Dry Low $NO_X$ combustors, a selective catalytic reduction (SCR) system with ammonia injection, an oxidation catalyst, a duct burner, and a heat recovery steam generator (HRSG). Each CTG will drive an electrical generator to produce approximately 180 MW of electricity. The plant will be a "combined-cycle plant," since the gas turbine and a steam turbine both turn electrical generators and produce power.

Each CTG will turn an electrical generator, but will also produce power by directing exhaust heat through its HRSG, which supplies steam to the steam turbine nominally rated at 300 MW, which turns another electrical generator.

Since two HRSGs will feed a single steam turbine generator, this design is referred to as a "two-on-one" configuration.

The CTGs will utilize Dry Low $NO_X$ (DLN) combustors, SCR with ammonia injection, and an oxidation catalyst to achieve the following emission rates:

$NO_X$: 2.0 ppmvd @ 15% $O_2$
VOC: 2.0 ppmvd @ 15% $O_2$
CO: 2.0 ppmvd @ 15% $O_2$
$SO_X$: 0.00282 lb/MMBtu (Hourly and Daily Limits; based on 1.0 gr S/100 dscf)
0.001 lb/MMBtu (Annual average; based on 0.36 gr S/100 dscf))
$PM_{10}$: 0.0048 lb/MMBtu (without duct burner firing)
0.0050 lb/MMBtu (with duct burner firing)

Continuous emissions monitoring systems (CEMs) will sample, analyze, and record $NO_X$, CO, and $O_2$ concentrations in the exhaust gas for each CTG.

**Heat Recovery Steam Generators (HRSGs)**
The HRSGs provide for the transfer of heat from the CTG exhaust gases to condensate and feedwater to produce stream. Each HRSG will be approximately 90 feet high and will have an exhaust stack approximately 145 feet tall by 19 feet in diameter. The size and shape of the

HRSGs are specific to their intended purpose of high efficiency recycling of waste heat from the CTG.

The HRSGs will be multi-pressure, natural-circulation boilers equipped with transition ducts and duct burners. Pressure components of each HRSG include a low pressure (LP) economizer, LP evaporator, LP deaerator/drum, LP superheater, intermediate pressure (IP) economizer, IP evaporator, IP drum, IP superheaters, high pressure (HP) economizer, HP evaporator, HP drum, and HP superheaters and reheaters.

Superheated HP steam is produced in the HRSG and flows to the steam turbine throttle inlet. The exhausted cold reheat steam from the steam turbine is mixed with IP steam from the HRSG and reintroduced into the HRSG through the reheaters. The hot reheat steam flows back from the HRSG into the STG. The LP superheated steam from the HRSG is admitted to the LP condenser. The condensate is pumped from the condenser back to the HRSG by condensate pumps. The condensate is preheated by an HRSG feedwater heater. Boiler feedwater pumps send the feedwater through economizers and into the boiler drums of the HRSG, where steam is produced, thereby completing the steam cycle.

Each HRSG is equipped with a SCR system that uses aqueous ammonia in conjunction with a catalyst bed to reduce $NO_X$ in the CTG exhaust gases. The catalyst bed is contained in a catalyst chamber located within each HRSG. Ammonia is injected upstream of the catalyst bed. The subsequent catalytic reaction converts $NO_X$ to nitrogen and water, resulting in a reduced concentration of $NO_X$ in the exhaust gases exiting the stack.

**Duct Burners**
Duct burners are installed in the HRSG transition duct between the HP superheater and reheat coils. Through the combustion of natural gas, the duct burners heat the CTG exhaust gases to generate additional steam at times when peak power is needed. The duct burners are also used as needed to control the temperature of steam produced by the HRSGs. The duct burners will have a maximum heat input rating of 562 MMBtu/hr on a higher heating value (HHV) basis per HRSG, and are expected to operate no more than 800 hours per year.

**Steam Turbine Generator**
The steam turbine system consists of a 300 MW nominally rated reheat steam turbine generator (STG), governor system, steam admission system, gland steam system, lubricating oil system, including oil coolers and filters and generator coolers. Steam from the HP superheater, reheater and IP superheater sections of the HRSG enters the corresponding sections of the STG as described previously. The steam expands through the turbine blading to drive the steam turbine and its generator. Upon exiting the turbine, the steam enters the deaerating condenser, where it is condensed to water.

**Auxiliary Boiler**
One 37.4 MMBtu/hr Cleaver Brooks Model CBL700-900-200#ST natural gas-fired boiler equipped with an Cleaver Brooks Model ProFire Ultra Low $NO_X$ burner, capable of providing up to 25,000 pounds per hour (lb/hr) of saturated steam. The boiler will be used to provide steam as needed for auxiliary purposes.

**Diesel-Fired Emergency IC Engine Powering a Fire Pump**
Emergency firewater will be provided by three pumps (a jockey pump, a main fire pump, and a back-up fire pump); two powered by electric motors and the other powered by a diesel-fired internal combustion engine. If the jockey pump is unable to maintain a set operating pressure in the piping network, the electric motor-driven fire pump will start automatically. If the electric motor-driven fire pump is unable to maintain a set operating pressure, the diesel engine-driven fire pump will start automatically. The diesel-fired engine will be rated at 288 horsepower. The engine will be limited to no greater than 50 hours per year of non-emergency operation in accordance with the applicant's proposal.

**Natural Gas-Fired Emergency IC Engine Powering an Electrical Generator**
One 860 hp Caterpillar Model G3512LE natural gas-fired IC engine generator set will provide power to the essential service AC system in the event of grid failure or loss of outside power to the plant. This engine will be limited to no greater than 50 hours per year of non-emergency operation in accordance with the applicant's proposal.

## V. EQUIPMENT LISTING:

**C-3953-10-1:** 180 MW NOMINALLY RATED COMBINED-CYCLE POWER GENERATING SYSTEM #1 CONSISTING OF A GENERAL ELECTRIC FRAME 7 MODEL PG7241FA NATURAL GAS-FIRED COMBUSTION TURBINE GENERATOR WITH DRY LOW $NO_X$ COMBUSTOR, A SELECTIVE CATALYTIC REDUCTION (SCR) SYSTEM, AN OXIDATION CATALYST, HEAT RECOVERY STEAM GENERATOR #1 (HRSG) WITH A 562 MMBTU/HR DUCT BURNER AND A 300 MW NOMINALLY RATED STEAM TURBINE SHARED WITH C-3953-11

**C-3953-11-1:** 180 MW NOMINALLY RATED COMBINED-CYCLE POWER GENERATING SYSTEM #2 CONSISTING OF A GENERAL ELECTRIC FRAME 7 MODEL PG7241FA NATURAL GAS-FIRED COMBUSTION TURBINE GENERATOR WITH DRY LOW $NO_X$ COMBUSTOR, A SELECTIVE CATALYTIC REDUCTION (SCR) SYSTEM, AN OXIDATION CATALYST, HEAT RECOVERY STEAM GENERATOR #2 (HRSG) WITH A 562 MMBTU/HR DUCT BURNER AND A 300 MW NOMINALLY RATED STEAM TURBINE SHARED WITH C-3953-10

**C-3953-12-1:** 37.4 MMBTU/HR CLEAVER BROOKS MODEL CBL-700-900-200#ST NATURAL GAS-FIRED BOILER WITH A CLEAVER BROOKS MODEL PROFIRE, OR DISTRICT APPROVED EQUIVALENT, ULTRA LOW NOX BURNER

**C-3953-13-1:** 288 BHP CLARKE MODEL JW6H-UF40 DIESEL-FIRED EMERGENCY IC ENGINE POWERING A FIRE PUMP

**C-3953-14-1:** 860 BHP CATERPILLAR MODEL 3456 NATURAL GAS-FIRED EMERGENCY IC ENGINE POWERING WITH NON-SELECTIVE CATALYTIC REDUCTION (NSCR) POWERING A 500 KW ELECTRICAL GENERATOR

## VI. EMISSION CONTROL TECHNOLOGY EVALUATION:

### i. C-3953-10-1 and C-3953-11-1 (Turbines)

Each CTG will be equipped with a Dry Low $NO_X$ combustor and will exhaust into a Selective Catalytic Reduction [SCR] system with ammonia injection, and a CO catalyst. The use of Dry Low $NO_X$ combustors and a SCR system with ammonia injection can achieve a $NO_X$ emission rate of 2.0 ppmvd @ 15% $O_2$. CO emissions of 2.0 ppmvd @ 15% $O_2$ have been demonstrated with the use of an oxidation catalyst [(1)]. And the use of DLN combustors and good combustion practices can achieve VOC emissions of 2.0 ppmvd @ 15% $O_2$.

Emissions from natural gas-fired turbines include $NO_X$, CO, VOC, $PM_{10}$, and $SO_X$.

$NO_X$ is the major pollutant of concern when combusting natural gas. Virtually all gas turbine $NO_X$ emissions originate as NO. This NO is further oxidized in the exhaust system or later in the atmosphere to form the more stable $NO_2$ molecule. There are two mechanisms by which $NO_X$ is formed in turbine combustors: 1) the oxidation of atmospheric nitrogen found in the combustion air (thermal $NO_X$ and prompt $NO_X$), and 2) the conversion of nitrogen chemically bound in the fuel (fuel $NO_X$).

Thermal $NO_X$ is formed by a series of chemical reactions in which oxygen and nitrogen present in the combustion air dissociate and subsequently react to form oxides of nitrogen. Prompt $NO_X$, a form of thermal $NO_X$, is formed in the proximity of the flame front as intermediate combustion products such as HCN, H, and NH are oxidized to form $NO_X$. Prompt $NO_X$ is formed in both fuel-rich flame zones and dry low $NO_X$ (DLN) combustion zones. The contribution of prompt $NO_X$ to overall $NO_X$ emissions is relatively small in conventional near-stoichiometric combustors, but this contribution is an increasingly significant percentage of overall thermal $NO_X$ emissions in DLN combustors. For this reason prompt $NO_X$ becomes an important consideration for DLN combustor designs, and establishes a minimum $NO_X$ level attainable in lean mixtures.

Fuel $NO_X$ is formed when fuels containing nitrogen are burned. Molecular nitrogen, present as $N_2$ in some natural gas, does not contribute significantly to fuel $NO_X$ formation. With excess air, the degree of fuel $NO_X$ formation is primarily a function of the nitrogen content in the fuel. When compared to thermal $NO_X$, fuel $NO_X$ is not currently a major contributor to overall $NO_X$ emissions from stationary gas turbines firing natural gas.

The level of $NO_X$ formation in a gas turbine, and hence the $NO_X$ emissions, is unique (by design factors) to each gas turbine model and operating mode. The primary factors that determine the amount of $NO_X$ generated are the combustor design, the types of fuel being burned, ambient conditions, operating cycles, and the power output of the turbine.

[1] Based on information supplied by the CTG manufacturer and information contained in the California Air Resources Board's September 1999 Guidance for Power Plant Siting and Best Available Control Technology document.

The design of the combustor is the most important factor influencing the formation of $NO_X$. Design parameters controlling air/fuel ratio and the introduction of cooling air into the combustor strongly influence thermal $NO_X$ formation. Thermal $NO_X$ formation is primarily a function of flame temperature and residence time. The extent of fuel/air mixing prior to combustion also affects $NO_X$ formation. Simultaneous mixing and combustion results in localized fuel-rich zones that yield high flame temperatures in which substantial thermal $NO_X$ production takes place. Injecting water or steam into a conventional combustor provides a heat sink that effectively reduces peak flame temperature, thereby reducing thermal $NO_X$ formation. Premixing air and fuel at a lean ratio approaching the lean flammability limit (approximately 50% excess air) significantly reduces peak flame temperature, resulting in minimum $NO_X$ formation during combustion. This is known as dry low $NO_X$ (DLN) combustion.

Selective Catalytic Reduction systems selectively reduce $NO_X$ emissions by injecting ammonia ($NH_3$) into the exhaust gas stream upstream of a catalyst. Nitrogen oxides, $NH_3$, and $O_2$ react on the surface of the catalyst to form molecular nitrogen ($N_2$) and $H_2O$. SCR is capable of over 90 percent $NO_X$ reduction. Titanium oxide is the SCR catalyst material most commonly used, though vanadium pentoxide, noble metals, or zeolites are also used. The ideal operating temperature for a conventional SCR catalyst is 600 to 750 °F. Exhaust gas temperatures greater than the upper limit (750 °F) will cause $NO_X$ and $NH_3$ to pass through the catalyst unreacted. Ammonia slip will be limited to 10 ppmvd @ 15% $O_2$.

Carbon monoxide is formed during the combustion process due to incomplete oxidation of the carbon contained in the fuel. Carbon monoxide formation can be limited by ensuring complete and efficient combustion of the fuel. High combustion temperatures, adequate excess air and good air/fuel mixing during combustion minimize CO emissions. Therefore, lowering combustion temperatures and staging combustion to limit $NO_X$ formation can result in increased CO emissions.

Post-combustion CO controls, such as oxidizing catalysts can also be used to reduce CO emissions. An oxidation catalyst utilizes a precious metal catalyst bed to convert carbon monoxide (CO) to carbon dioxide ($CO_2$).

Inlet air temperature and density directly affects turbine performance. The hotter and drier the inlet air temperature, the lower the efficiency and capacity of the turbine. Conversely, colder air improves the efficiency and reduces emissions by reducing the amount of fuel required to achieve the required turbine output. The inlet air cooler will allow the turbine to operate in a more efficient manner than it would without it. The increased efficiency will reduce the amount of fuel necessary to achieve the required power output. The reduction in fuel consumption will result in lower combustion contaminant emissions.

The inlet air filter will remove particulate matter from the combustion air stream, reducing the amount of particulate matter emitted.

The lube oil coalescer will result in the merging together of oil mist to form larger droplets. The larger droplets will return to the oil stream instead of being emitted.

**ii. C-3953-12-1 (Boiler)**

Emissions from natural gas-fired boilers include $NO_X$, CO, VOC, $PM_{10}$, and $SO_X$.

$NO_X$ is the major pollutant of concern when burning natural gas. $NO_X$ formation is either due to thermal fixation of atmospheric nitrogen in the combustion air (thermal $NO_X$) or due to conversion of chemically bound nitrogen in the fuel (fuel $NO_X$). Due to the low fuel nitrogen content of natural gas, nearly all $NO_X$ emissions are thermal $NO_X$. Formation of thermal $NO_X$ is affected by four furnace zone factors: (1) nitrogen concentration, (2) oxygen concentration, (3) peak temperature, and (4) time of exposure at peak temperature.

The Cleaver Brooks boiler will control the formation of thermal $NO_X$ with an Cleaver Brooks ultra low $NO_X$ burner. Cleaver Brooks burners reduce $NO_X$ by pre-mixing gaseous fuel and combustion air in a region near the burner exit, at a stoichiometry that minimizes Prompt $NO_X$. This also eliminates the traditional $NO_X$ versus CO tradeoff.

**iii. C-3953-13-1 (Diesel IC engine powering fire water pump)**

The diesel-fired emergency IC engine (fire pump) will be equipped with a turbocharger, an intercooler/aftercooler, and will be fired on very low (0.0015%) sulfur diesel.

The emission control devices/technologies and their effect on diesel engine emissions are detailed below.[2]

The turbocharger reduces the $NO_X$ emission rate from the engine by approximately 10% by increasing the efficiency and promoting more complete burning of the fuel.

The intercooler/aftercooler functions in conjunction with the turbocharger to reduce the inlet air temperature. By reducing the inlet air temperature, the peak combustion temperature is lowered, which reduces the formation of thermal $NO_X$. $NO_X$ emissions are reduced by approximately 15% with this control technology.

The use of low sulfur (0.0015% by weight sulfur maximum) diesel fuel reduces $SO_X$ emissions by approximately 99% from standard diesel fuel.

**iv. C-3953-14-1 (Natural gas IC engine powering electrical generator)**

The natural gas-fired emergency IC engine (generator) will be equipped with an intercooler/aftercooler, lean burn technology, and will be fired on PUC-Regulated natural gas.

The emission control devices/technologies and their effect on natural gas engine emissions are detailed below.

[2] From "Non-catalytic $NO_x$ Control of Stationary Diesel Engines", by Don Koeberlein, CARB.

The intercooler/aftercooler functions in conjunction with the turbocharger to reduce the inlet air temperature. By reducing the inlet air temperature, the peak combustion temperature is lowered, which reduces the formation of thermal $NO_X$. $NO_X$ emissions are reduced by approximately 15% with this control technology.

Lean burn technology increases the volume of air in the combustion process and therefore increases the heat capacity of the mixture. This technology also incorporates improved swirl patterns to promote thorough air/fuel mixing. This in turn lowers the combustion temperature and reduces $NO_X$ formation.

## VII. GENERAL CALCULATIONS:

The facility has proposed to limit the annual facility wide $NO_X$ emission to 198,840 lb/year, and the annual facility wide CO emission to 197,928 lb/year.

All $PM_{10}$ emissions are assumed to be $PM_{2.5}$ emissions.

### i. C-3953-10-1 and C-3953-11-1 (Turbines)

- Heating value of natural gas is 1,013 Btu/scf (per applicant).

- Maximum daily emissions for each CTG for VOC, $PM_{10}$ and $SO_X$ during the commissioning period are estimated assuming twenty-four (24) hours operating while firing at full load.

- The commissioning period will not exceed 408 hours per CTG and the emissions emitted during the commissioning period will accrue towards the maximum annual emissions limit.

- Maximum daily emissions for each CTG for $NO_X$, CO, and VOC are estimated assuming six (6) hours operating in startup and shutdown mode and eighteen (18) hours operating while firing at full load with operation of the duct burner.

- Maximum daily emissions for each CTG for $PM_{10}$, $SO_X$, and $NH_3$ are estimated assuming twenty-four (24) hours operating while firing at full load with the operation of the duct burner.

- Maximum annual emissions for each CTG for VOC are estimated assuming the CTG is operated according to a weekend and weekday hot start scenario. The weekend and weekday hot start scenario results in CTG operation of 547.5 (1.5 hr/hot start x 365 hot start/yr) hours operating in startup and shutdown mode, 800 hours operating while firing at full load with the duct burner, and 6,683 hours operating while firing at full load without the duct burner. This scenario is an estimate of what the projected annual emissions from the unit could be if it was

operated according to that schedule. Since the operational schedule of the power plant is based on electrical demand, these units cannot be held to this specific operational schedule.

- The facility has proposed a facility wide $NO_X$ emission limit of 198,840 lb/year. To determine the validity of this limit, the maximum annual emissions for each CTG for $NO_X$ are estimated assuming the CTG is operated according to a weekend and weekday hot start scenario. The weekend and weekday hot start scenario results in CTG operation of 547.5 (1.5 hr/hot start x 365 hot start/yr) hours operating in startup and shutdown mode, 800 hours operating while firing at full load with the duct burner, and 6,683 hours operating while firing at full load without the duct burner. This scenario is an estimate of what the projected annual emissions from the unit could be if it was operated according to that schedule. Since the operational schedule of the power plant is based on electrical demand, these units cannot be held to this specific operational schedule. The calculated $NO_X$ emissions from an individual turbine operating at this scenario (calculated in Section VII.C.2) is not greater than the proposed facility wide $NO_X$ emission limit; however the $NO_X$ emissions from the operation of both turbines according to this scenario are far greater than the proposed facility wide $NO_X$ emission limit. Therefore, the facility wide limit is a valid limit and the $NO_X$ emissions from the turbines will ultimately be restricted by this limit.

- The facility has proposed a facility wide CO emission limit of 197,928 lb/year. To determine the validity of this limit, the maximum annual emissions for each CTG for CO are estimated assuming the CTG is operated according to a weekend shutdown and weekday hot start scenario. The weekend shutdown and weekday hot start scenario results in CTG operation of 624 ((1.5 hr/hot start x 208 hot start/yr) + (6.0 hr/cold start x 52 cold starts/year)) hours operating in startup and shutdown mode, 800 hours operating while firing at full load with the duct burner, and 3,800 hours operating while firing at full load without the duct burner. This scenario is an estimate of what the projected annual emissions from the unit could be if it was operated according to that schedule. Since the operational schedule of the power plant is based on electrical demand, these units cannot be held to this specific operational schedule. The calculated CO emissions from this scenario (calculated in Section VII.C.2) are greater than the proposed facility wide CO emission limit; therefore the facility wide emissions limit is a valid limit and the turbine's CO emissions will ultimately be restricted by this limit.

- Maximum annual emissions for each CTG for $PM_{10}$, $SO_X$, and $NH_3$ are estimated assuming the CTG is operated according to a baseload scenario. The baseload scenario results in CTG operation of 800 hours operating while firing at full load with the duct burner and 7,960 hours operating while firing at full load without the duct burner.

### ii. C-3953-12-1 (Boiler)

- External $O_2$ stack gas concentration is 3%.
- Natural gas F factor is 8,710 dscf/MMBtu (Ref. 40 CFR Part 60, Appendix A, Method 19).
- Heating value of natural gas is 1,013 Btu/scf (per applicant).
- The applicant is proposing a maximum natural gas usage rate of 37.4 MMBtu/hr.
- Maximum $SO_X$ emission factor determined by performing a mass balance assuming a natural gas sulfur content of 1 gr S/100 scf. Calculation shown below.

  (1 ~~gr S~~/100 ~~dscf~~ x 1 ~~lb S~~/7000 ~~gr~~ x 64 lb $SO_X$/32 ~~lb S~~ x 1 ~~scf~~/1013 ~~Btu~~ x $10^6$ ~~Btu~~/MMBtu)
  = 0.00282 lb/MMBtu

- Maximum daily and annual emissions for all pollutants are estimated assuming twelve (12) hours per day and 1,248 hours per year operating at full load.[3]
- Operating schedule of 12 hr/day and 1,248 hrs/year.

### iii. C-3953-13-1 (Diesel IC engine powering fire water pump)

- Diesel F factor (adjusted to 60 °F) is 9,051 dscf/MMBtu.
- Density of diesel is 7.1 lb/gal.
- Higher heating value of diesel is 137,000 Btu/scf.
- BHP to Btu/hr conversion is 2,542.5 Btu/hp·hr.
- Thermal efficiency of the engine: commonly ≈ 35%.
- Emissions are based on 24 hours per day (maximum emergency use) and 50 hours per year of operation (maximum non-emergency use).

### iv. C-3953–14-1 (Natural gas IC engine powering electrical generator)

- EPA F-factor (adjusted to 60 °F) is 8,578 dscf/MMBtu (40 CFR 60 Appendix B)
- Fuel heating value 1,013 Btu/dscf (per applicant)
- Maximum daily $SO_X$ emission factor determined by performing a mass balance assuming a natural gas sulfur content of 1 gr S/100 scf. Calculation shown below.

  (1 ~~gr S~~/100 ~~dscf~~ x 1 ~~lb S~~/7000 ~~gr~~ x 64 lb $SO_X$/32 ~~lb S~~ x 1 ~~scf~~/1013 ~~Btu~~ x $10^6$ ~~Btu~~/MMBtu)
  = 0.00282 lb/MMBtu

- BHP to Btu/hr conversion is 2,542.5 Btu/hp·hr.
- Thermal efficiency of the engine: commonly ≈ 35%.
- Emissions are based on 24 hours per day (maximum emergency use) and 50 hours per year of operation (maximum non-emergency use).

[3] Applicant has indicated that the unit will be used a maximum of 12 hours on a startup day.

## B. Emission Factors

### i. C-3953-10-1 and C-3953-11-1 (Turbines)

The maximum air contaminant mass emission rates (lb/hr) during the commissioning period estimated by the facility (see Attachment C) for the proposed CTGs are summarized below:

| Commissioning Period Emissions | | | | | |
|---|---|---|---|---|---|
| | $NO_X$ | CO | VOC | $PM_{10}$ | $SO_X$ |
| Mass Emission Rate (per turbine, lb/hr) | 160 | 1,000 | 16 | N/A[5] | N/A[4] |

The maximum air contaminant mass emission rates (lb/hr) with and without duct burner firing, concentrations (ppmvd @ 15% $O_2$), and startup and shutdown emissions rates (lb/hr) provided by the applicant (see Attachment D for applicant proposed emissions) for the proposed CTGs are summarized below.

The emission rates from the turbines and duct burners are calculated below:

**Maximum Emission Rate Without Duct Burner Firing:**

The worst-case $NO_X$, $PM_{10}$, CO, VOC, and $NH_3$ mass emission rates are when each turbine operates at 100% load and an ambient air inlet temperature of 32 °F. The worst-case $SO_X$ mass emission rate will be determined assuming a natural gas sulfur content of 1 gr S/100 scf. The following equation will be used to calculate the emission rate of the CTG without the duct burner firing:

Emission Rate (lb/hr) = CTG Max Heat Input (MMBtu/hr) x Emission Factor (lb/MMBtu)

$NO_X$ Emission Rate (lb/hr) = (1,856.3 MMBtu/hr) x (0.0073 lb-$NO_X$/MMBtu)
**= 13.55 lb-$NO_X$/hr**

CO Emission Rate (lb/hr) = (1,856.3 MMBtu/hr) x (0.0045 lb-CO/MMBtu)
**= 8.35 lb-CO/hr**

VOC Emission Rate (lb/hr) = (1,856.3 MMBtu/hr) x (0.0018 lb-VOC/MMBtu)
**= 3.34 lb-VOC/hr**

$PM_{10}$ Emission Rate (lb/hr) = (1,856.3 MMBtu/hr) x (0.0048 lb-$PM_{10}$/MMBtu)
**= 8.91 lb-$PM_{10}$/hr**

[4] $PM_{10}$ and $SO_X$ emissions during commissioning period are equal to the maximum hourly emissions during baseload facility operation.

$SO_X$ Emission Rate (lb/hr) = (1,856.3 MMBtu/hr) x (0.00282 lb-$SO_X$/MMBtu)
**= 5.23 lb-$SO_X$/hr**

NH3 Emission Rate (lb/hr) = ppm x MW x ($2.64\times10^{-9}$) x ff x HV x FL x [20.9 / (20.9 – $O_2$%)]

Where:
ppm is the emission concentration in ppmvd @ 15% $O_2$ (10 ppmv)
MW is the molecular weight of the pollutant: ($MW_{NH3}$ = 17 lb/lb-mol)
$2.64 \times 10^{-9}$ is one over the molar specific volume (lb-mol/MMscf, at 60 °F)
ff is the F-factor for natural gas: (8,578 scf/MMBtu, at 60 °F)
HV is the heating value of natural gas: (1,013 Btu/scf)
FL is the amount of natural gas each turbine can burn in any given hour: (CTG w/o duct burner 1.832 MMscf/hour, as calculated below)
(1,856.3 MMBtu/hr) ÷ (1,013 MMBtu/MMscf) = 1.832 MMscf/hr
$O_2$ is the stack oxygen content to which the emission concentrations are corrected: (15%)

$NH_3$ Emission Rate (lb/hr) = 10 x 17 x ($2.64\times10^{-9}$) (lb-mol/MMscf) x 8,578 (scf/MMBtu) x 1,013 (Btu/scf) x 1.832 (MMscf/hr) x [20.9 / (20.9 – 15.0)]
**= 25.31 lb-NH3/hr**

| **Maximum Emission Rates and Concentrations Without Duct Burner Firing (@ 100% Load & 32 °F)** | | | | | | |
|---|---|---|---|---|---|---|
| | $NO_X$ | CO | VOC | $PM_{10}$ | $SO_X$ | $NH_3$ |
| Mass Emission Rates (per turbine, lb/hr) | 13.55 | 8.35 | 3.34 | 8.91 | 5.23 | 25.31 |
| ppmvd @ 15% $O_2$ limits | 2.0 | 2.0 | 1.4 | -- | -- | 10.0 |
| lb/MMBtu* | 0.0073 | 0.0045 | 0.0018 | 0.0048 | 0.00282 | -- |

* Emission factors were taken from Table 6.2-1.1 in the DOC application submittal.

**Maximum Emission Rate With Duct Burner Firing:**

The worst-case $NO_X$, $SO_X$, $PM_{10}$, CO, VOC, and $NH_3$ mass emission rates are when each turbine operates at 100% load and an ambient air inlet temperature of 101 °F. The worst-case $SO_X$ mass emission rate will be determined assuming a natural gas sulfur content of 1 gr S/100 scf. The following equation will be used to calculate the emission rate of the CTG with the duct burner firing:

Emission Rate (lb/hr) = [CTG Max Heat Input + Duct Burner Max Heat Input] (MMBtu/hr) x Emission Factor (lb/MMBtu)

$NO_X$ Emission Rate (lb/hr) = (2,356.5 MMBtu/hr) x (0.0073 lb-$NO_X$/MMBtu)
**= 17.20 lb-$NO_X$/hr**

CO Emission Rate (lb/hr) = (2,356.5 MMBtu/hr) x (0.0045 lb-CO/MMBtu)
**= 10.60 lb-CO/hr**

VOC Emission Rate (lb/hr) = (2,356.5 MMBtu/hr) x (0.0025 lb-VOC/MMBtu)
**= 5.89 lb-VOC/hr**

$PM_{10}$ Emission Rate (lb/hr) = (2,356.5 MMBtu/hr) x (0.0050 lb-$PM_{10}$/MMBtu)
**= 11.78 lb-$PM_{10}$/hr**

$SO_X$ Emission Rate (lb/hr) = (2,356.5 MMBtu/hr) x (0.00282 lb-$SO_X$/MMBtu)
**= 6.65 lb-$SO_X$/hr**

NH3 Emission Rate (lb/hr) = ppm x MW x ($2.64 \times 10^{-9}$) x ff x HV x FL x [20.9 / (20.9 – $O_2$%)]

Where:
ppm is the emission concentration in ppmvd @ 15% $O_2$ (10 ppmv)
MW is the molecular weight of the pollutant: ($MW_{NH3}$ = 17 lb/lb-mol)
$2.64 \times 10^{-9}$ is one over the molar specific volume (lb-mol/MMscf, at 60 °F)
ff is the F-factor for natural gas: (8,578 scf/MMBtu, at 60 °F)
HV is the heating value of natural gas: (1,013 Btu/scf)
FL is the amount of natural gas each turbine can burn in any given hour: (CTG w duct burner 2.326 MMscf/hour, as calculated below)
(2,356.5 MMBtu/hr) ÷ (1,013 MMBtu/MMscf) = 2.326 MMscf/hr
$O_2$ is the stack oxygen content to which the emission concentrations are corrected: (15%)

$NH_3$ Emission Rate (lb/hr) = 10 x 17 x ($2.64 \times 10^{-9}$) (lb-mol/MMscf) x 8,578 (scf/MMBtu) x 1,013 (Btu/scf) x 2.326 (MMscf/hr) x [20.9 / (20.9 – 15.0)]
**= 32.13 lb-NH3/hr**

| **Maximum Emission Rates and Concentrations With Duct Burner Firing (@ 100% Load & 101 °F)** | | | | | | |
|---|---|---|---|---|---|---|
| | $NO_X$ | CO | VOC | $PM_{10}$ | $SO_X$ | $NH_3$ |
| Mass Emission Rates (per turbine, lb/hr) | 17.20 | 10.60 | 5.89 | 11.78 | 6.65 | 32.13 |
| ppmvd @ 15% $O_2$ limits | 2.0 | 2.0 | 2.0 | -- | -- | 10.0 |
| lb/MMBtu* | 0.0074 | 0.0045 | 0.0025 | 0.0050 | 0.00282 | -- |

* Emission factors were taken from Table 6.2-1.1 in the DOC application submittal.

| Startup and Shutdown Emissions | | | | | |
|---|---|---|---|---|---|
| | $NO_X$ | CO | VOC | $PM_{10}$ | $SO_X$ |
| Maximum Mass Emission Rate (per turbine, lb/hr) | 160 | 1,000 | 16 | N/A[6] | N/A[5] |
| Average Mass Emission Rate (per turbine, lb/hr) | 80 | 900 | 16 | N/A[6] | N/A[6] |

### ii. C-3953-12-1 (Boiler)

For the new boiler, the emissions factors for $NO_X$, CO, VOC, and $PM_{10}$ are provided by the applicant. The $SO_X$ emission factor is calculated as shown below.

| Boiler Emission Factors* | | |
|---|---|---|
| Pollutant | ppmv @ 3%$O_2$ | lb/MMBtu |
| $NO_X$ | 9.0 | 0.011 |
| CO | 50.0 | 0.037 |
| VOC | 10.0 | 0.0043 |
| $PM_{10}$ | -- | 0.005 |
| $SO_X$** | -- | 0.00282 |

*Note: lb/MMBtu equivalent of ppmv values @ 3% $O_2$ as provided by the Applicant
** $SO_X$ emission factor based on the maximum proposed sulfur content of 1 gr/100 dscf.

(1 ~~gr S~~/100 ~~dscf~~ x 1 ~~lb S~~/7000 ~~gr~~ x 64 lb $SO_X$/32 ~~lb S~~ x 1 ~~scf~~/1013 ~~Btu~~ x $10^6$ ~~Btu~~/MMBtu)
= 0.00282 lb/MMBtu

### iii. C-3953-13-1 (Diesel IC engine powering fire water pump)

For the new emergency diesel-fired IC engine powering a fire water pump, the emissions factors for $NO_X$, CO, VOC, and $PM_{10}$ are provided by the applicant and are guaranteed by the engine manufacturer. The $SO_X$ emission factor is calculated using the sulfur content in the diesel fuel (0.0015% sulfur).

| Diesel-fired IC Engine Emission Factors | | |
|---|---|---|
| | g/hp·hr | Source |
| $NO_X$ | 3.4 | Engine Manufacturer |
| CO | 0.447 | Engine Manufacturer |
| VOC | 0.38 | Engine Manufacturer |
| $PM_{10}$ | 0.059 | Engine Manufacturer |
| *$SO_X$ | 0.005 | Mass Balance Equation Below |

[5] $PM_{10}$ and $SO_X$ emissions during startups and shutdowns are lower than maximum hourly emissions during baseload facility operation.

$$*0.0015\% \times \frac{7.1\,lb \cdot fuel}{gallon} \times \frac{2\,lb \cdot SO_2}{1\,lb \cdot S} \times \frac{1\,gal}{137{,}000\,Btu} \times \frac{1\,hp\,input}{0.35\,hp\,out} \times \frac{2{,}542.5\,Btu}{hp \cdot hr} \times \frac{453.6\,g}{lb} = 0.005\,\frac{g\,SOx}{hp \cdot hr}$$

### iv. C-3953-14-1 (Natural gas IC engine powering electrical generator)

For the new emergency natural gas-fired IC engine powering an electrical generator, the emissions factors for $NO_X$, CO, VOC, and $PM_{10}$ are provided by the applicant and are guaranteed by the engine manufacturer. The $SO_X$ emission factor is calculated using the fuel sulfur content from District Policy APR 1720.

| Natural Gas-fired IC Engine Emission Factors | | |
|---|---|---|
| | g/hp·hr | Source |
| $NO_X$ | 1.0 | Engine Manufacturer |
| CO | 0.6 | Engine Manufacturer |
| VOC | 0.33 | Engine Manufacturer |
| $PM_{10}$ | 0.034 | Engine Manufacturer |
| **$SO_X$ | 0.0094 | Mass Balance Equation Below |

**$SO_X$ is calculated as follows:

$$0.00285\ \frac{lb - SO_x}{MMBtu} \times \frac{1\,MMBtu}{1{,}000{,}000\,Btu} \times \frac{2{,}542.5\,Btu}{bhp - hr} \times \frac{1\,bhp\,input}{0.35\,bhp\,out} \times \frac{453.6\,g}{lb} = 0.0094\ \frac{g - SO_x}{bhp - hr}$$

## C. Calculations

### 1. Pre-Project Potential to Emit (PE1)

Section 3.26 of Rule 2201 defines the potential to emit (PE) as the maximum capacity of an emissions unit to emit a pollutant under its physical and operational design. Since this is a brand new facility, the pre-project potential to emit (PE1) for all the emissions units associated with this project is equal to zero.

### 2. Post Project Potential to Emit (PE2):

### i. C-3953-10-1 and C-3953-11-1 (Turbines)

#### *a. Maximum Hourly PE*

The maximum hourly potential to emit for $NO_X$, CO, and VOC from each CTG will occur when the unit is operating under start-up mode. The maximum hourly PE for both turbines operating together is when both are starting up and firing their duct burners.

The combined startup NOx emissions from the two turbines will be limited to 240 lbs/hr [maximum startup emission rate (160 lbs/hr) + average startup emission rate (80 lbs/hr)]. Similarly, the combined startup CO emissions from the two turbines will be limited to 1,902 lbs/hr, [maximum startup emission rate (1,000 lbs/hr) + average startup emission rate (902 lbs/hr)].

The maximum hourly emissions are summarized in the table below:

| **Maximum Hourly Potential to Emit** | | | | | |
|---|---|---|---|---|---|
| | Maximum Startup/Shutdown Emissions (lb/hr) | Turbine w/ Duct Burner Emissions Rate | Turbine #1 Emissions (lb/hr) | Turbine #2 Emissions (lb/hr) | Maximum Hourly Emissions for Both Turbines |
| $NO_X$ | 160 | 17.20 | 13.55 | 13.55 | 240.00 |
| CO | 1,000 | 10.60 | 8.35 | 8.35 | 1,902.00 |
| VOC | 16 | 5.89 | 3.34 | 3.34 | 32.00 |
| $PM_{10}$ | N/A[6] | 11.78 | 8.91 | 8.91 | 23.56 |
| $SO_X$ | N/A[7] | 6.65 | 5.23 | 5.23 | 13.30 |
| $NH_3$ | N/A | 32.13 | 25.31 | 25.31 | 64.26 |

### *b. Maximum Daily PE*

Maximum daily emissions for $NO_X$, CO, and VOC occurs when each CTG undergoes six (6) hours operating in startup or shutdown mode, and eighteen (18) hours operating with duct burner firing at full load. The startup and shutdown emissions for $PM_{10}$, $SO_X$, and NH3 are will be lower or equivalent to the emissions rate when the unit is fired at 100% load; therefore the maximum daily emissions for $PM_{10}$, $SO_X$, and NH3 occurs when each CTG is operated for twenty four (24) hours with duct burner firing at full load. The results are summarized in the table below:

| **Maximum Daily Potential to Emit (w/ Startup and Shutdown)** | | | | |
|---|---|---|---|---|
| | Average Startup/Shutdown Emissions Rate | Emissions Rate @ 100% Load with duct burner (101° F) | Emissions Rate @ 100% Load without duct burner (32° F) | DEL (per CTG) |
| $NO_X$ | 80 lb/hr (avg) | 17.20 lb/hr | 13.03 lb/hr | 789.6 lb/day |
| CO | 900 lb/hr (avg) | 10.60 lb/hr | 8.35 lb/hr | 5,590.8 lb/day |
| VOC | 16 lb/hr (avg) | 5.89 lb/hr | 3.34 lb/hr | 202.0 lb/day |
| $PM_{10}$ | N/A[7] | 11.78 lb/hr | 8.91 lb/hr | 282.7 lb/day |
| $SO_X$ | N/A[7] | 6.65 lb/hr | 5.23 lb/hr | 159.6 lb/day |
| $NH_3$ | N/A | 32.13 lb/hr | 25.31 lb/hr | 771.1 lb/day |

[6] $PM_{10}$ and $SO_X$ emissions during startups and shutdowns are lower than maximum hourly emissions.

### *c. Maximum Annual PE*

The facility has indicated that the turbines will be operated in one of three different scenarios: weekend and weekday hot start scenario, weekend shutdown and weekday hot start scenario, and baseload scenario. The $SO_X$ emission factors used to calculate the annual potential emissions will be based on the applicant proposed average natural gas sulfur limit 0.36 gr/100 dscf.

$SO_X$ EF = (0.36 ~~gr S~~/100 ~~dscf~~) x (1 ~~lb S~~/7000 ~~gr~~) x (64 lb $SO_X$/32 ~~lb S~~) x (1 ~~scf~~/1013 ~~Btu~~) x ($10^6$ ~~Btu~~/MMBtu)
**= 0.001 lb-$SO_X$/MMBtu**

CTG w/o Duct Burner Firing:
$SO_X$ Emission Rate (lb/hr) = (1,856.3 MMBtu/hr) x (0.001 lb-$SO_X$/MMBtu)
**= 1.86 lb-$SO_X$/hr**

CTG w/ Duct Burner Firing:
$SO_X$ Emission Rate (lb/hr) = (2,356.5 MMBtu/hr) x (0.001 lb-$SO_X$/MMBtu)
**= 2.36 lb-$SO_X$/hr**

Potential annual emissions for each pollutant will be calculated for each of the three scenarios in the tables below:

**Scenario 1) Weekend and Weekday Hot Start:**

547.5 (1.5 hr/hot start x 365 hot start/yr) hours operating in startup and shutdown mode, 800 hours operating while firing at full load with the duct burner, and 6,683 hours operating while firing at full load without the duct burner. Since startup and shutdown emission rates for $PM_{10}$, $SO_X$, and NH3 are less than the emission rate when the CTG is fired at 100% load w/o the duct burner, the startup and shutdown emission rates will be assumed to be equivalent to the CTG fired at 100% load w/o the duct burner. Since the CTGs will be fired throughout the year, the emission factors for the unit when fired at the average ambient temperature (63° F) will be used to calculate the potential annual emissions.

| Annual Potential to Emit<br>Scenario 1) Weekend and Weekday Hot Start* | | | | |
|---|---|---|---|---|
| | Average Startup/Shutdown Emissions Rate | Emissions Rate @ 100% Load with duct burner (63° F) | Emissions Rate @ 100% Load without duct burner (63° F) | Annual PE (per CTG)) |
| $NO_X$ | 80 lb/hr (avg) | 16.34 lb/hr | 13.03 lb/hr | **143,951 lb/year** |
| CO | 900 lb/hr (avg) | 10.60 lb/hr | 8.35 lb/hr | 557,033 lb/year |
| VOC | 16 lb/hr (avg) | 5.68 lb/hr | 3.17 lb/hr | **34,489 lb/year** |
| $PM_{10}$ | N/A(7) | 11.27 lb/hr | 9.00 lb/hr | 74,091 lb/year |
| $SO_X$ | N/A(7) | 2.36 lb/hr | 1.86 lb/hr | 15,337 lb/year |
| $NH_3$ | N/A | 32.13 lb/hr | 25.31 lb/hr | 208,708 lb/year |

* Emission factors were taken from Table 6.2-1.1 in the DOC application submittal.

**Scenario 2) Weekend Shutdown and Weekday Hot Start:**

624 ((1.5 hr/hot start x 208 hot start/yr) + (6.0 hr/cold start x 52 cold starts/year)) hours operating in startup and shutdown mode, 800 hours operating while firing at full load with the duct burner, and 3,800 hours operating while firing at full load without the duct burner. Since startup and shutdown emission rates for $PM_{10}$, $SO_X$, and NH3 are less than the emission rate when the CTG is fired at 100% load w/o the duct burner, the startup and shutdown emission rates will be assumed to be equivalent to the CTG fired at 100% load w/o the duct burner. Since the CTGs will be fired throughout the year, the emission factors for the unit when fired at the average ambient temperature (63° F) will be used to calculate the potential annual emissions.

| Annual Potential to Emit<br>Scenario 2) Weekend Shutdown and Weekday Hot Start* | | | | |
|---|---|---|---|---|
| | Average Startup/Shutdown Emissions Rate | Emissions Rate @ 100% Load with duct burner (63° F) | Emissions Rate @ 100% Load without duct burner (63° F) | Annual PE (per CTG) |
| $NO_X$ | 80 lb/hr (avg) | 16.34 lb/hr | 13.03 lb/hr | 112,506 lb/year |
| CO | 900 lb/hr (avg) | 10.60 lb/hr | 8.35 lb/hr | 601,810 lb/year |
| VOC | 16 lb/hr (avg) | 5.68 lb/hr | 3.17 lb/hr | 26,574 lb/year |
| $PM_{10}$ | N/A(7) | 11.27 lb/hr | 9.00 lb/hr | 48,832 lb/year |
| $SO_X$ | N/A(7) | 2.36 lb/hr | 1.86 lb/hr | 10,117 lb/year |
| $NH_3$ | N/A | 32.13 lb/hr | 25.31 lb/hr | 137,675 lb/year |

* Emission factors were taken from Table 6.2-1.1 in the DOC application submittal.

**Scenario 3) Baseload:**

800 hours operating while firing at full load with the duct burner, and 7,960 hours operating while firing at full load without the duct burner. Since the CTGs will be fired throughout the year, the emission factors for the unit when fired at the average ambient temperature (63° F) will be used to calculate the potential annual emissions.

| **Annual Potential to Emit Baseload Scenario*** | | | | |
|---|---|---|---|---|
| | Average Startup/Shutdown Emissions Rate | Emissions Rate @ 100% Load with duct burner (63° F) | Emissions Rate @ 100% Load without duct burner (63° F) | Annual PE (per CTG) |
| $NO_X$ | 80 lb/hr (avg) | 16.34 lb/hr | 13.03 lb/hr | 116,791 lb/year |
| CO | 900 lb/hr (avg) | 10.60 lb/hr | 8.35 lb/hr | 74,946 lb/year |
| VOC | 16 lb/hr (avg) | 5.68 lb/hr | 3.17 lb/hr | 29,777 lb/year |
| $PM_{10}$ | N/A[7] | 11.27 lb/hr | 9.00 lb/hr | **80,656 lb/year** |
| $SO_X$ | N/A[7] | 2.36 lb/hr | 1.86 lb/hr | **16,694 lb/year** |
| $NH_3$ | N/A | 32.13 lb/hr | 25.31 lb/hr | **219,972 lb/year** |

* Emission factors were taken from Table 6.2-1.1 in the DOC application submittal.

**Maximum Annual Potential to Emit:**

The highest annual potential emissions, for each pollutant, from the three different scenarios will be taken to determine the maximum annual potential to emit for the CTG. The results are summarized in the table below:

| **Maximum Annual Potential to Emit** | | |
|---|---|---|
| | Annual PE (per CTG) | Scenario |
| $NO_X$ | 143,951 lb/year | Scenario 1 |
| CO | 197,928 lb/year | Facility Wide Limit |
| VOC | 34,489 lb/year | Scenario 2 |
| $PM_{10}$ | 80,656 lb/year | Scenario 3 |
| $SO_X$ | 16,694 lb/year | Scenario 3 |
| $NH_3$ | 219,972 lb/year | Scenario 3 |

### *d. Maximum Quarterly PE*

Maximum quarterly emissions for each unit will be determined by dividing the maximum annual emissions into 4 quarters:

| Maximum Quarterly Potential to Emit | | | | | | |
|---|---|---|---|---|---|---|
| | $NO_X$ | CO | VOC | $PM_{10}$ | $SO_X$ | $NH_3$ |
| 1st Quarter | 35,987.75 | 49,482 | 8,622.25 | 20,164 | 4,173.5 | 54,993 |
| 2nd Quarter | 35,987.75 | 49,482 | 8,622.25 | 20,164 | 4,173.5 | 54,993 |
| 3rd Quarter | 35,987.75 | 49,482 | 8,622.25 | 20,164 | 4,173.5 | 54,993 |
| 4th Quarter | 35,987.75 | 49,482 | 8,622.25 | 20,164 | 4,173.5 | 54,993 |

### ii. C-3953-12-1 (Boiler)

The potential to emit for the boiler is calculated as follows, and summarized in the table below.

$PE_{NOx}$ = (0.011 lb/MMBtu) * (37.4 MMBtu/hr)
= **0.41 lb $NO_X$/hr**

= (0.011 lb/MMBtu) * (37.4 MMBtu/hr) * (12 hr/day)
= **4.9 lb $NO_X$/day**

= (0.011 lb/MMBtu) * (37.4 MMBtu/hr) * (1,248 hr/year)
= **513 lb $NO_X$/year**

= (513 lb $NO_X$/year) ÷ (4 qtr/year)
= **128 lb $NO_X$/qtr**

$PE_{CO}$ = (0.037 lb/MMBtu) * (37.4 MMBtu/hr)
= **1.38 lb CO/hr**

= (0.037 lb/MMBtu) * (37.4 MMBtu/hr) * (12 hr/day)
= **16.6 lb CO/day**

= (0.037 lb/MMBtu) * (37.4 MMBtu/hr) * (1,248 hr/year)
= **1,727 lb CO/year**

= (1,727 lb CO/year) * (4 qtr/year)
= **432 lb CO/qtr**

$PE_{VOC}$ = (0.0043 lb/MMBtu) * (37.4 MMBtu/hr)
= **0.16 lb VOC/hr**

= (0.0043 lb/MMBtu) * (37.4 MMBtu/hr) * (12 hr/day)
= **1.9 lb VOC/day**

= (0.0043 lb/MMBtu) * (37.4 MMBtu/hr) * (1,248 hr/year)
= **201 lb VOC/year**

= (201 lb/year) * (4 qtr/year)
= **50 lb VOC/qtr**

$PE_{PM10}$ = (0.005 lb/MMBtu) * (37.4 MMBtu/hr)
= **0.19 lb $PM_{10}$/hr**

= (0.005 lb/MMBtu) * (37.4 MMBtu/hr) * (12 hr/day)
= **2.2 lb $PM_{10}$/day**

= (0.005 lb/MMBtu) * (37.4 MMBtu/hr) * (1,248 hr/year)
= **233 lb $PM_{10}$/year**

= (233 lb/year) * (4 qtr/year)
= **58 lb $PM_{10}$/qtr**

$PE_{SOx}$ = (0.00282 lb/MMBtu) * (37.4 MMBtu/hr)
= **0.11 lb $SO_X$/hr**

= (0.00282 lb/MMBtu) * (37.4 MMBtu/hr) * (12 hr/day)
= **1.3 lb $SO_X$/day**

= (0.00282 lb/MMBtu) * (37.4 MMBtu/hr) * (1,248 hr/year)
= **132 lb $SO_X$/year**

= (132 lb/year) * (4 qtr/year)
= **33 lb $SO_X$/qtr**

| **Post Project Potential to Emit (PE2) (C-3953-12-1)** | | | | |
|---|---|---|---|---|
| | Hourly Emissions (lb/hr) | Daily Emissions (lb/day) | Quarterly Emissions (lb/qtr) | Annual Emissions (lb/year) |
| $NO_X$ | 0.41 | 4.9 | 128 | 513 |
| CO | 1.38 | 16.6 | 432 | 1,727 |
| VOC | 0.16 | 1.9 | 50 | 201 |
| $PM_{10}$ | 0.19 | 2.2 | 58 | 233 |
| $SO_X$ | 0.11 | 1.3 | 33 | 132 |

**iii. C-3953-13-1 (Diesel IC engine powering fire water pump)**

The emissions for the emergency fire pump engine is calculated as follows, and summarized in the table below:

$PE_{NOx}$ = (3.4 g/hp·hr) * (288 hp) ÷ (453.6 g/lb)
= **2.16 lb $NO_X$/hr**

= (3.4 g/hp·hr) * (288 hp) ÷ (453.6 g/lb) * (24 hr/day)
= **51.8 lb $NO_X$/day**

= (3.4 g/hp·hr) * (288 hp) ÷ (453.6 g/lb) * (12.5 hr/qtr)
= **27 lb $NO_X$/qtr**

= (3.4 g/hp·hr) * (288 hp) ÷ (453.6 g/lb) * (50 hr/year)
= **108 lb $NO_X$/year**

$PE_{CO}$ = (0.447 g/hp·hr) * (288 hp) ÷ (453.6 g/lb)
= **0.28 lb CO/hr**

= (0.447 g/hp·hr) * (288 hp) ÷ (453.6 g/lb * (24 hr/day)
= **6.8 lb CO/day**

= (0.447 g/hp·hr) * (288 hp) ÷ (453.6 g/lb) * (12.5 hr/qtr)
= **4 lb CO/qtr**

= (0.447 g/hp·hr) * (288 hp) ÷ (453.6 g/lb) * (50 hr/year)
= **14 lb CO/year**

$PE_{VOC}$ = (0.38 g/hp·hr) * (288 hp) ÷ (453.6 g/lb)
= **0.24 lb VOC/hr**

= (0.38 g/hp·hr) * (288 hp) ÷ (453.6 g/lb) * (24 hr/day)
= **5.8 lb VOC/day**

= (0.38 g/hp·hr) * (288 hp) ÷ (453.6 g/lb) * (12.5 hr/qtr)
= **3 lb VOC/qtr**

= (0.38 g/hp·hr) * (288 hp) ÷ (453.6 g/lb) * (50 hr/year)
= **12 lb VOC/year**

$PE_{PM10}$ = (0.059 g/hp·hr) * (288 hp) ÷ (453.6 g/lb)
= **0.04 lb $PM_{10}$/hr**

= (0.059 g/hp·hr) * (288 hp) ÷ (453.6 g/lb) * (24 hr/day)
= **0.9 lb $PM_{10}$/day**

= (0.059 g/hp·hr) * (288 hp) ÷ (453.6 g/lb) * (12.5 hr/qtr)
= **0.5 lb $PM_{10}$/qtr**

= (0.059 g/hp·hr) * (288 hp) ÷ (453.6 g/lb) * (50 hr/year)
= **1.9 lb $PM_{10}$/year**

$PE_{SOx}$ = (0.005 g/hp·hr) * (288 hp) ÷ (453.6 g/lb)
= **0.00 lb $SO_X$/hr**

= (0.005 g/hp·hr) * (288 hp) ÷ (453.6 g/lb) * (24 hr/day)
= **0.1 lb $SO_X$/day**

= (0.005 g/hp·hr) * (288 hp) ÷ (453.6 g/lb) * (12.5 hr/qtr)
= **0 lb $SO_X$/qtr**

= (0.005 g/hp·hr) * (288 hp) ÷ (453.6 g/lb) * (50 hr/year)
= **0 lb $SO_X$/year**

| **Post Project Potential to Emit (PE2) (C-3953-13-1)** | | | | |
|---|---|---|---|---|
| | Hourly Emissions (lb/hr) | Daily Emissions (lb/day) | Quarterly Emissions (lb/qtr) | Annual Emissions (lb/year) |
| $NO_X$ | 2.16 | 51.8 | 27 | 108 |
| CO | 0.28 | 6.8 | 4 | 14 |
| VOC | 0.24 | 5.8 | 3 | 12 |
| $PM_{10}$ | 0.04 | 0.9 | 0.5 | 2 |
| $SO_X$ | 0.00 | 0.1 | 0 | 0 |

**iv. C-3953-14-1 (Natural gas IC engine powering electrical generator)**

The emissions for the emergency IC engine is calculated as follows, and summarized in the table below:

$PE_{NOx}$ = (1.0 g/hp·hr) * (860 hp) ÷ (453.6 g/lb)
= **1.90 lb $NO_X$/hr**

= (1.0 g/hp·hr) * (860 hp) ÷ (453.6 g/lb) * (24 hr/day)
= **45.5 lb $NO_X$/day**

= (1.0 g/hp·hr) * (860 hp) ÷ (453.6 g/lb) * (12.5 hr/qtr)
= **24 lb $NO_X$/qtr**

= (1.0 g/hp·hr) * (860 hp) ÷ (453.6 g/lb) * (50 hr/year)
= **95 lb $NO_X$/year**

$PE_{CO}$ = (0.6 g/hp·hr) * (860 hp) ÷ (453.6 g/lb)
= **1.14 lb CO/hr**

= (0.6 g/hp·hr) * (860 hp) ÷ (453.6 g/lb) * (24 hr/day)
= **27.3 lb CO/day**

= (0.6 g/hp·hr) * (860 hp) ÷ (453.6 g/lb) * (12.5 hr/qtr)
= **14 lb CO/qtr**

= (0.6 g/hp·hr) * (860 hp) ÷ (453.6 g/lb) * (50 hr/year)
= **57 lb CO/year**

$PE_{VOC}$ = (0.33 g/hp·hr) * (860 hp) ÷ (453.6 g/lb)
= **0.63 lb VOC/hr**

= (0.33 g/hp·hr) * (860 hp) ÷ (453.6 g/lb) * (24 hr/day)
= **15.0 lb VOC/day**

= (0.33 g/hp·hr) * (860 hp) ÷ (453.6 g/lb) * (12.5 hr/qtr)
= **8 lb VOC/qtr**

= (0.33 g/hp·hr) * (860 hp) ÷ (453.6 g/lb) * (50 hr/year)
= **31 lb VOC/year**

$PE_{PM10}$ = (0.034 g/hp·hr) * (860 hp) ÷ (453.6 g/lb)
= **0.06 lb $PM_{10}$/hr**

= (0.034 g/hp·hr) * (860 hp) ÷ (453.6 g/lb) * (24 hr/day)
= **1.5 lb $PM_{10}$/day**

= (0.034 g/hp·hr) * (860 hp) ÷ (453.6 g/lb) * (12.5 hr/qtr)
= **1 lb $PM_{10}$/qtr**

= (0.034 g/hp·hr) * (860 hp) ÷ (453.6 g/lb) * (50 hr/year)
= **3 lb $PM_{10}$/year**

$PE_{SOx}$ = (0.0094 g/hp·hr) * (860 hp) ÷ (453.6 g/lb)
= **0.02 lb $SO_X$/hr**

= (0.0094 g/hp·hr) * (860 hp) ÷ (453.6 g/lb) * (24 hr/day)
= **0.4 lb $SO_X$/day**

= (0.0094 g/hp·hr) * (860 hp) ÷ (453.6 g/lb) * (12.5 hr/qtr)
= **0 lb $SO_X$/qtr**

= (0.0094 g/hp·hr) * (860 hp) ÷ (453.6 g/lb) * (50 hr/year)
= **1 lb $SO_X$/year**

| **Post Project Potential to Emit (PE2) (C-3953-14-1)** | | | | |
|---|---|---|---|---|
| | Hourly Emissions (lb/hr) | Daily Emissions (lb/day) | Quarterly Emissions (lb/qtr) | Annual Emissions (lb/year) |
| $NO_X$ | 1.90 | 45.5 | 24 | 95 |
| CO | 1.14 | 27.3 | 14 | 57 |
| VOC | 0.63 | 15.0 | 8 | 31 |
| $PM_{10}$ | 0.06 | 1.5 | 1 | 3 |
| $SO_X$ | 0.02 | 0.4 | 0 | 1 |

### 3. Pre-Project Stationary Source Potential to Emit (SSPE1)

Pursuant to Section 4.9 of District Rule 2201, the Pre-project Stationary Source Potential to Emit (SSPE1) is the Potential to Emit (PE) from all units with valid Authorities to Construct (ATC) or Permits to Operate (PTO) at the Stationary Source and the quantity of emission reduction credits (ERC) which have been banked since September 19, 1991 for Actual Emissions Reductions that have occurred at the source, and which have not been used on-site. Since this is a new facility, there are no valid ATCs, PTOs, or ERCs at the Stationary Source; therefore, the SSPE1 will be equal to zero.

### 4. Post-Project Stationary Source Potential to Emit (SSPE2)

Pursuant to Section 4.10 of District Rule 2201, the Post Project Stationary Source Potential to Emit (SSPE2) is the Potential to Emit (PE) from all units with valid Authorities to Construct (ATC) or Permits to Operate (PTO) at the Stationary Source and the quantity of emission reduction credits (ERC) which have been banked since September 19, 1991 for Actual Emissions Reductions that have occurred at the source, and which have not been used on-site. The District is issuing a DOC for this project and not individual ATC's. Therefore, the SSPE2 will be determined by summing the potential emissions from the units included in the DOC.

| Post-project Stationary Source Potential to Emit [SSPE2] (lb/year) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Permit Unit | $NO_X$ * | CO ** | VOC | $PM_{10}$ | $SO_X$ | $NH_3$ | $PM_{2.5}$ *** |
| C-3953-10-1 | 198,840 | 197,928 | 34,489 | 80,656 | 16,694 | 219,972 | 80,656 |
| C-3953-11-1 | | | 34,489 | 80,656 | 16,694 | 219,972 | 80,656 |
| C-3953-12-1 | | | 201 | 233 | 132 | 0 | 233 |
| C-3953-13-1 | | | 12 | 2 | 0 | 0 | 2 |
| C-3953-14-1 | | | 31 | 3 | 1 | 0 | 3 |
| Post-project SSPE (SSPE2) | **198,840** | **197,928** | **69,222** | **161,550** | **33,521** | **439,944** | **161,550** |

* The facility has proposed to limit the $NO_X$ emission from this facility to 198,840 lb/year.
** The facility has proposed to limit the CO emission from this facility to 197,928 lb/year.
*** All $PM_{10}$ emissions are $PM_{2.5}$.

## 5. Major Source Determination

Pursuant to Section 3.24 of District Rule 2201, a major source is a stationary source with post-project emissions or a Post-project Stationary Source Potential to Emit (SSPE2), equal to or exceeding one or more of the following threshold values.

| Major Source Determination | | | | | | |
|---|---|---|---|---|---|---|
| | $NO_X$ (lb/year) | CO (lb/year) | VOC (lb/year) | $PM_{10}$ (lb/year) | $SO_X$ (lb/year) | $PM_{2.5}$ (lb/year) |
| Post-project SSPE (SSPE2) | 198,840 | 197,928 | 69,222 | 161,550 | 33,521 | 161,550 |
| Major Source Threshold | 50,000 | 200,000 | 50,000 | 140,000 | 140,000 | 200,000 |
| Major Source? | Yes | No | Yes | Yes | No | No |

## 6. Annual Baseline Emissions (BE)

Per District Rule 2201, Section 3.7, the baseline emissions, for a given pollutant, shall be equal to the pre-project potential to emit for:

- Any emission unit located at a non-major source,
- Any highly utilized emission unit, located at a major source,
- Any fully-offset emission unit, located at a major source, or
- Any clean emission unit located at a major source

otherwise,

BE = Historic Actual Emissions (HAE), calculated pursuant to Section 3.22 of District Rule 2201

As shown above, this facility will be a major source for $NO_X$, VOC, and $PM_{10}$ emissions after this project. However, since the units in this project are all new emissions units, there are no historical actual emissions or pre-project potential to emit. Therefore, the baseline $NO_X$, CO, VOC, $PM_{10}$ and $SO_X$ emissions will be set equal to the following:

BE = 0 lb/year

### 7. Major Modification

Major Modification is defined in 40 CFR Part 51.165 as "*any physical change in or change in the method of operation of a major stationary source that would result in a significant net emissions increase of any pollutant subject to regulation under the Act.*"

Since this is a new facility, this project cannot be considered a Major Modification.

### 8. Federal Major Modification

As shown above, this project does not constitute a Major Modification. Therefore, in accordance with District Rule 2201, Section 3.17, this project does not constitute a Federal Major Modification and no further discussion is required.

## VIII. COMPLIANCE:

***Rule 1080 Stack Monitoring***

This Rule grants the APCO the authority to request the installation and use of continuous emissions monitors (CEMs), and specifies performance standards for the equipment and administrative requirements for recordkeeping, reporting, and notification.

### i. C-3953-10-1 and C-3953-11-1 (Turbines)

The two CTGs will be equipped with operational CEMs for $NO_X$, CO, and $O_2$. Provisions included in the operating permit are consistent with the requirements of this Rule. Compliance with the requirements of this Rule is anticipated.

***Proposed Rule 1080 Conditions:***

- The owner or operator shall install, certify, maintain, operate and quality-assure a Continuous Emission Monitoring System (CEMS) which continuously measures and records the exhaust gas $NO_X$, CO and $O_2$ concentrations. Continuous emissions monitor(s) shall be capable of monitoring emissions during normal operating conditions, and during startups and shutdowns, provided the CEMS passes the relative accuracy requirement for startups and shutdowns specified herein. If relative accuracy of CEMS cannot be demonstrated during startup conditions, CEMS results during startup and shutdown events shall be replaced with startup emission rates obtained from source testing to determine compliance with emission limits contained in this document. [District Rules 1080 and 4703 and 40 CFR 60.4340(b)(1)]

- The CEMS shall complete a minimum of one cycle of operation (sampling, analyzing, and data recording) for each successive 15-minute period or shall meet equivalent specifications established by mutual agreement of the District, the ARB and the EPA. [District Rule 1080 and 40 CFR 60.4345(b)]

- The $NO_X$, CO and $O_2$ CEMS shall meet the requirements in 40 CFR 60, Appendix F Procedure 1 and Part 60, Appendix B Performance Specification 2 (PS 2), or shall meet equivalent specifications established by mutual agreement of the District, the ARB, and the EPA. [District Rule 1080 and 40 CFR 60.4345(a)]

- Audits of continuous emission monitors shall be conducted quarterly, except during quarters in which relative accuracy and compliance source testing are both performed, in accordance with EPA guidelines. The District shall be notified prior to completion of the audits. Audit reports shall be submitted along with quarterly compliance reports to the District. [District Rule 1080]

- The owner/operator shall perform a relative accuracy test audit (RATA) for $NO_X$, CO and $O_2$ as specified by 40 CFR Part 60, Appendix F, 5.11, at least once every four calendar quarters. The permittee shall comply with the applicable requirements for quality assurance testing and maintenance of the continuous emission monitor equipment in accordance with the procedures and guidance specified in 40 CFR Part 60, Appendix F. [District Rule 1080]

- APCO or an authorized representative shall be allowed to inspect, as determined to be necessary, the required monitoring devices to ensure that such devices are functioning properly. [District Rule 1080]

- Results of the CEM system shall be averaged over a one hour period for $NO_X$ emissions and a three hour period for CO emissions using consecutive 15-minute sampling periods in accordance with all applicable requirements of CFR 60.13. [District Rule 4703 and 40 CFR 60.13]

- Results of continuous emissions monitoring shall be reduced according to the procedures established in 40 CFR, Part 51, Appendix P, paragraphs 5.0 through 5.3.3, or by other methods deemed equivalent by mutual agreement with the District, the ARB, and the EPA. [District Rule 1080]

- The owner or operator shall, upon written notice from the APCO, provide a summary of the data obtained from the CEM systems. This summary shall be in the form and the manner prescribed by the APCO. [District Rule 1080]

- The facility shall install and maintain equipment, facilities, and systems compatible with the District's CEM data polling software system and shall make CEM data available to the District's automated polling system on a daily basis. [District Rule 1080]

- Upon notice by the District that the facility's CEM system is not providing polling data, the facility may continue to operate without providing automated data for a maximum of 30 days per calendar year provided the CEM data is sent to the District by a District-approved alternative method. [District Rule 1080]

- The permittee shall maintain the following records: the date, time and duration of any malfunction of the continuous monitoring equipment; dates of performance testing; dates of evaluations, calibrations, checks, and adjustments of the continuous monitoring equipment; date and time period which a continuous monitoring system or monitoring device was inoperative. [District Rules 1080 and 2201 and 40 CFR 60.8(d)]

- The owner or operator shall submit a written report of CEM operations for each calendar quarter to the APCO. The report is due on the 30th day following the end of the calendar quarter and shall include the following: Time intervals, data and magnitude of excess NOx emissions, nature and the cause of excess (if known), corrective actions taken and preventive measures adopted; Averaging period used for data reporting corresponding to the averaging period specified in the emission test period used to determine compliance with an emission standard; Applicable time and date of each period during which the CEM was inoperative (monitor downtime), except for zero and span checks, and the nature of system repairs and adjustments; A negative declaration when no excess emissions occurred. [District Rule 1080 and 40 CFR 60.4375(a) and 60.4395]

**ii. C-3953-12-1 (Boiler)**

The boiler will be equipped with operational CEMs for $NO_X$, CO, and $O_2$. Provisions included in the operating permit are consistent with the requirements of this Rule. Compliance with the requirements of this Rule is anticipated.

***Proposed Rule 1080 Conditions:***

- {1832} The exhaust stack shall be equipped with a continuous emissions monitor (CEM) for NOx, CO, and O2. The CEM shall meet the requirements of 40 CFR parts 60 and 75 and shall be capable of monitoring emissions during startups and shutdowns as well as during normal operating conditions. [District Rules 2201 and 1080]

- {1833} The facility shall install and maintain equipment, facilities, and systems compatible with the District's CEM data polling software system and shall make CEM data available to the District's automated polling system on a daily basis. [District Rule 1080]

- {1834} Upon notice by the District that the facility's CEM system is not providing polling data, the facility may continue to operate without providing automated data for a maximum of 30 days per calendar year provided the CEM data is sent to the District by a District-approved alternative method. [District Rule 1080]

- {1836} Results of continuous emissions monitoring shall be reduced according to the procedure established in 40 CFR, Part 51, Appendix P, paragraphs 5.0 through 5.3.3, or by other methods deemed equivalent by mutual agreement with the District, the ARB, and the EPA. [District Rule 1080]

- {1837} Audits of continuous emission monitors shall be conducted quarterly, except during quarters in which relative accuracy and total accuracy testing is performed, in accordance with EPA guidelines. The District shall be notified prior to completion of the audits. Audit reports shall be submitted along with quarterly compliance reports to the District. [District Rule 1080]

- {1838} The owner/operator shall perform a relative accuracy test audit (RATA) as specified by 40 CFR Part 60, Appendix F, 5.11, at least once every four calendar quarters. The permittee shall comply with the applicable requirements for quality assurance testing and maintenance of the continuous emission monitor equipment in accordance with the procedures and guidance specified in 40 CFR Part 60, Appendix F. [District Rule 1080]

- {1839} The permittee shall submit a written report to the APCO for each calendar quarter, within 30 days of the end of the quarter, including: time intervals, data and magnitude of excess emissions, nature and cause of excess emissions (if known), corrective actions taken and preventive measures adopted; averaging period used for data reporting shall correspond to the averaging period for each respective emission standard; applicable time and date of each period during which the CEM was inoperative (except for zero and span checks) and the nature of system repairs and adjustments; and a negative declaration when no excess emissions occurred. [District Rule 1080]

***Rule 1081 Source Sampling***

This Rule requires adequate and safe facilities for use in sampling to determine compliance with emissions limits, and specifies methods and procedures for source testing and sample collection.

**i. C-3953-10-1 and C-3953-11-1 (Turbines)**

The requirements of this Rule will be included in the operating permits. Compliance with this Rule is anticipated.

***Proposed Rule 1081 Conditions:***

- The exhaust stack shall be equipped with permanent provisions to allow collection of stack gas samples consistent with EPA test methods and shall be equipped with safe permanent provisions to sample stack gases with a portable NOx, CO, and O2 analyzer during District inspections. The sampling ports shall be located in accordance with the CARB regulation titled California Air Resources Board Air Monitoring Quality Assurance Volume VI, Standard Operating Procedures for Stationary Emission Monitoring and Testing. [District Rule 1081]

- Source testing to measure startup NOx, CO, and VOC mass emission rates shall be conducted for one of the gas turbines (C-3953-10 or C-3953-11) prior to the end of the commissioning period and at least once every seven years thereafter. CEM relative accuracy shall be determined during startup source testing in accordance with 40 CFR 60, Appendix B. [District Rule 1081]

- Source testing (with and without duct burner firing) to measure the NOx, CO, and VOC emission rates (lb/hr and ppmvd @ 15% O2) shall be conducted within 60 days after the end of the commissioning period and at least once every twelve months thereafter. [District Rules 1081 and 4703]

- Source testing (with and without duct burner firing) to measure the PM10 emission rate (lb/hr) and the ammonia emission rate shall be conducted within 60 days after the end of the commissioning period and at least once every twelve months thereafter. [District Rule 1081]

- Compliance with natural gas sulfur content limit shall be demonstrated within 60 days after the end of the commissioning period and weekly thereafter. After demonstrating compliance with the fuel sulfur content limit for 8 consecutive weeks for a fuel source, then the testing frequency shall not be less than monthly. If a test shows noncompliance with the sulfur content requirement, the source must return to weekly testing until eight consecutive weeks show compliance. [District Rules 1081, 2540, and 4001]

- Demonstration of compliance with the annual average sulfur content limit shall be demonstrated by a 12 month rolling average of the sulfur content either (i) documented in a valid purchase contract, a supplier certification, a tariff sheet or transportation contract or (ii) tested using ASTM Methods D1072, D3246, D4084, D4468, D4810, D6228, D6667 or Gas Processors Association Standard 2377. [District Rules 1081 and 2201]

- Compliance demonstration (source testing) shall be District witnessed, or authorized and samples shall be collected by a California Air Resources Board certified testing laboratory. Source testing shall be conducted using the methods and procedures approved by the District. The District must be notified 30 days prior to any compliance source test, and a source test plan must be submitted for approval 15 days prior to testing. The results of each source test shall be submitted to the District within 60 days thereafter. [District Rule 1081]

- The following test methods shall be used: $NO_X$ - EPA Method 7E or 20; CO - EPA Method 10 or 10B; VOC - EPA Method 18 or 25; PM10 - EPA Method 5 (front half and back half) or 201 and 202a; ammonia - BAAQMD ST-1B; and $O_2$ - EPA Method 3, 3A, or 20. EPA approved alternative test methods as approved by the District may also be used to address the source testing requirements of this permit. [District Rules 1081 and 4703 and 40 CFR 60.4400(1)(i)]

**ii. C-3953-12-1 (Boiler)**

The requirements of this Rule will be included in the operating permit. Compliance with this Rule is anticipated.

***Proposed Rule 1081 Conditions:***

- The exhaust stack shall be equipped with permanent provisions to allow collection of stack gas samples consistent with EPA test methods and shall be equipped with safe permanent provisions to sample stack gases with a portable NOx, CO, and O2 analyzer during District inspections. The sampling ports shall be located in accordance with the CARB regulation titled California Air Resources Board Air Monitoring Quality Assurance Volume VI, Standard Operating Procedures for Stationary Emission Monitoring and Testing. [District Rule 1081]

- {109} Source testing shall be conducted using the methods and procedures approved by the District. The District must be notified at least 30 days prior to any compliance source test, and a source test plan must be submitted for approval at least 15 days prior to testing. [District Rule 1081]

- {110} The results of each source test shall be submitted to the District within 60 days thereafter. [District Rule 1081]

***Rule 1100 Equipment Breakdown***

This Rule defines a breakdown condition and the procedures to follow if one occurs. The corrective action, the issuance of an emergency variance, and the reporting requirements are also specified.

**i. C-3953-10-1 and C-3953-11-1 (Turbines)**

The requirements of this Rule will be included in the operating permits. Compliance with this Rule is anticipated.

***Proposed Rule 1100 Conditions:***

- Permittee shall notify the District of any breakdown condition as soon as reasonably possible, but no later than one hour after its detection, unless the owner or operator demonstrates to the District's satisfaction that the longer reporting period was necessary. [District Rule 1100, 6.1]

- The District shall be notified in writing within ten days following the correction of any breakdown condition. The breakdown notification shall include a description of the equipment malfunction or failure, the date and cause of the initial failure, the estimated emissions in excess of those allowed, and the methods utilized to restore normal operations. [District Rule 1100, 7.0]

***Rule 2010 Permits Required***

This Rule requires any person building, altering, or replacing any operation, article, machine, equipment, or other contrivance, the use of which may cause the issuance of air contaminants, to first obtain authorization from the District in the form of an ATC. By the submission of a DOC application, Avenal Power Center, LLC is complying with the requirements of this Rule.

***Rule 2201 New and Modified Stationary Source Review Rule***

***A. BACT:***

**1. BACT Applicability**

BACT requirements are triggered on a pollutant-by-pollutant basis and on an emissions unit-by-emissions unit basis for the following*:

a. Any new emissions unit with a potential to emit exceeding two pounds per day,
b. The relocation from one Stationary Source to another of an existing emissions unit with a potential to emit exceeding two pounds per day,
c. Modifications to an existing emissions unit with a valid Permit to Operate resulting in an AIPE exceeding two pounds per day, and/or
d. Any new or modified emissions unit, in a stationary source project, which results in a Major Modification.

*Except for CO emissions from a new or modified emissions unit at a Stationary Source with an SSPE2 of less than 200,000 pounds per year of CO.

**i. C-3953-10-1 and C-3953-11-1 (Turbines)**

As seen in Section VII.C.2.b of this evaluation, the applicant is proposing to install two new combustion turbine generators with PEs greater than 2 lb/day for $NO_X$, CO, VOC, $PM_{10}$, and $SO_X$. BACT is triggered for $NO_X$, VOC, $PM_{10}$, and $SO_X$ criteria pollutants since the PEs are greater than 2 lbs/day. Since the SSPE2 for CO is not greater than 200,000 lbs/year, BACT is not triggered for CO emissions.

The PE of ammonia is greater than two pounds per day for the two CTGs. However, the ammonia emissions are intrinsic to the operation of the SCR system, which is BACT for $NO_X$. The emissions from a control device that is determined by the District to be BACT are not subject to BACT.

**ii. C-3953-12-1 (Boiler)**

As seen in Section VII.C.2 of this evaluation, the applicant is proposing to install a new boiler with a PE greater than 2 lb/day for $NO_X$, CO, VOC, $PM_{10}$, and $SO_X$. BACT is triggered for $NO_X$, VOC, and $PM_{10}$ criteria pollutants since the PEs are greater than 2 lbs/day. Since the SSPE2 for CO is not greater than 200,000 lbs/year, BACT is not triggered for CO emissions.

**iii. C-3953-13-1 (Diesel IC engine powering fire water pump)**

As seen in Section VII.C.2 of this evaluation, the applicant is proposing to install a new diesel-fired IC engine (fire pump) with a PE greater than 2 lb/day for $NO_X$, CO, and VOC. BACT is triggered for $NO_X$, and VOC criteria pollutants since the PEs are greater than 2 lbs/day. Since the SSPE2 for CO is not greater than 200,000 lbs/year, BACT is not triggered for CO emissions.

**iv. C-3953-14-1 (Natural gas IC engine powering electrical generator)**

As seen in Section VII.C.2 of this evaluation, the applicant is proposing to install a new natural gas-fired IC engine (generator) with a PE greater than 2 lb/day for $NO_X$, CO, and VOC. BACT is triggered for $NO_X$, and VOC criteria pollutants since the PEs are greater than 2 lbs/day. Since the SSPE2 for CO is not greater than 200,000 lbs/year, BACT is not triggered for CO emissions.

**2. BACT Guidance**

The District BACT Clearinghouse was created to assist applicants in selecting appropriate control technology for new and modified sources, and to assist the District staff in conducting the necessary BACT analysis. The Clearinghouse will include, for various class and category of sources, available control technologies and methods that meet one or more of the following conditions:

- Have been achieved in practice for such emissions unit and class of source; or
- Are contained in any SIP approved by the EPA for such emissions unit category and class of source; or
- Are any other emission limitation or control technique, including process and equipment changes of basic or control equipment, found to be technologically feasible for such class or category of sources or for a specific source.

Attachment E will include the BACT Guidelines from the BACT Clearinghouse applicable to the new emissions units associated with this project.

**i. C-3953-10-1 and C-3953-11-1 (Turbines)**

BACT Guideline 3.4.2 is applicable to the two combustion turbine generator installations [Gas Fired Turbine = or > 50 MW, Uniform Load, with Heat Recovery].

**ii. C-3953-12-1 (Boiler)**

BACT Guideline 1.1.2 is applicable to the 37.4 MMBtu/hr boiler. [Boiler - > 20 MMBtu/hr, Natural gas-fired, base-loaded or with small load swings.]

**iii. C-3953-13-1 (Diesel IC engine powering fire water pump)**

BACT Guideline 3.1.4, applies to the diesel-fired emergency IC engine powering a fire pump. [Emergency Diesel I.C. Engine Driving a Fire Pump]

**iv. C-3953-14-1 (Natural gas IC engine powering electrical generator)**

BACT Guideline 3.1.8, applies to the natural gas-fired emergency IC engine powering an electrical generator. [Emergency Gas-Fired I.C. Engine > or = 250 hp, Lean Burn]

## 3. Top-Down Best Available Control Technology (BACT) Analysis

Per Permit Services Policies and Procedures for BACT, a Top-Down BACT analysis shall be performed as a part of the application review for each application subject to the BACT requirements pursuant to the District's NSR Rule.

For Permit Units C-3953-10-1 and -11-1 see Attachment F.

For Permit Unit C-3953-12-1 see Attachment F.

For Permit Unit C-3953-13-1 see Attachment F.

For Permit Unit C-3953-14-1 see Attachment F.

## 4. BACT Summary:

### i. C-3953-10-1 and C-3953-11-1 (Turbines)

BACT has been satisfied by the following:

$NO_X$: 2.0 ppmv @ 15% $O_2$ (1-hour rolling average, except during startup/shutdown) with Dry Low $NO_X$ Combustors, SCR with ammonia injection and natural gas fuel.

VOC: 1.5 ppmv @ 15% $O_2$ (without duct burner firing; 3-hour rolling average).
2.0 ppmv @ 15% $O_2$ (with duct burner firing; 3-hr rolling average).

$PM_{10}$: Air inlet filter cooler, lube oil vent coalescer, and natural gas fuel

$SO_X$: PUC regulated natural gas with a sulfur content of 1.0 gr/100 scf or less

### ii. C-3953-12-1 (Boiler)

BACT has been satisfied by the following:

$NO_X$: 9.0 ppmv @ 15% $O_2$ with Ultra Low $NO_X$ burners and natural gas fuel.

VOC: Natural gas fuel.

$PM_{10}$: Natural gas fuel.

$SO_X$: Natural gas fuel.

**iii. C-3953-13-1 (Diesel IC engine powering fire water pump)**

BACT has been satisfied by the following:

$NO_X$: Certified $NO_X$ emissions of 6.9 g/hp·hr or less

VOC: No VOC control. Any add on VOC control device would void the Underwriters Laboratory (UL) certification.

**iv. C-3953-14-1 (Natural gas IC engine powering electrical generator)**

BACT has been satisfied by the following:

$NO_X$: = or < 1.0 g/bhp-hr (lean burn natural gas fired engine, or equal)

VOC: 90% control efficiency (oxidation catalyst, or equal)

Therefore, the following condition will be listed on the DOC to ensure compliance:

- {3492} This IC engine shall be equipped with a three-way catalyst. [District Rule 2201]

## *C. Offsets:*

### 1. Offset Applicability:

Pursuant to Section 4.5.3, offset requirements shall be triggered on a pollutant by pollutant basis and shall be required if the Post-project Stationary Source Potential to Emit (SSPE2) equals to or exceeds emissions of 20,000 lbs/year for $NO_X$ and VOC, 200,000 lbs/year for CO, 54,750 lbs/year for $SO_X$ and 29,200 lbs/year for $PM_{10}$. As seen in the table below, the facility's SSPE2 is greater than the offset thresholds for $NO_X$, CO, VOC, $PM_{10}$, and $SO_X$ emissions. Therefore, offset calculations are necessary.

| Offset Determination | | | | | |
|---|---|---|---|---|---|
| | $NO_X$ (lb/year) | CO (lb/year) | VOC (lb/year) | $PM_{10}$ (lb/year) | $SO_X$ (lb/year) |
| Post-project SSPE (SSPE2) | 198,840 | 197,928 | 69,222 | 161,550 | 33,521 |
| Offset Threshold | 20,000 | 200,000 | 20,000 | 29,200 | 54,750 |
| Offsets Required? | Yes | No | Yes | Yes | No |

**2. Quantity of Offsets Required:**

Per District Rule 2201, Section 4.6.1, emission offsets shall not be required for increases in carbon monoxide in attainment areas if the applicant demonstrates to the satisfaction of the APCO, that the Ambient Air Quality Standards are not violated in the areas to be affected, and such emissions will be consistent with Reasonable Further Progress, and will not cause or contribute to a violation of Ambient Air Quality Standards.

Per Sections 4.7.2 and 4.7.3, the quantity of offsets in pounds per year for $NO_X$, VOC, and $PM_{10}$ is calculated as follows for sources with an SSPE1 less than the offset threshold levels before implementing the project being evaluated.

Offsets Required (lb/year) = ([SSPE2 – Offset Threshold] + ICCE) x DOR, for all new or modified emissions units in the project,

Where,
SSPE2 = Post Project Facility Potential to Emit, (lb/year)
ICCE = Increase in Cargo Carrier Emissions, (lb/year)
DOR = Distance Offset Ratio, determined pursuant to Section 4.8

Per Section 4.6.2, emergency equipment that is used exclusively as emergency standby equipment for electrical power generation or any other emergency equipment as approved by the APCO that does not operate more than 200 hours per year of non-emergency purposes and is not used pursuant to voluntary arrangements with a power supplier to curtail power, is exempt from providing emission offsets. Therefore, permit units C-3953-13-1 and C-3953-14-1 will be exempt from providing offsets and the emissions associated with these permit units contributing to the SSPE2 should be removed prior to calculating actual offset amounts.

Offset = ([SSPE2 – Emergency Equipment - Offset Threshold] + ICCE) x DOR, for all new or modified emissions units in the project,

**<u>$NO_X$ Offset Calculations:</u>**

The facility has proposed to provide the same quarterly offsets that were required to be provided in the facility's initial project (C-1080386). The reason for this request is to enable the facility to preserve full flexibility to operate the facility at the previously permitted rates during any calendar quarter, provided the new annual emission limits are not exceeded. The facility is required to maintain a 12 month rolling calculation of their $NO_X$ and CO emissions; therefore compliance with this quarterly limit will be enforceable. The quarterly offsets from project C-1080386 are shown below.

Quarterly Emissions to be Offset (Project C-1080386)

Annual Offsets = 268,415 lb/year * DOR

Quarterly Offsets $_{1st\ Qtr}$ = 67,103.75 lbs of $NO_X$ * DOR
Quarterly Offsets $_{2nd\ Qtr}$ = 67,103.75 lbs of $NO_X$ * DOR
Quarterly Offsets $_{3rd\ Qtr}$ = 67,103.75 lbs of $NO_X$ * DOR
Quarterly Offsets $_{4th\ Qtr}$ = 67,103.75 lbs of $NO_X$ * DOR

Pursuant to Section 4.8 of District Rule 2201, the distance offset ratio shall be 1.0:1 if the emission offsets originated at the same Stationary Source as the new or modified emissions unit; 1.2.1 for Non-Major Sources if the emission offsets originated within 15 miles of the new or modified emissions unit's Stationary Source; 1.3.1 for Major Sources if the emission offsets originated within 15 miles of the new or modified emissions unit's Stationary Source; or 1.5:1 if the emission offsets originated 15 miles or more from the new or modified emissions unit's Stationary Source.

Assuming a worst case offset ratio of 1.5:1, the amount of $NO_X$ ERC's that need to be withdrawn is:

Offsets Required = 268,415 lb-$NO_X$/year x 1.5
Offsets Required = 402,623 lb-$NO_X$/year

Calculating the appropriate quarterly emissions to be offset is as follows:

| **Quantity of Offsets Required** | | | | | |
|---|---|---|---|---|---|
| | 1st Quarter (lb/qtr) | 2nd Quarter (lb/qtr) | 3rd Quarter (lb/qtr) | 4th Quarter (lb/qtr) | Total (lb/year) |
| $NO_X$ | 100,655 | 100,656 | 100,656 | 100,656 | 402,623 |

The applicant has stated that the facility plans to use ERC certificates C-899-2, C-902-2, N-720-2, N-722-2, N-726-2, N-728-2, S-2814-2, and S-2321-2 to offset the increases in $NO_X$ emissions associated with this project. The above Certificates have available quarterly $NO_X$ credits as follows:

| Offset Proposal | | | | | |
|---|---|---|---|---|---|
| | 1st Quarter (lb/qtr) | 2nd Quarter (lb/qtr) | 3rd Quarter (lb/qtr) | 4th Quarter (lb/qtr) | **Total (lb/year)** |
| ERC #C-899-2 | 2,243 | 2,243 | 2,243 | 2,243 | **8,972** |
| ERC #C-902-2 | 13,879 | 6,131 | 1,086 | 8,539 | **29,635** |
| ERC #N-720-2 | 0 | 9 | 1,255 | 437 | **1,701** |
| ERC #N-722-2 | 0 | 1,166 | 88,317 | 1,422 | **90,905** |
| ERC #N-726-2 | 0 | 0 | 4,728 | 0 | **4,728** |
| ERC #N-728-2 | 10,542 | 3,731 | 2,487 | 5,171 | **21,931** |
| ERC #S-2814-2 | 6,121 | 13,869 | 18,914 | 11,461 | **50,365** |
| ERC #S-2321-2* | 51,000 | 51,000 | 51,000 | 51,000 | **204,000** |
| **Total** | **83,784** | **78,147** | **170,027** | **80,269** | **412,227** |

*ERC certificate split from this ERC.

Project $NO_X$ offset requirements

The applicant states that $NO_X$ ERC certificates C-899-2, C-902-2, N-720-2, N-722-2, N-726-2, N-728-2, S-2814-2, and S-2321-2 will be utilized to supply the $NO_X$ offset requirements.

Per Rule 2201 Section 4.13.8, Actual Emission Reductions (i.e. ERCs) that occurred from April through November (i.e. 2nd and 3rd Quarter), inclusive, may be used to offset increases in $NO_X$ or VOC during any period of the year. Since 3rd quarter $NO_X$ ERCs will be used to offset $NO_X$ emissions, the above applies to the $NO_X$ ERCs.

| | 1st Quarter | 2nd Quarter | 3rd Quarter | 4th Quarter |
|---|---|---|---|---|
| $NO_X$ Emissions to be offset: (at a 1.5:1 DOR): | 100,655 | 100,656 | 100,656 | 100,656 |
| Available ERCs from certificates C-899-2, C-902-2, N-720-2, N-722-2, N-726-2, N-728-2, S-2814-2, and S-2321-2*: | 83,784 | 78,147 | 170,027 | 80,269 |
| 3rd qtr. ERCs applied to 1st qtr. ERCs: | 16,871 | 0 | -16,871 | 0 |
| 3rd qtr. ERCs applied to 2nd qtr. ERCs: | 0 | 22,509 | -22,509 | 0 |
| 3rd qtr. ERCs applied to 4th qtr. ERCs: | 0 | 0 | -20,387 | 20,387 |
| Remaining ERCs from certificates S-2321-2: | 0 | 0 | 9,604 | 0 |
| Remaining $NO_X$ emissions to be offset (at a 1.5:1 DOR): | 0 | 0 | 0 | 0 |

As seen above, the facility has sufficient credits to fully offset the quarterly $NO_X$ emissions increases associated with this project.

**VOC Offset Calculations:**

VOC SSPE2 = 69,222 lb/year
C-3953-13-1 (VOC) = 12 lb/year
C-3953-14-1 (VOC) = 31 lb/year
VOC offset threshold = 20,000 lb/year

Offsets = [69,222 – (12) – (31) – 20,000]
= 49,179 lb/year * DOR

Calculating the appropriate quarterly emissions to be offset is as follows:

Offsets = (49,179 lb/year ÷ 4 qtr/year) * DOR
= 12,294.75 lb/qtr * offset ratio

$PE_{1st\ Qtr}$ = 12,294.75 lbs of VOC * DOR
$PE_{2nd\ Qtr}$ = 12,294.75 lbs of VOC * DOR
$PE_{3rd\ Qtr}$ = 12,294.75 lbs of VOC * DOR
$PE_{4th\ Qtr}$ = 12,294.75 lbs of VOC * DOR

Pursuant to Section 4.8 of District Rule 2201, the distance offset ratio shall be 1.0:1 if the emission offsets originated at the same Stationary Source as the new or modified emissions unit; 1.2.1 for Non-Major Sources if the emission offsets originated within 15 miles of the new or modified emissions unit's Stationary Source; 1.3.1 for Major Sources if the emission offsets originated within 15 miles of the new or modified emissions unit's Stationary Source; or 1.5:1 if the emission offsets originated 15 miles or more from the new or modified emissions unit's Stationary Source.

Assuming a worst case offset ratio of 1.5:1, the amount of VOC ERC's that need to be withdrawn is:

$PE_{1st\ Qtr}$ = 12,294.75 lbs of VOC * 1.5 = 18,442 lbs
$PE_{2nd\ Qtr}$ = 12,294.75 lbs of VOC * 1.5 = 18,442 lbs
$PE_{3rd\ Qtr}$ = 12,294.75 lbs of VOC * 1.5 = 18,442 lbs
$PE_{4th\ Qtr}$ = 12,294.75 lbs of VOC * 1.5 = 18,442 lbs

Calculating the appropriate quarterly emissions to be offset is as follows:

| Quantity of Offsets Required | | | | | |
|---|---|---|---|---|---|
| | 1st Quarter (lb/qtr) | 2nd Quarter (lb/qtr) | 3rd Quarter (lb/qtr) | 4th Quarter (lb/qtr) | Total (lb/year) |
| VOC | 18,442 | 18,442 | 18,442 | 18,442 | 73,769 |

The applicant has stated that the facility plans to use ERC certificates C-897-1, C-898-1, N-724-1, N-725-1, S-2812-1, S-2813-1, and S-2817-1 to offset the increases in VOC emissions associated with this project. The above Certificates have available quarterly VOC credits as follows:

| Offset Proposal | | | | | |
|---|---|---|---|---|---|
| | 1st Quarter (lb/qtr) | 2nd Quarter (lb/qtr) | 3rd Quarter (lb/qtr) | 4th Quarter (lb/qtr) | **Total (lb/year)** |
| ERC #C-897-1 | 45 | 45 | 45 | 45 | **180** |
| ERC #C-898-1 | 5,480 | 6,496 | 4,696 | 6,616 | **23,288** |
| ERC #N-724-1 | 0 | 0 | 241 | 0 | **241** |
| ERC #N-725-1 | 0 | 0 | 709 | 0 | **709** |
| ERC #S-2812-1 | 31,432 | 31,424 | 31,417 | 31,417 | **125,690** |
| ERC #S-2813-1 | 12,500 | 12,500 | 12,500 | 12,500 | **50,000** |
| ERC #S-2817-1 | 11,431 | 11,424 | 11,417 | 11,417 | **45,689** |
| **Total** | **60,887** | **61,887** | **61,022** | **61,991** | **245,787** |

Project VOC offset requirements

The applicant states that $NO_X$ ERC certificates C-897-1, C-898-1, N-724-1, N-725-1, S-2812-1, S-2813-1, and S-2817-1 will be utilized to supply the VOC offset requirements.

| | 1st Quarter | 2nd Quarter | 3rd Quarter | 4th Quarter |
|---|---|---|---|---|
| VOC Emissions to be offset: (at a 1.5:1 DOR): | 18,442 | 18,442 | 18,442 | 18,442 |
| Available ERCs from certificates C-897-1, C-898-1, N-724-1, N-725-1, | 5,525 | 6,541 | 5,691 | 6,661 |
| Remaining VOC emissions to be offset (at a 1.5:1 DOR): | 12,917 | 11,901 | 12,751 | 11,781 |
| VOC Emissions to be offset: (at a 1.5:1 DOR): | 12,917 | 11,901 | 12,751 | 11,781 |
| Available ERCs from certificates S-2812-1, S-2813-1, and S-2817-1 | 55,363 | 55,348 | 55,334 | 55,334 |
| Remaining ERCs from certificates S-2812-1, S-2813-1, and S-2817-1: | 42,446 | 43,447 | 42,583 | 43,553 |
| Remaining VOC emissions to be offset (at a 1.5:1 DOR): | 0 | 0 | 0 | 0 |

As seen above, the facility has sufficient credits to fully offset the quarterly VOC emissions increases associated with this project.

**$PM_{10}$ Offset Calculations:**

$PM_{10}$ SSPE2 = 161,550 lb/year
C-3953-13-1 ($PM_{10}$) = 2 lb/year
C-3953-14-1 ($PM_{10}$) = 3 lb/year
$PM_{10}$ Offset threshold = 29,200 lb/year

Offsets = [(161,550 – (2) – (3) - 29,200 + 0) x DOR]
= 132,345 lb/year x DOR

Calculating the appropriate quarterly emissions to be offset is as follows (in lb/qtr):

Offsets = (132,345 lb/year ÷ 4 qtr/year) * DOR
= 33,086 lb/qtr * offset ratio

$PE_{1st\ Qtr}$ = 33,086 lbs of $PM_{10}$ * DOR
$PE_{2nd\ Qtr}$ = 33,086 lbs of $PM_{10}$ * DOR
$PE_{3rd\ Qtr}$ = 33,086 lbs of $PM_{10}$ * DOR
$PE_{4th\ Qtr}$ = 33,086 lbs of $PM_{10}$ * DOR

The applicant is proposing to use ERC Certificates C-894-4, N-721-4, N-723-4, N-762-5, S-2788-5, S-2789-5, S-2790-5, and 2791-5 which have an original site of reduction greater than 15 miles from the location of this project. Therefore, a distance offset ratio of 1.5:1 is applicable and the amount of $PM_{10}$ ERCs that need to be withdrawn is:

Offsets Required (lb/year) = 132,345 lb/year x 1.5
= 198,518 lb/year

Calculating the appropriate quarterly emissions to be offset is as follows (in lb/qtr):

| Quantity of Offsets Required | | | | | |
|---|---|---|---|---|---|
| | 1st Quarter (lb/qtr) | 2nd Quarter (lb/qtr) | 3rd Quarter (lb/qtr) | 4th Quarter (lb/qtr) | Total (lb/year) |
| $PM_{10}$ | 49,630 | 49,629 | 49,629 | 49,630 | 198,518 |

The applicant has stated that the facility plans to use ERC certificates C-894-4, N-721-4, N-723-4, N-762-5, S-2788-5, S-2789-5, S-2790-5, and 2791-5 to offset the increases in $PM_{10}$ emissions associated with this project. The applicant has purchased the following quarterly amounts of the above certificates:

| Offset Proposal | | | | | |
|---|---|---|---|---|---|
| | 1st Quarter (lb/qtr) | 2nd Quarter (lb/qtr) | 3rd Quarter (lb/qtr) | 4th Quarter (lb/qtr) | **Total (lb/year)** |
| ERC #C-896-4 | 80 | 80 | 80 | 80 | **320** |
| ERC #N-721-4 | 0 | 0 | 3,215 | 0 | **3,215** |
| ERC #N-723-4 | 0 | 0 | 985 | 0 | **985** |
| ERC #S-2791-5 | 92,179 | 23,666 | 69,157 | 96,288 | **281,290** |
| ERC #S-2790-5 | 12,862 | 491 | 0 | 8,499 | **21,852** |
| ERC #S-2789-5 | 6 | 14 | 12 | 8 | **40** |
| ERC #S-2788-5 | 5 | 7 | 3 | 6 | **21** |
| ERC #N-762-5 | 21,000 | 21,000 | 21,000 | 21,000 | **84,000** |
| **Total** | **126,131** | **45,256** | **94,449** | **125,877** | **391,723** |

Project $PM_{10}$ offset requirements

The applicant states either $PM_{10}$ ERC certificates C-894-4, N-721-4, N-723-4, N-762-5, S-2788-5, S-2789-5, S-2790-5, and 2791-5 will be utilized to supply the $PM_{10}$ offset requirements.

| | 1st Quarter | 2nd Quarter | 3rd Quarter | 4th Quarter |
|---|---|---|---|---|
| $PM_{10}$ Emissions to be offset: (at a 1.5:1 ratio): | 49,630 | 49,629 | 49,629 | 49,630 |
| Available ERCs from certificates C-896-4, N-721-4, and N-723-4: | 80 | 80 | 4,280 | 80 |
| ERCs applied from certificates C-896-4, N-721-4, and N-723-4 fully withdrawn as certificates C-896-4, N-721-4, and N-723-4: | -80 | -80 | -4,280 | -80 |
| Remaining ERCs from certificate C-896-4, N-721-4, and N-723-4: | 0 | 0 | 0 | 0 |
| Remaining $PM_{10}$ emissions to be offset (at a 1.5:1 ratio): | 49,550 | 49,549 | 45,349 | 49,550 |

Per Rule 2201 Section 4.13.3.2, interpollutant offsets between $PM_{10}$ and $PM_{10}$ precursors (i.e. $SO_X$) may be allowed. The applicant is proposing to use interpollutant offsets $SO_X$ for $PM_{10}$ at an interpollutant ratio of 1.0:1 (see Attachment H). Per Rule 2201 Section 4.13.7, Actual Emission Reductions (i.e. ERCs) that occurred from October through March (i.e. 1st and 4th Quarter), inclusive, may be used to offset increases in PM during any period of the year. Since the $SO_X$ ERCs are being used to offset $PM_{10}$ emissions, the above applies to the $SO_X$ ERCs.

In addition, the overall offset ratio is equal to the multiplication of the distance and interpollutant ratios (1.5 x 1.000 = 1.5).

| | 1st Quarter | 2nd Quarter | 3rd Quarter | 4th Quarter |
|---|---|---|---|---|
| Remaining $PM_{10}$ Emissions to be offset: (at a 1.5:1 ratio): | 49,550 | 49,549 | 45,349 | 49,550 |
| Remaining $PM_{10}$ emissions to be offset with $SO_X$ ERCs (at a 1.5:1 distance ratio and a 1.000:1 interpollutant $SO_X$:$PM_{10}$ ratio): | 49,550 | 49,549 | 45,349 | 49,550 |
| Remaining ERCs from certificates N-762-5, S-2788-5, S-2789-5, and S-2790-5: | 33,873 | 21,512 | 21,015 | 29,513 |
| Remaining ERCs from certificates N-762-5, S-2788-5, S-2789-5, and S-2790-5: | 0 | 0 | 0 | 0 |
| Remaining $PM_{10}$ emissions to be offset (at a 1.5:1 ratio and a 1.000:1 interpollutant $SO_X$:$PM_{10}$ ratio): | 15,677 | 28,037 | 24,334 | 20,037 |

| | 1st Quarter | 2nd Quarter | 3rd Quarter | 4th Quarter |
|---|---|---|---|---|
| Remaining PM10 Emissions to be offset: (at a 1.5:1 distance ratio and a 1.000:1 interpollutant $SO_X$:$PM_{10}$ ratio): | 15,677 | 28,037 | 24,334 | 20,037 |
| Remaining ERCs from certificate S-2791-5: | 92,179 | 23,666 | 69,157 | 96,288 |
| 1st qtr. ERCs applied to 2nd qtr. ERCs: | -4,371 | 4,371 | 0 | 0 |
| Adjusted Remaining ERCs from certificate S-2791-5: | 87,808 | 28,037 | 69,157 | 96,288 |
| Remaining PM10 emissions to be offset (at a 1.5:1 ratio and a 1.000:1 interpollutant $SO_X$:$PM_{10}$ ratio): | 15,677 | 28,037 | 24,334 | 20,037 |
| ERCs applied from certificate S-2791-5 partially withdrawn: | 15,677 | 28,037 | 24,334 | 20,037 |
| Remaining ERCs from certificate S-2791-5: | 72,131 | 0 | 44,823 | 76,251 |

As seen above, the facility has sufficient credits to fully offset the quarterly $SO_X$ and $PM_{10}$ emissions increases associated with this project.

**Offset Conditions:**

The following conditions will ensure compliance with the offset requirements of this rule:

- Prior to initial operation of C-3953-10-1, C-3953-11-1, and C-3953-12-1, permittee shall provide NOx (as NO2) emission reduction credits for the following quantities of emissions: 1st quarter – 67,103 lb; 2nd quarter – 67,104 lb; 3rd quarter – 67,104 lb; and 4th quarter – 67,104 lb. Offsets shall be provided at the appropriate distance ratio specified in Rule 2201. [District Rule 2201]

- Prior to initial operation of C-3953-10-1, C-3953-11-1, and C-3953-12-1, permittee shall provide VOC emission reduction credits for the following quantities of emissions: 1st quarter – 12,294 lb; 2nd quarter – 12,295 lb; 3rd quarter – 12,295 lb; and 4th quarter – 12,295 lb. Offsets shall be provided at the appropriate distance ratio specified in Rule 2201. [District Rule 2201]

- Prior to initial operation of C-3953-10-1, C-3953-11-1, and C-3953-12-1, permittee shall provide $PM_{10}$ emission reduction credits for the following quantities of emissions: 1st quarter – 33,087 lb; 2nd quarter – 33,086 lb; 3rd quarter – 33,086 lb; and 4th quarter – 33,086 lb. Offsets shall be provided at the appropriate distance ratio specified in Rule 2201. SOx ERC's may be used to offset PM10 increases at an interpollutant ratio of 1.0 lb-SOx : 1.0 lb-PM10. [District Rule 2201]

- ERC certificate numbers (or any splits from these certificates) C-897-1, C-898-1, N-724-1, N-725-1, S-2812-1, S-2813-1, S-2817-1, C-899-2, C-902-2, N-720-2, N-722-2, N-726-2, N-728-2, S-2814-2, S-2321-2, C-896-4, N-721-4, N-723-4, S-2791-5, S-2790-5, S-2789-5, S-2788-5, or N-762-5 shall be used to supply the required offsets, unless a revised offsetting proposal is received and approved by the District, upon which this determination of compliance (DOC) shall be reissued, administratively specifying the new offsetting proposal. Original public noticing requirements, if any, shall be duplicated prior to reissuance of the DOC. [District Rule 2201]

## *D. Public Notification:*

### 1. Applicability

District Rule 2201, section 5.4, requires a public notification for the affected pollutants from the following types of projects:

- New Major Sources
- Major Modifications
- New emission units with a PE > 100 lb/day of any one pollutant (IPE Notifications)
- Any project which results in the offset thresholds being surpassed (Offset Threshold Notification), and/or
- Any permitting action with a SSIPE exceeding 20,000 lb/yr for any one pollutant. (SSIPE Notice)

#### a. New Major Source Notice Determination

New Major Sources are new facilities, which are also Major Sources.

As shown in Section VII.C.6 above, the SSPE2 is greater than the Major Source threshold for $NO_X$, VOC, and $PM_{10}$. Therefore, public noticing is required for this project for new Major Source purposes because this facility is becoming a new Major Source.

#### b. Major Modification

As demonstrated in Section VII.C.7 above, this project does not constitute a Major Modification; therefore, public noticing for Major Modification purposes is not required.

#### c. PE Notification

Applications which include a new emissions unit with a Potential to Emit greater than 100 pounds during any one day for any pollutant will trigger public noticing requirements. The potential to emit for each unit is summarized in the table below.

| Post-Project Potential to Emit | | | | | | |
|---|---|---|---|---|---|---|
| Permit Unit | $NO_X$ (lb/day) | CO (lb/day) | VOC (lb/day) | $PM_{10}$ (lb/day) | $SO_X$ (lb/day) | $NH_3$ (lb/day) |
| C-3953-10-1 | 789.6 | 5,590.8 | 202.0 | 282.7 | 159.6 | 771.1 |
| C-3953-11-1 | 789.6 | 5,590.8 | 202.0 | 282.7 | 159.6 | 771.1 |
| C-3953-12-1 | 4.9 | 16.6 | 1.9 | 2.2 | 1.3 | 0 |
| C-3953-13-1 | 51.8 | 6.8 | 5.8 | 0.9 | 0.1 | 0 |
| C-3953-14-1 | 45.5 | 27.3 | 15.0 | 1.5 | 0.4 | 0 |
| **Threshold (lb/day)** | **100** | **100** | **100** | **100** | **100** | **100** |
| Notification Required? | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** |

According to the table above, permit units C-3953-10-1 and -11-1 will each have a Potential to Emit greater than 100 lb/day for $NO_X$, CO, VOC, $PM_{10}$, $SO_X$, or $NH_3$ emissions. Therefore, public noticing will be required for PE > 100 lbs/day purposes.

### e. Offset Threshold

Public notification is required if the Pre-Project Stationary Source Potential to Emit (SSPE1) is increased from a level below the offset threshold to a level exceeding the emissions offset threshold, for any pollutant.

The following table compares the SSPE1 with the SSPE2 in order to determine if any offset thresholds have been surpassed with this project.

| Offset Threshold | | | | |
|---|---|---|---|---|
| Pollutant | SSPE1 (lb/year) | SSPE2 (lb/year) | Offset Threshold | Public Notice Required? |
| $NO_X$ | 0 | 198,840 | 20,000 lb/year | Yes |
| CO | 0 | 197,928 | 200,000 lb/year | No |
| VOC | 0 | 69,222 | 20,000 lb/year | Yes |
| $PM_{10}$ | 0 | 161,550 | 29,200 lb/year | Yes |
| $SO_X$ | 0 | 33,521 | 54,750 lb/year | No |

As detailed above, offset thresholds were surpassed for $NO_X$, VOC, and $PM_{10}$ emissions with this project; therefore public noticing is required for offset purposes.

### f. SSIPE Notification

Public notification is required for any permitting action that results in a Stationary Source Increase in Permitted Emissions (SSIPE) of more than 20,000 lb/year of any affected pollutant. According to District policy, the SSIPE is calculated as the Post Project Stationary Source Potential to Emit (SSPE2) minus the Pre-Project Stationary

Source Potential to Emit (SSPE1), i.e. SSIPE = SSPE2 – SSPE1. The values for SSPE2 and SSPE1 are calculated according to Rule 2201, Sections 4.9 and 4.10, respectively. The SSIPE is compared to the SSIPE Public Notice thresholds in the following table:

| SSIPE Notification | | | | | |
|---|---|---|---|---|---|
| **Pollutant** | **SSPE2 (lb/year)** | **SSPE1 (lb/year)** | **SSIPE (lb/year)** | **SSIPE Public Notice Threshold** | **Public Notice Required?** |
| $NO_X$ | 198,840 | 0 | 198,840 | 20,000 lb/year | Yes |
| CO | 197,928 | 0 | 197,928 | 20,000 lb/year | Yes |
| VOC | 69,222 | 0 | 69,222 | 20,000 lb/year | Yes |
| $PM_{10}$ | 161,550 | 0 | 161,550 | 20,000 lb/year | Yes |
| $SO_X$ | 33,521 | 0 | 33,521 | 20,000 lb/year | Yes |

As demonstrated above, the SSIPE's for $NO_X$, CO, VOC, $PM_{10}$ and $SO_X$ emissions were greater than 20,000 lb/year; therefore public noticing for SSIPE purposes is required.

**2. Public Notice Requirements**

Section 5.5 details the actions taken by the District when pubic noticing is triggered according to the application types above. Since public noticing requirements are triggered for this project (i.e. New Major Source, PE's > 100 lbs/day, offset thresholds being exceeded, and SSIPEs greater than 20,000 lbs/year), the District shall public notice this project according to the requirements of Section 5.5.

## ***E. Daily Emission Limits:***

Daily emissions limitations (DELs) and other enforceable conditions are required by Section 3.15 to restrict a unit's maximum daily emissions, to a level at or below the emissions associated with the maximum design capacity.

***Proposed Rule 2201 (DEL) Conditions:***

The following condition will be included to demonstrate compliance with facility wide annual $NO_X$ and CO emissions limits.

- Annual emissions from the facility, calculated on a twelve month rolling basis, shall not exceed any of the following limits: $NO_X$ (as $NO_2$) – 198,840 lb/year; CO – 197,928 lb/year. [District Rule 2201]

**i. C-3953-10-1 and C-3953-11-1 (Turbines)**

For the turbines, the DELs for $NO_X$, CO, VOC, $PM_{10}$, $SO_X$, and $NH_3$ will consist of lb/day and/or emission factors.

- Emission rates from this unit (with duct burner firing), except during startup and shutdown periods, shall not exceed any of the following limits: NOx (as NO2) – 17.20 lb/hr and 2.0 ppmvd @ 15% O2; VOC (as methane) – 5.89 lb/hr and 2.0 ppmvd @ 15% O2; CO – 10.60 lb/hr and 2.0 ppmvd @ 15% O2; PM10 – 11.78 lb/hr; or SOx (as SO2) – 6.65 lb/hr. NOx (as NO2) emission limits are one hour rolling averages. All other emission limits are three hour rolling averages. [District Rules 2201, 4001, and 4703]

- Emission rates from this unit (without duct burner firing), except during startup and shutdown periods, shall not exceed any of the following limits: NOx (as NO2) - 13.55 lb/hr and 2.0 ppmvd @ 15% O2; VOC (as methane) - 3.34 lb/hr and 1.4 ppmvd @ 15% O2; CO – 8.35 lb/hr and 2.0 ppmvd @ 15% O2; PM10 – 8.91 lb/hr; or SOx (as SO2) – 5.23 lb/hr. NOx (as NO2) emission limits are one hour rolling averages. All other emission limits are three hour rolling averages. [District Rules 2201, 4001, and 4703]

- During start-up and shutdown, CTG exhaust emission rates shall not exceed any of the following limits: $NO_X$ (as $NO_2$) – 160 lb/hr; CO – 1,000 lb/hr; VOC (as methane) – 16 lb/hr; $PM_{10}$ – 11.78 lb/hr; $SO_X$ (as $SO_2$) – 6.652 lb/hr; or $NH_3$ – 32.13 lb/hr. [District Rules 2201 and 4703]

- Daily emissions from the CTG shall not exceed the following limits: $NO_X$ (as $NO_2$) – 412.8 lb/day; CO – 254.4 lb/day; VOC – 141.4 lb/day; $PM_{10}$ – 282.7 lb/day; $SO_X$ (as $SO_2$) – 159.6 lb/day, or $NH_3$ – 771.1 lb/day. [District Rule 2201]

- Emissions from this unit, on days when a startup and/or shutdown occurs, shall not exceed the following limits: NOx (as NO2) – 789.6 lb/day; VOC – 202.0 lb/day; CO – 5,590.8 lb/day; PM10 – 282.7 lb/day; SOx (as SO2) – 159.6 lb/day, or $NH_3$ – 771.1 lb/day. [District Rule 2201]

- The ammonia (NH3) emissions shall not exceed 10 ppmvd @ 15% O2 over a 24 hour rolling average. [District Rule 2201]

- The CTG shall be fired exclusively on PUC-regulated natural gas with a sulfur content no greater than 1.0 grain of sulfur compounds (as S) per 100 dry scf of natural gas. [District Rule 2201 and 40 CFR 60.4330(a)(2)]

- Annual average of the sulfur content of the CTG shall not exceed 0.36 grain of sulfur compounds (as S) per 100 dry scf of natural gas. [District Rule 2201]

In addition to the daily emissions limits specified above, the following conditions will also be included to ensure continued compliance for the proposed turbines:

- Annual emissions from the CTG, calculated on a twelve month rolling basis, shall not exceed any of the following limits: $NO_X$ (as $NO_2$) – 143,951 lb/year; CO – 197,928 lb/year; VOC – 34,489 lb/year; $PM_{10}$ – 80,656 lb/year; or $SO_X$ (as $SO_2$) – 16,694 lb/year; or $NH_3$ – 208,708 lb/year. [District Rule 2201]

- Each one hour period shall commence on the hour. Each one hour period in a three hour rolling average will commence on the hour. The three hour average will be compiled from the three most recent one hour periods. Each one hour period in a twenty-four hour average for ammonia slip will commence on the hour. [District Rule 2201]

- Daily emissions will be compiled for a twenty-four hour period starting and ending at twelve-midnight. Each month in the twelve consecutive month rolling average emissions shall commence at the beginning of the first day of the month. The twelve consecutive month rolling average emissions to determine compliance with annual emissions limitations shall be compiled from the twelve most recent calendar months. [District Rule 2201]

**ii. C-3953-12-1 (Boiler)**

The DELs for the boiler will consist of lb/MMBtu and ppmv emissions limits. This will be sufficient to establish a maximum daily potential to emit based on the maximum daily fuel use limit.

- Emission rates from this unit shall not exceed any of the following limits: NOx (as NO2) - 9.0 ppmvd @ 3% O2 or 0.011 lb/MMBtu; VOC (as methane) - 10.0 ppmvd @ 3% O2; CO - 50.0 ppmvd @ 3% O2 or 0.037 lb/MMBtu; PM10 - 0.005 lb/MMBtu; or SOx (as SO2) - 0.00282 lb/MMBtu. [District Rules 2201, 4305, 4306, and 4351]

In addition the following permit conditions will appear on the permit:

- {2964} The unit shall only be fired on PUC-regulated natural gas. [District Rule 2201]

**iii. C-3953-13-1 (Diesel IC engine fire pump)**

For the emergency IC engine powering a fire pump, the DELs will be stated in the form of emission factors, the maximum engine horsepower rating, and the maximum operational time of 24 hours per day.

- Emissions from this IC engine shall not exceed any of the following limits: 3.4 g-NOx/bhp-hr, 0.447 g-CO/bhp-hr, or 0.38 g-VOC/bhp-hr. [District Rule 2201 and 13 CCR 2423 and 17 CCR 93115]

- Emissions from this IC engine shall not exceed 0.059 g-PM10/bhp-hr based on USEPA certification using ISO 8178 test procedure. [District Rules 2201 and 4102 and 13 CCR 2423 and 17 CCR 93115]

- {3395} Only CARB certified diesel fuel containing not more than 0.0015% sulfur by weight is to be used. [District Rules 2201 and 4801 and 17 CCR 93115]

**iv. C-3953-14-1 (Natural gas IC engine electrical generator)**

For the emergency IC engine powering a generator, the DELs will be stated in the form of emission factors, the maximum engine horsepower rating, and the maximum operational time of 24 hours per day.

- Emissions from this IC engine shall not exceed any of the following limits: 1.0 g-NOx/bhp-hr, 0.034 g-PM10/bhp-hr, 0.6 g-CO/bhp-hr, or 0.33 g-VOC/bhp-hr. [District Rule 2201]

- {3491} This IC engine shall be fired on Public Utility Commission (PUC) regulated natural gas only. [District Rules 2201 and 4801]

## ***F. Compliance Certification:***

Section 4.15.2 of this Rule requires the owner of a new major source or a source undergoing a major modification to demonstrate to the satisfaction of the District that all other major sources owned by such person and operating in California are in compliance with all applicable emission limitations and standards. As discussed above, this facility is a new major source; therefore this requirement is applicable. Included in Attachment I is Avenal Power Center's certification for the Avenal Energy Project.

## ***G. Air Quality Impact Analysis:***

Section 4.14.2 of this Rule requires that an air quality impact analysis (AQIA) be conducted for the purpose of determining whether the operation of the proposed equipment will cause or make worse a violation of an air quality standard. The Technical Services Division of the SJVAPCD conducted the required analysis. Refer to Attachment G of this document for the AQIA summary sheet.

The proposed location is in an attainment area for $NO_X$, CO, and $SO_X$. As shown by the table below, the proposed equipment will not cause a violation of an air quality standard for $NO_X$, CO, or $SO_X$.

| AAQA Results Summary | | | | | |
|---|---|---|---|---|---|
| Pollutant | 1 hr Average | 3 hr Average | 8 hr Average | 24 hr Average | Annual Average |
| CO | Pass | N/A | Pass | N/A | N/A |
| $NO_x$ | Pass | N/A | N/A | N/A | Pass |
| $SO_x$ | Pass | Pass | N/A | Pass | Pass |

The proposed location is in a non-attainment area for $PM_{10}$. The increase in the ambient $PM_{10}$ concentration due to the proposed equipment is shown on the table titled Calculated Contribution. The levels of significance, from 40 CFR Part 51.165 (b)(2), are shown on the table titled Significance Levels.

| Significance Levels | | | | | |
|---|---|---|---|---|---|
| Pollutant | Significance Levels ($\mu g/m^3$) - 40 CFR Part 51.165 (b)(2) | | | | |
| | Annual Avg. | 24 hr Avg. | 8 hr Avg. | 3 hr Avg. | 1 hr Avg. |
| $PM_{10}$ | 1.0 | 5 | N/A | N/A | N/A |

| Calculated Contribution | | | | | |
|---|---|---|---|---|---|
| Pollutant | Calculated Contributions ($\mu g/m^3$) | | | | |
| | Annual Avg. | 24 hr Avg. | 8 hr Avg. | 3 hr Avg. | 1 hr Avg. |
| $PM_{10}$ | 0.38 | 1.6 | N/A | N/A | N/A |

As shown, the calculated contribution of $PM_{10}$ will not exceed the EPA significance level. This project is not expected to cause or make worse a violation of an air quality standard.

## *H. Compliance Assurance:*

### 1. Source Testing

#### i. C-3953-10-1 and C-3953-11-1

District Rule 4703 requires $NO_X$ and CO emission testing as well as percent turbine efficiency testing on an annual basis. The District Source Test Policy (APR 1705 10/09/97) requires annual testing for all pollutants controlled by catalysts. The control equipment will include a SCR system and an oxidation catalyst. Ammonia slip is an indicator of how well the SCR system is performing and $PM_{10}$ emissions are a good indicator of how well the inlet air cooler/filter are performing.

Therefore, source testing for $NO_X$, CO, VOC, $PM_{10}$, and ammonia slip will be required within 60 days after the end of the commissioning period and at least once every 12 months thereafter.

Also, initial source testing of $NO_X$, CO, and VOC startup emissions will be required for one gas turbine engine initially and not less than every seven years thereafter. This testing will serve two purposes: to validate the startup emission estimates used in the emission calculations and to verify that the CEMs accurately measure startup emissions.

Each CTG will have a separate exhaust stack. The units will be equipped with CEMs for $NO_X$, CO, and $O_2$. Each CTG will be equipped with an individual CEM. Each CEM will have two ranges to allow accurate measurements of $NO_X$ and CO emissions during startup. The CEMs must meet the installation, performance, relative accuracy, and quality assurance requirements specified in 40 CFR 60.13 and Appendix B (referenced in the CEM requirements of Rule 4703) and the acid rain requirements in 40 CFR Part 75.

40 CFR Part 60 subpart KKKK requires that fuel sulfur content be documented or monitored. Refer to the monitoring section of this document for a discussion of the fuel sulfur testing requirements.

40 CFR Part 60 subpart Db requires $NO_X$ testing for the duct burners. The District will accept the $NO_X$ source testing required by District Rule 4703 as equivalent to $NO_X$ testing required by 40 CFR 60 subpart Db.

**ii. C-3953-12-1**

This unit is subject to District Rule 4305, *Boilers, Steam Generators and Process Heaters, Phase 2*, and District Rule 4306, *Boilers, Steam Generators and Process Heaters, Phase 3*. Source testing requirements, in accordance with District Rules 4305 and 4306, will be discussed in Section VIII, *District Rules 4305 and 4306*, of this evaluation.

**iii. C-3953-13-1 and C-3953-14-1**

Pursuant to District Policy APR 1705, source testing is not required for emergency standby IC engines to demonstrate compliance with Rule 2201.

**2. Monitoring**

**i. C-3953-10-1 and C-3953-11-1**

Monitoring of $NO_X$ emissions is required by District Rule 4703. The applicant has proposed a CEMS for $NO_X$.

CO monitoring is not specifically required by any applicable Rule or Regulation. Nevertheless, due to erratic CO emission concentrations during start-up and shutdown periods, it is necessary to limit the CO emissions on a pound per hour basis. Therefore, a CO CEMS is necessary to show compliance with the CO limits of this permit. The applicant has proposed a CO CEMS.

40 CFR Part 60 Subpart KKKK and District Rule 4703 requires monitoring of the fuel consumption. Fuel consumption monitoring will be required.

40 CFR Part 60 Subpart KKKK requires monitoring of the fuel sulfur content. The gas supplier, Pacific Gas & Electric (PG&E), may deliver gas with a sulfur content of up to 1.0 gr/scf. Since the sulfur content of the natural gas would not exceed this value, it is District practice to allow the facility to demonstrate compliance with the limit by providing gas purchase contracts, supplier certification, tariff sheet or transportation contract; or, if these documents cannot be provided, physically monitor the fuel sulfur content weekly for eight consecutive weeks and semi-annually thereafter if the fuel sulfur content remains below 1.0 gr/scf. Avenal Power Center, LLC will be operating these turbines in compliance with the fuel sulfur content monitoring requirements as described in the Rule 4001, Subpart KKKK discussion below. Therefore, compliance with the monitoring requirements will be satisfied.

**ii. C-3953-12-1**

As required by District Rule 4305, *Boilers, Steam Generators and Process Heaters, Phase 2*, and District Rule 4306, *Boilers, Steam Generators and Process Heaters, Phase 3*, this unit is subject to monitoring requirements. Monitoring requirements, in accordance with District Rules 4305 and 4306, will be discussed in Section VIII, *District Rules 4305 and 4306*, of this evaluation.

**iii. C-3953-13-1 and C-3953-14-1**

No monitoring is required to demonstrate compliance with Rule 2201.

**3. Recordkeeping**

**i. C-3953-10-1 and C-3953-11-1**

The applicant will be required to keep records of all of the parameters that are required to be monitored. Refer to section VIII.F.2 of this document for a discussion of the parameters that will be monitored.

**ii. C-3953-12-1**

As required by District Rule 4305, *Boilers, Steam Generators and Process Heaters, Phase 2*, and District Rule 4306, *Boilers, Steam Generators and Process Heaters, Phase 3*, this unit is subject to recordkeeping requirements. Recordkeeping requirements, in accordance with District Rules 4305 and 4306, will be discussed in Section VIII, *District Rules 4305 and 4306*, of this evaluation.

The following permit condition will be listed on permit as follows:

- All records shall be maintained and retained on-site for a minimum of five (5) years, and shall be made available for District inspection upon request. [District Rules 1070, 4305, and 4306]

**iii. C-3953-13-1 and C-3953-14-1**

Recordkeeping is required to demonstrate compliance with the offset, public notification, and daily emission limit requirements of Rule 2201. As required by District Rule 4702, *Stationary Internal Combustion Engines - Phase 2*, these IC engines are subject to recordkeeping requirements. Recordkeeping requirements, in accordance with District Rule 4702, will be discussed in Section VIII, *District Rule 4702*, of this evaluation.

**4. Reporting**

**i. C-3953-10-1 and C-3953-11-1**

40 CFR Part 60 Subpart KKKK requires that the facility report the use of fuel with a sulfur content of more than 0.8% by weight. Such reporting will be required.

40 CFR Part 60 Subpart KKKK requires the reporting of exceedences of the $NO_X$ emission limit of the permit. Such reporting will be required.

**ii. C-3953-12-1**

No reporting is required to demonstrate compliance with Rule 2201.

**iii. C-3953-13-1 and C-3953-14-1**

No reporting is required to demonstrate compliance with Rule 2201.

***Rule 2520 Federally Mandated Operating Permits***

This project will be subject to Rule 2520 (Title V) because it will meet the following criteria specified in section 2.0:

- Section 2.3 states, "Any major source." The facility will be a major source for $NO_X$, VOC, and $PM_{10}$ after this project.

- Section 2.4 states, "Any emissions unit, including an area source, subject to a standard or other requirement promulgated pursuant to section 111 (NSPS) or 112 (HAPs) of the CAA..." The turbines are subject to NSPS.

- Section 2.5 states "A source with an acid rain unit for which application for an acid rain permit is required pursuant to Title IV (Acid Rain Program) of the CAA." The turbines are subject to the acid rain program.

- Section 2.6 states, "Any source required to have a preconstruction review permit pursuant to the requirements of the prevention of significant deterioration (PSD) program under Title I of the Federal Clean Air Act." This facility is not required to obtain a PSD permit.

Pursuant to Rule 2520 section 5.3.1 Avenal Power Center must submit a Title V application within 12 months of commencing operations. No action is required at this time.

- Permittee shall submit an application to comply with SJVUAPCD District Rule 2520 - Federally Mandated Operating Permits within twelve months of commencing operation. [District Rule 2520]

***Rule 2540 Acid Rain Program***

The proposed CTG's are subject to the acid rain program as phase II units, i.e. they will be installed after 11/15/90 and each has a generator nameplate rating greater than 25 MW.

The acid rain program will be implemented through a Title V operating permit. Federal regulations require submission of an acid rain permit application at least 24 months before the later of 1/1/2000 or the date the unit expects to generate electricity. The facility anticipates beginning commercial operation in November of 2011.

The acid rain program requirements for this facility are relatively minimal. Monitoring of the $NO_X$ and $SO_X$ emissions and a relatively small quantity of $SO_X$ allowances (from a national $SO_X$ allowance bank) will be required as well as the use of a $NO_X$ CEM.

The following condition will be placed on permits C-3953-10-1, -11-1 and -14-1 to ensure that Avenal Power Center, LLC submits an application to comply with the requirements of the acid rain program within the appropriate timeframe:

- Permittee shall submit an application to comply with SJVUAPCD District Rule 2540 - Acid Rain Program. [District Rule 2540]

### *Rule 2550 Federally Mandated Preconstruction Review for Major Sources of Air Toxics*

Section 2.0 states, "*The provisions of this rule shall only apply to applications to construct or reconstruct a major air toxics source with Authority to Construct issued on or after June 28, 1998.*" The applicant has provided the following analysis for Noncriteria pollutants/HAPs.

Noncriteria pollutants are compounds that have been identified as pollutants that pose a significant health hazard. Nine of these pollutants are regulated under the Federal New Source Review program: lead, asbestos, beryllium, mercury, fluorides, sulfuric acid mist, hydrogen sulfide, total reduced sulfur, and reduced sulfur compounds.[7]

In addition to these nine compounds, the federal Clean Air Act lists 189 substances as potential hazardous air pollutants (Clean Air Act Sec. 112(b)(1)). The SJVAPCD has also published a list of compounds it defines as potential toxic air contaminants (Toxics Policy, May 1991; Rule 2-1-316). Any pollutant that may be emitted from the project and is on the federal New Source Review List, the federal Clean Air Act list, and/or the SJVAPCD toxic air contaminant list has been evaluated.

Noncriteria pollutant emission factors for the analysis of emissions from the gas turbines were obtained from AP-42 (Table 3.1-3, 4/00, and Table 3.4-1 of the Background Document for Section 3.1), from the California Air Resources Board's CATEF database for gas turbines, and from source tests on a similar turbine. Specifically, factors for all pollutants except formaldehyde, hexane, propylene, and naphthalene and other PAHs were taken from AP-42.[8] AP-42 did not contain factors for hexane or propylene, and did not include speciated data for PAHs. Factors for these pollutants and for naphthalene were taken from the CATEF database (mean values). The emission factor for formaldehyde was taken from the results of a June 2000 source test on a dry Low $NO_X$ combustor-equipped large frame turbine.

[7] These pollutants are regulated under federal and state air quality programs; however, they are evaluated as noncriteria pollutants by the California Energy Commission (CEC).
[8] Factors for acrolein and benzene reflect the use of an oxidation catalyst and were taken from Table 3.4-1 of the Background Document for Section 3.1.

**Hazardous Air Pollutant Emissions (per CATEF)**
**Avenal Energy Project – GE Frame 7 (with Duct Burners)**

| Hazardous Air Pollutant | CATEF Emission Factor (lb/MMSCF)[1] | Maximum Hourly Emissions per Turbine (lb/hr)[2] | Maximum Annual Emissions per Turbine (tpy)[3] | Maximum Annual Emissions both Turbines (tpy) |
|---|---|---|---|---|
| Acetaldehyde | 4.08E-02 | 0.09 | 0.33 | 0.67 |
| Acrolein | 3.69E-03 | 0.01 | 0.03 | 6.04E-02 |
| Benzene | 3.33E-03 | 0.01 | 0.03 | 5.45E-02 |
| 1,3-Butadiene | 4.39E-04 | 9.38E-04 | 3.59E-03 | 7.19E-03 |
| Ethyl benzene | 3.26E-02 | 0.07 | 0.27 | 0.53 |
| Formaldehyde | 1.65E-01 | 0.35 | 1.35 | 2.70 |
| Hexane | 2.59E-01 | 0.55 | 2.12 | 4.24 |
| Naphthalene | 1.33E-03 | 2.84E-03 | 1.09E-02 | 2.18E-02 |
| Polycyclic aromatic hydrocarbons (PAH) | --- | --- | --- | --- |
| Anthracene | 3.38E-05 | 7.22E-05 | 2.77E-04 | 5.53E-04 |
| Benzo(a)anthracene | 2.26E-05 | 4.83E-05 | 1.85E-04 | 3.70E-04 |
| Benzo(a)pyrene | 1.39E-05 | 2.97E-05 | 1.14E-04 | 2.28E-04 |
| Benzo(b)fluoranthrene | 1.13E-05 | 2.41E-05 | 9.25E-05 | 1.85E-04 |
| Benzo(k)fluoranthrene | 1.10E-05 | 2.35E-05 | 9.00E-05 | 1.80E-04 |
| Chrysene | 2.52E-05 | 5.38E-05 | 2.06E-04 | 4.12E-04 |
| Dibenz(a,h)anthracene | 2.35E-05 | 5.02E-05 | 1.92E-04 | 3.85E-04 |
| Indeno(1,2,3-cc)pyrene | 2.35E-05 | 5.02E-05 | 1.92E-04 | 3.85E-04 |
| Propylene oxide | 2.96E-02 | 6.32E-02 | 2.42E-01 | 0.48 |
| Toluene | 1.33E-01 | 0.28 | 1.09 | 2.18 |
| Xylenes | 6.53E-02 | 0.14 | 0.53 | 1.07 |
| **Total** | | | **6.01** | **12.02** |

(1) From AP-42 and CATEF databases and source tests.
(2) Based on a maximum hourly turbine fuel use of 2,224.1 MMBtu/hr (with duct burner) and fuel HHV of 1,021 Btu/scf. (2.14 MMscf/hr)
(3) Based on a maximum annual turbine fuel use of 16,711,728 MMBtu/year (with duct burner) and fuel HHV of 1,021 Btu/scf. (16,368 MMscf/yr)

Although the turbines/HRSGs will be equipped with oxidation catalyst systems, only the acrolein and benzene emission factors reflect any control effectiveness. As discussed above, these factors are based on test data rather than any assumption regarding catalyst control efficiency.

Therefore, as emissions of each individual HAP are below 10 tons per year and total HAP emissions are below 25 tons per year, the Avenal Power Center, LLC Project will not be a major air toxics source and the provisions of this rule do not apply.

***Rule 4001 New Source Performance Standards***

**40 CFR 60 – Subpart Dc**

NSPS Subpart Dc applies to steam generating units that are constructed, reconstructed, or modified after 6/9/89 and have a maximum design heat input capacity of 100 MMBtu/hr or less, but greater than or equal to 10 MMBtu/hr. Subpart Dc has standards for $SO_X$ and $PM_{10}$.

60.42c – Standards for Sulfur Dioxide

Since coal is not combusted by the boiler in this project, the requirements of this section are not applicable.

60.43c – Standards for Particulate Matter

The boiler is not fired on coal, combusts mixtures of coal with other fuels, combusts wood, combusts mixtured of wood with other fuels, or oil; therefore it will not be subject to the requirements of this section.

60.44c – Compliance and Performance Tests Methods and Procedures for Sulfur Dioxide.

Since the boiler in this project is not subject to the sulfur dioxide requirements of this subpart, no testing to show compliance is required. Therefore, the requirements of this section are not applicable to the boiler in this project.

60.45c – Compliance and Performance Test Methods and Procedures for Particulate Matter

Since the boiler in this project is not subject to the particulae matter requirements of this subpart, no testing to show compliance is required. Therefore, the requirements of this section are not applicable to the boiler in this project.

60.46c – Emission Monitoring for Sulfur Dioxide

Since the boiler in this project is not subject to the sulfur dioxide requirements of this subpart, no monitoring is required. Therefore, the requirements of this section are not applicable to the boiler in this project.

60.47c – Emission Monitoring for Particulate Matter

Since the boiler in this project is not subject to the particulate matter requirements of this subpart, no monitoring is required. Therefore, the requirements of this section are not applicable to the boiler in this project.

60.48c – Reporting and Recordingkeeping Requirements

Section 60.48c (a) states that the owner or operator of each affected facility shall submit notification of the date of construction or reconstruction, anticipated startup, and actual startup, as provided by §60.7 of this part. This notification shall include:

(1) The design heat input capacity of the affected facility and identification of fuels to be combusted in the affected facility.

*The design heat input capacity and type of fuel combusted at the facility will be listed on the unit's equipment description. No conditions are required to show compliance with this requirement.*

(2) If applicable, a copy of any Federally enforceable requirement that limits the annual capacity factor for any fuel mixture of fuels under §60.42c or §40.43c.

*This requirement is not applicable since the units are not subject to §60.42c or §40.43c.*

(3) The annual capacity factor at which the owner or operator anticipates operating the affected facility based on all fuels fired and based on each individual fuel fired.

*The facility has not proposed an annual capacity factor; therefore one will not be required.*

(4) Notification if an emerging technology will be used for controlling $SO_2$ emissions. The Administrator will examine the description of the control device and will determine whether the technology qualifies as an emerging technology. In making this determination, the Administrator may require the owner or operator of the affected facility to submit additional information concerning the control device. The affected facility is subject to the provisions of §60.42c(a) or (b)(1), unless and until this determination is made by the Administrator

*This requirement is not applicable since the units will not be equipped with an emerging technology used to control $SO_2$ emissions.*

Section 60.48 c (g) states that the owner or operator of each affected facility shall record and maintain records of the amounts of each fuel combusted during each day. The following conditions will be added to the permit to assure compliance with this section.

- A non-resettable, totalizing mass or volumetric fuel flow meter to measure the amount of fuel combusted in the unit shall be installed, utilized and maintained. [District Rules 2201 and 40 CFR 60.48 (c)(g)]

- Permittee shall maintain daily records of the type and quantity of fuel combusted by the boiler. [District Rules 2201 and 40 CFR 60.48 (c)(g)]

Section 60.48 c (i) states that all records required under this section shall be maintained by the owner or operator of the affected facility for a period of two years following the date of such record. District Rule 4306 requires that records be kept for five years.

**40 CFR 60 – Subpart GG**

40 CFR Part 60 Subpart GG applies to all stationary gas turbines with a heat input greater than 10.7 gigajoules per hour (10.2 MMBtu/hr), that commence construction, modification, or reconstruction after October 3, 1977. Avenal Power Center, LLC has indicated that the installation and construction of the proposed turbines will be completed in 2011. Therefore, these turbines meet the applicability requirements of this subpart.

40 CFR 60 Subpart KKKK, Section 60.4305(a), states that this subpart applies to all stationary gas turbines with a heat input greater than 10.7 gigajoules (10 MMBtu) per hour, which commenced construction, modification, or reconstruction after February 18, 2005. Avenal Power Center, LLC has indicated that the installation and construction of the proposed turbines will be completed in 2011. Therefore, these turbines also meet the applicability requirements of this subpart.

40 CFR 60 Subpart KKKK, Section 60.4305(b), states that stationary combustion turbines regulated under this subpart are exempt from the requirements of 40 CFR 60 Subpart GG. As discussed above, 40 CFR 60 Subpart KKKK is applicable to these proposed turbines. Therefore, they are exempt from the requirements of 40 CFR 60 Subpart GG and no further discussion is required.

**40 CFR 60 - Subpart IIII**

§60.4200 - Applicability

40 CFR Part 60 Subpart IIII applies to all owners and operators of stationary compression ignited internal combustion engines that commence construction after July 11, 2005, where the engines are:

1) Manufactured after April 1, 2006, if not a fire pump engine.
2) Manufactured as a National Fire Protection Association (NFPA) fire pump engine after July 1, 2006.

Since the proposed engines will be installed after July 11, 2005 and will be manufactured after April 1, 2006, this subpart applies.

All of the applicable standards of this subpart are less restrictive than current District requirements. This engine will comply with all current District standards so further discussion is required.

**40 CFR Part 60, Subpart JJJ**

The engine in this project is rated at over 100 bhp and per 60.4233(e) is subject to the limits presented in Table 1 of this subpart. The Table 1 limits as well as the proposed emissions are shown on the following table. This regulation does not specify an emissions averaging period.

| | Table 1 Limit | Proposed Emissions | Compliant |
|---|---|---|---|
| NOx (g/bhp-hr) | 2.0 | 1.0 | Yes |
| CO (g/bhp-hr) | 4.0 | 0.6 | Yes |
| VOC (g/bhp-hr) | 1.0 | 0.33 | Yes |

Therefore, the natural gas-fired IC engine in this project meets all applicable requirements of this subpart.

**40 CFR 60 – Subpart KKKK**

40 CFR Part 60 Subpart KKKK applies to all stationary gas turbines rated at greater than or equal to 10 MMBtu/hr that commence construction, modification, or reconstruction after February 18, 2005. The proposed gas turbines involved in this project have a rating of 1,794.5 MMBtu/hr and will be installed after February 18, 2005. Therefore, this subpart applies to these gas turbines.

Subpart KKKK established requirements for nitrogen oxide ($NO_X$) and sulfur dioxide ($SO_X$) emissions.

Section 60.4320 - Standards for Nitrogen Oxides:

Paragraph (a) states that $NO_X$ emissions shall not exceed the emission limits specified in Table 1 of this subpart. Paragraph (b) states that if you have two or more turbines that are connected to a single generator, each turbine must meet the emission limits for $NO_X$. Table 1 states that new, modified, or reconstructed turbines firing natural gas with a combustion turbine heat input at peak load of greater than 850 MMBtu/hr shall meet a $NO_X$ emissions limit of 15 ppmvd @ 15% $O_2$ or 54 ng/J of useful output (0.43 lb/MWh).

Avenal Power Center is proposing a $NO_X$ emission concentration limit of 2.0 ppmvd @ 15% $O_2$ for each turbine. Therefore, the proposed turbines will be operating in compliance with the $NO_X$ emission requirements of this subpart. The following conditions will ensure continued compliance with the requirements of this section:

- Emission rates from this unit (with duct burner firing), except during startup and shutdown periods, shall not exceed any of the following limits: NOx (as NO2) – 17.44 lb/hr and 2.0 ppmvd @ 15% O2; VOC (as methane) – 6.13 lb/hr and 2.0 ppmvd @ 15% O2; CO – 10.60 lb/hr and 2.0 ppmvd @ 15% O2; PM10 – 11.78 lb/hr; or SOx (as SO2) – 6.72 lb/hr. NOx (as NO2) emission limits are one hour rolling averages. All other emission limits are three hour rolling averages. [District Rules 2201, 4001, and 4703]

- Emission rates from this unit (without duct burner firing), except during startup and shutdown periods, shall not exceed any of the following limits: NOx (as NO2) - 13.28 lb/hr and 2.0 ppmvd @ 15% O2; VOC (as methane) - 3.23 lb/hr and 1.4 ppmvd @ 15% O2; CO – 8.35 lb/hr and 2.0 ppmvd @ 15% O2; PM10 – 8.97 lb/hr; or SOx (as SO2) – 5.11 lb/hr. NOx (as NO2) emission limits are one hour rolling averages. All other emission limits are three hour rolling averages. [District Rules 2201, 4001, and 4703]

Section 60.4330 - Standards for Sulfur Dioxide:

Paragraph (a) states that if your turbine is located in a continental area, you must comply with one of the following:

(1) Operator must not cause to be discharged into the atmosphere from the subject stationary combustion turbine any gases which contain $SO_2$ in excess of 110 nanograms per Joule (ng/J) (0.90) pounds per megawatt-hour (lb/MWh)) gross output; or
(2) Operator must not burn in the subject stationary combustion turbine any fuel which contains total potential sulfur emissions in excess of 26 ng $SO_2$/J (0.060 lb $SO_2$/MMBtu) heat input.

Avenal Power Center is proposing to burn natural gas fuel in each of these turbines with a maximum sulfur content of 1.0 grain/ 100 scf (0.00285 lb/MMBtu). Therefore, the proposed turbines will be operating in compliance with the $SO_X$ emission requirements of this section. The following condition will ensure continued compliance with the requirements of this section:

- The CTG shall be fired exclusively on PUC-regulated natural gas with a sulfur content of no greater than 1.0 grains of sulfur compounds (as S) per 100 dry scf of natural gas. [District Rule 2201 and 40 CFR 60.4330(a)(2)]

Section 60.4335 – $NO_X$ Compliance Demonstration, with Water or Steam Injection:

Paragraph (a) states that when a turbine is using water or steam injection to reduce $NO_X$ emissions, you must install, calibrate, maintain and operate a continuous monitoring system to monitor and record the fuel consumption and the ratio of water or steam to fuel being fired in the turbine when burning a fuel that requires water or steam injection for compliance.

Avenal Power Center does not use water or steam injection in their turbines therefore; the requirements of this section are not applicable to the turbines in this project.

Section 60.4340 – $NO_X$ Compliance Demonstration, without Water or Steam Injection:

Paragraph (b) states that as an alternative to annual source testing, the facility may install, calibrate, maintain and operate one of the following continuous monitoring systems:

(1) Continuous emission monitoring as described in §§60.4335(b) and 60.4345, or
(2) Continuous parameter monitoring

Avenal Power Center has proposed to install a CEMS system as described in §§60.4335(b) and 60.4345 therefore; the following condition will ensure continued compliance with the requirements of this section:

- The owner or operator shall install, certify, maintain, operate and quality-assure a Continuous Emission Monitoring System (CEMS) which continuously measures and records the exhaust gas $NO_X$, CO and $O_2$ concentrations. Continuous emissions monitor(s) shall be capable of monitoring emissions during normal operating conditions, and during startups and shutdowns, provided the CEMS passes the relative accuracy requirement for startups and shutdowns specified herein. If relative accuracy of CEMS cannot be demonstrated during startup conditions, CEMS results during startup and shutdown events shall be replaced with startup emission rates obtained from source testing to determine compliance with emission limits contained in this document. [District Rules 1080 and 4703 and 40 CFR 60.4340(b)(1)]

Section 60.4345 – CEMS Equipment Requirements:

Paragraph (a) states that each $NO_X$ diluent CEMS must be installed and certified according to Performance Specification 2 (PS 2) in Appendix B to this part, except the 7-day calibration drift is based on unit operating days, not calendar days. With state approval, Procedure 1 in Appendix F to this part is not required. Alternatively, a $NO_X$ diluent CEMS that is installed and certified according to Appendix A of Part 75 of this chapter is acceptable for use under this subpart. The relative accuracy test audit (RATA) of the CEMS shall be performed on a lb/MMBtu basis.

Paragraph (b) states that as specified in §60.13(e)(2), during each full unit operating hour, both the $NO_X$ monitor and the diluent monitor must complete a minimum of one cycle of operation (sampling, analyzing, and data recording) for each 15-minute quadrant of the hour, to validate the hour. For partial unit operating hours, at least one valid data point must be obtained with each monitor for each quadrant of the hour in which the unit operates. For unit operating hours in which required quality assurance and maintenance activities are performed on the CEMS, a minimum of two valid data points (one in each of

two quadrants) are required for each monitor to validate the $NO_X$ emission rate for the hour.

Paragraph (c) states that each fuel flowmeter shall be installed, calibrated, maintained, and operated according to the manufacturer's instructions. Alternatively, with state approval, fuel flowmeters that meet the installation, certification, and quality assurance requirements of Appendix D to Part 75 of this chapter are acceptable for use under this subpart.

Paragraph (d) states that each watt meter, steam flow meter, and each pressure or temperature measurement device shall be installed, calibrated, maintained, and operated according to manufacturer's instructions.

Paragraph (e) states that the owner or operator shall develop and keep on-site a quality assurance (QA) plan for all of the continuous monitoring equipment described in paragraphs (a), (c), and (d) of this section. For the CEMS and fuel flow meters, the owner or operator may, with state approval, satisfy the requirements of this paragraph by implementing the QA program and plan described in section 1 of Appendix B to Part 75 of this chapter.

Avenal Power Center will be required to install and operate a $NO_X$ CEMS in accordance with the requirements of this section. As discussed above, Avenal Power Center is not required to install a fuel flow meter, watt meter, steam flow meter, or a pressure or temperature measurement device to comply with the requirements of this subpart. Therefore, the proposed turbines will be operating in compliance with the requirements of this section. The following conditions will ensure continued compliance with the requirements of this section:

- The $NO_X$, CO and $O_2$ CEMS shall meet the requirements in 40 CFR 60, Appendix F Procedure 1 and Part 60, Appendix B Performance Specification 2 (PS 2), or shall meet equivalent specifications established by mutual agreement of the District, the ARB, and the EPA. [District Rule 1080 and 40 CFR 60.4345(a)]

- The CEMS shall complete a minimum of one cycle of operation (sampling, analyzing, and data recording) for each successive 15-minute period or shall meet equivalent specifications established by mutual agreement of the District, the ARB and the EPA. [District Rule 1080 and 40 CFR 60.4345(b)]

Section 60.4350 – CEMS Data and Excess $NO_X$ Emissions:

Section 60.4350 states that for purposes of identifying excess emissions:

(a) All CEMS data must be reduced to hourly averages as specified in §60.13(h).

(b) For each unit operating hour in which a valid hourly average, as described in §60.4345(b), is obtained for both $NO_X$ and diluent monitors, the data acquisition and handling system must calculate and record the hourly $NO_X$ emission rate in units of ppm or lb/MMBtu, using the appropriate equation from Method 19 in Appendix A of this part. For any hour in which the hourly average $O_2$ concentration exceeds 19.0 percent $O_2$ (or the hourly average $CO_2$ concentration is less than 1.0 percent $CO_2$), a diluent cap value of 19.0 percent $O_2$ or 1.0 percent $CO_2$ (as applicable) may be used in the emission calculations.

(c) Correction of measured $NO_X$ concentrations to 15 percent $O_2$ is not allowed.

(d) If you have installed and certified a $NO_X$ diluent CEMS to meet the requirements of Part 75 of this chapter, states can approve that only quality assured data from the CEMS shall be used to identify excess emissions under this subpart. Periods where the missing data substitution procedures in Subpart D of Part 75 are applied are to be reported as monitor downtime in the excess emissions and monitoring performance report required under §60.7(c).

(e) All required fuel flow rate, steam flow rate, temperature, pressure, and megawatt data must be reduced to hourly averages.

(f) Calculate the hourly average $NO_X$ emission rates, in units of the emission standards under §60.4320, using either ppm for units complying with the concentration limit or the equations 1 (simple cycle turbines) or 2 (combined cycle turbines) listed in §60.4350, paragraph (f).

Avenal Power Center is proposing to monitor the $NO_X$ emissions rates from the turbines with a CEMS. The CEMS system will be used to determine if, and when, any excess $NO_X$ emissions are released to the atmosphere from the turbine exhaust stacks. The CEMS will be operated in accordance with the methods and procedures described above. Therefore, the proposed turbines will be operating in compliance with the requirements of this section. The following condition will ensure continued compliance with the requirements of this section:

- Results of continuous emissions monitoring shall be reduced according to the procedure established in 40 CFR, Part 51, Appendix P, paragraphs 5.0 through 5.3.3, or by other methods deemed equivalent by mutual agreement with the District, the ARB, and the EPA. [District Rule 1080]

Section 60.4355 – Parameter Monitoring Plan:

This section sets forth the requirements for operators that elect to continuously monitor parameters in lieu of installing a CEMS for $NO_X$ emissions. As discussed above, Avenal Power Center is proposing to install CEMS on each of these turbines that will directly measure $NO_X$ emissions. Therefore, the requirements of this section are not applicable and no further discussion is required.

Sections 60.4360, 60.4365 and 60.4370 – Monitoring of Fuel Sulfur Content:

Section 60.4360 states that an operator must monitor the total sulfur content of the fuel being fired in the turbine, except as provided in §60.4365. The sulfur content of the fuel must be determined using total sulfur methods described in §60.4415. Alternatively, if the total sulfur content of the gaseous fuel during the most recent performance test was less than half the applicable limit, ASTM D4084, D4810, D5504, or D6228, or Gas Processors Association Standard 2377 (all of which are incorporated by reference, see §60.17), which measure the major sulfur compounds, may be used.

Section 60.4365 states that an operator may elect not to monitor the total sulfur content of the fuel combusted in the turbine, if the fuel is demonstrated not to exceed potential sulfur emissions of 26 ng $SO_2$/J (0.060 lb $SO_2$/MMBtu) heat input for units located in continental areas and 180 ng $SO_2$/J (0.42 lb $SO_2$/MMBtu) heat input for units located in noncontinental areas or a continental area that the Administrator determines does not have access to natural gas and that the removal of sulfur compounds would cause more environmental harm than benefit. You must use one of the following sources of information to make the required demonstration:

(a) The fuel quality characteristics in a current, valid purchase contract, tariff sheet or transportation contract for the fuel, specifying that the maximum total sulfur content for oil use in continental areas is 0.05 weight percent (500 ppmw) or less and 0.4 weight percent (4,000 ppmw) or less for noncontinental areas, the total sulfur content for natural gas use in continental areas is 20 grains of sulfur or less per 100 standard cubic feet and 140 grains of sulfur or less per 100 standard cubic feet for noncontinental areas, has potential sulfur emissions of less than less than 26 ng $SO_2$/J (0.060 lb $SO_2$/MMBtu) heat input for continental areas and has potential sulfur emissions of less than less than 180 ng $SO_2$/J (0.42 lb $SO_2$/MMBtu) heat input for noncontinental areas; or

(b) Representative fuel sampling data which show that the sulfur content of the fuel does not exceed 26 ng $SO_2$/J (0.060 lb $SO_2$/MMBtu) heat input for continental areas or 180 ng $SO_2$/J (0.42 lb $SO_2$/MMBtu) heat input for noncontinental areas. At a minimum, the amount of fuel sampling data specified in section 2.3.1.4 or 2.3.2.4 of Appendix D to Part 75 of this chapter is required.

Avenal Power Center is proposing to operate these turbines on natural gas that contains a maximum sulfur content of 1.0 grains/100 scf. Primarily, the natural gas supplier should be able to provide a purchase contract, tariff sheet or transportation contract for the fuel that demonstrates compliance with the natural gas sulfur content limit. However, Avenal Power Center has asked that the option of either using a purchase contract, tariff sheet or transportation contract or actually physically monitoring the sulfur content be incorporated into their permit.

Section 60.4370 states that the frequency of determining the sulfur content of the fuel must be as follows:

(a) *Fuel oil.* For fuel oil, use one of the total sulfur sampling options and the associated sampling frequency described in sections 2.2.3, 2.2.4.1, 2.2.4.2, and 2.2.4.3 of Appendix D to Part 75 of this chapter (*i.e.*, flow proportional sampling, daily sampling, sampling from the unit's storage tank after each addition of fuel to the tank, or sampling each delivery prior to combining it with fuel oil already in the intended storage tank).

(b) *Gaseous fuel.* If you elect not to demonstrate sulfur content using options in §60.4365, and the fuel is supplied without intermediate bulk storage, the sulfur content value of the gaseous fuel must be determined and recorded once per unit operating day.

(c) *Custom schedules.* Notwithstanding the requirements of paragraph (b) of this section, operators or fuel vendors may develop custom schedules for determination of the total sulfur content of gaseous fuels, based on the design and operation of the affected facility and the characteristics of the fuel supply. Except as provided in paragraphs (c)(1) and (c)(2) of this section, custom schedules shall be substantiated with data and shall be approved by the Administrator before they can be used to comply with the standard in §60.4330.

When actually required to physically monitor the sulfur content in the fuel burned in these turbines, Avenal Power Center is proposing a custom monitoring schedule. The District and EPA have previously approved a custom monitoring schedule of at least one per week. Then, if compliance with the fuel sulfur content limit is demonstrated for eight consecutive weeks, the monitoring frequency shall be at least once every six months. If any six month monitoring period shows an exceedance, weekly monitoring shall resume. Avenal Power Center is proposing to follow this same pre-approved fuel sulfur content monitoring scheme for the turbines. The following condition will ensure continued compliance with the requirements of this section:

- The sulfur content of each fuel source shall be: (i) documented in a valid purchase contract, a supplier certification, a tariff sheet or transportation contract or (ii) monitored within 60 days of the end of the commission period and weekly thereafter. If the sulfur content is demonstrated to be less than 1.0 gr/100 scf for eight consecutive weeks, then the monitoring frequency shall be every six months. If the result of any six month monitoring demonstrates that the fuel does not meet the fuel sulfur content limit, weekly monitoring shall resume. [District Rule 2201 and 40 CFR 60.4360, 60.4365(a) and 60.4370(c)]

Section 60.4380 – Excess $NO_X$ Emissions:

Section 60.4380 establishes reporting requirements for periods of excess emissions and monitor downtime. Paragraph (a) lists requirements for operators choosing to monitor parameters associated with water or steam to fuel ratios. As discussed above, Avenal Power Center is not proposing to monitor parameters associated with water or steam to fuel ratios to predict what the $NO_X$ emissions from the turbines will be. Therefore, the requirements of this paragraph are not applicable and no further discussion is required.

Paragraph (b) states that for turbines using CEM's:

(1) An excess emissions is any unit operating period in which the 4-hour or 30-day rolling average $NO_X$ emission rate exceeds the applicable emission limit in §60.4320. For the purposes of this subpart, a "4-hour rolling average $NO_X$ emission rate" is the arithmetic average of the average $NO_X$ emission rate in ppm or ng/J (lb/MWh) measured by the continuous emission monitoring equipment for a given hour and the three unit operating hour average $NO_X$ emission rates immediately preceding that unit operating hour. Calculate the rolling average if a valid $NO_X$ emission rate is obtained for at least 3 of the 4 hours. For the purposes of this subpart, a "30-day rolling average $NO_X$ emission rate" is the arithmetic average of all hourly $NO_X$ emission data in ppm or ng/J (lb/MWh) measured by the continuous emission monitoring equipment for a given day and the twenty-nine unit operating days immediately preceding that unit operating day. A new 30-day average is calculated each unit operating day as the average of all hourly $NO_X$ emissions rates for the preceding 30 unit operating days if a valid $NO_X$ emission rate is obtained for at least 75 percent of all operating hours.

(2) A period of monitor downtime is any unit operating hour in which the data for any of the following parameters are either missing or invalid: $NO_X$ concentration, CO2 or $O_2$ concentration, fuel flow rate, steam flow rate, steam temperature, steam pressure, or megawatts. The steam flow rate, steam temperature, and steam pressure are only required if you will use this information for compliance purposes.

(3) For operating periods during which multiple emissions standards apply, the applicable standard is the average of the applicable standards during each hour. For hours with multiple emissions standards, the applicable limit for that hour is determined based on the condition that corresponded to the highest emissions standard.

Paragraph (c) lists requirements for operators who choose to monitor combustion parameters that document proper operation of the $NO_X$ emission controls. Avenal Power Center is not proposing to monitor combustion parameters that document proper operation of the $NO_X$ emission controls. Therefore, the requirements of this paragraph are not applicable and no further discussion is required.

The following condition will ensure continued compliance with the requirements of this section:

- Excess emissions shall be defined as any operating hour in which the 4-hour or 30-day rolling average $NO_X$ concentration exceeds applicable emissions limit and a period of monitor downtime shall be any unit operating hour in which sufficient data are not obtained to validate the hour for either $NO_X$ or O2 (or both). [40 CFR 60.4380(b)(1)]

Section 60.4385 – Excess $SO_X$ Emissions:

Section 60.4385 states that if an operator chooses the option to monitor the sulfur content of the fuel, excess emissions and monitoring downtime are defined as follows:

(a) For samples of gaseous fuel and for oil samples obtained using daily sampling, flow proportional sampling, or sampling from the unit's storage tank, an excess emission occurs each unit operating hour included in the period beginning on the date and hour of any sample for which the sulfur content of the fuel being fired in the combustion turbine exceeds the applicable limit and ending on the date and hour that a subsequent sample is taken that demonstrates compliance with the sulfur limit.

(b) If the option to sample each delivery of fuel oil has been selected, you must immediately switch to one of the other oil sampling options (i.e., daily sampling, flow proportional sampling, or sampling from the unit's storage tank) if the sulfur content of a delivery exceeds 0.05 weight percent. You must continue to use one of the other sampling options until all of the oil from the delivery has been combusted, and you must evaluate excess emissions according to paragraph (a) of this section. When all of the fuel from the delivery has been burned, you may resume using the as-delivered sampling option.

(c) A period of monitor downtime begins when a required sample is not taken by its due date. A period of monitor downtime also begins on the date and hour of a required sample, if invalid results are obtained. The period of monitor downtime ends on the date and hour of the next valid sample.

Avenal Power Center will be following the definitions and procedures specified above for determining periods of excess $SO_X$ emissions. Therefore, the proposed turbines will be operating in compliance with the requirements of this section.

Sections 60.4375, 60.4380, 60.4385 and 60.4395 – Reporting:

These sections establish the reporting requirements for each turbine. These requirements include methods and procedures for submitting reports of monitoring parameters, annual performance tests, excess emissions and periods of monitor downtime. Avenal Power Center is proposing to maintain records and submit reports in accordance with the requirements specified in these sections. Therefore, the proposed turbines will be operating in compliance with the requirements of this section. The following condition will ensure continued compliance with the requirements of this section:

- The owner or operator shall submit a written report of CEM operations for each calendar quarter to the APCO. The report is due on the 30th day following the end of the calendar quarter and shall include the following: Time intervals, data and magnitude of excess $NO_X$ emissions, nature and the cause of excess (if known), corrective actions taken and preventative measures adopted; Averaging period used for data reporting corresponding to the averaging period specified in the emission test period and used to determine compliance with an emissions standard; Applicable time and date of each period during which the CEM was inoperative (monitor downtime), except for zero and span checks, and the nature of system repairs and adjustments; A negative declaration when no excess emissions occurred. [District Rule 1080 and 40 CFR 60.4375(a) and 60.4395]

Section 60.4400 – $NO_X$ Performance Testing:

Section 60.4400, paragraph (a) states that an operator must conduct an initial performance test, as required in §60.8. Susequent $NO_X$ performance tests shall be conducted on an annual basis (no more than 14 calendar months following the previous performance test).

Paragraphs (1), (2) and (3) set fourth the requirements for the methods that are to be used during source testing.

Avenal Power Center will be required to source test the exhaust of these turbines within 120 days of initial startup and at least once every 12 months thereafter. They will be required to source test in accordance with the methods and procedures specified in paragraphs (1), (2), and (3). Therefore, the proposed turbines will be operating in compliance with the requirements of this section. The following conditions will ensure continued compliance with the requirements of this section:

- Source testing to determine compliance with the NOx, CO and VOC emission rates (lb/hr and ppmvd @ 15% $O_2$), NH3 emission rate (ppmvd @ 15% $O_2$) and $PM_{10}$ emission rate (lb/hr) shall be conducted at least once every 12 months. [District Rules 1081, 2201 and 4703 and 40 CFR 60.4400(a)]

- The following test methods shall be used: $NO_X$ - EPA Method 7E or 20; CO - EPA Method 10 or 10B; VOC - EPA Method 18 or 25; PM10 - EPA Method 5 (front half and back half) or 201 and 202a; ammonia - BAAQMD ST-1B; and $O_2$ - EPA Method 3, 3A, or 20. EPA approved alternative test methods as approved by the District may also be used to address the source testing requirements of this permit. [District Rules 1081 and 4703 and 40 CFR 60.4400(1)(i)]

Section 60.4405 – Initial CEMS Relative Accuracy Testing:

Section 60.4405 states that if you elect to install and certify a $NO_X$-diluent CEMS, then the initial performance test required under §60.8 may be performed in the alternative manner described in paragraphs (a), (b), (c) and (d). Avenal Power Center has not indicated that they would like to perform the initial performance test of the CEMS using the alternative methods described in this section. Therefore, the requirements of this section are not applicable and no further discussion is required.

Section 60.4410 – Parameter Monitoring Ranges:

Section 60.4410 sets fourth requirements for operators that elect to monitor combustion parameters or parameters indicative of proper operation of $NO_X$ emission controls. As discussed above, Avenal Power Center is proposing to install a CEMS system to monitor the $NO_X$ emissions from each of these turbines and is not proposing to monitor combustion parameters or parameters indicative of proper operation. Therefore, the requirements of this section are not applicable and no further discussion is required.

Section 60.4415– $SO_X$ Performance Testing:

Section 60.4415 states that an operator must conduct an initial performance test, as required in §60.8. Subsequent $SO_2$ performance tests shall be conducted on an annual basis (no more than 14 calendar months following the previous performance test). There are three methodologies that you may use to conduct the performance tests.

(1) If you choose to periodically determine the sulfur content of the fuel combusted in the turbine, a representative fuel sample would be collected following ASTM D5287 (incorporated by reference, see §60.17) for natural gas or ASTM D4177 (incorporated by reference, see §60.17) for oil. Alternatively, for oil, you may follow the procedures for manual pipeline sampling in section 14 of ASTM D4057 (incorporated by reference, see §60.17). The fuel analyses of this section may be performed either by you, a service contractor retained by you, the fuel vendor, or any other qualified agency. Analyze the samples for the total sulfur content of the fuel using:

(i) For liquid fuels, ASTM D129, or alternatively D1266, D1552, D2622, D4294, or D5453 (all of which are incorporated by reference, see §60.17); or

(ii) For gaseous fuels, ASTM D1072, or alternatively D3246, D4084, D4468, D4810, D6228, D6667, or Gas Processors Association Standard 2377 (all of which are incorporated by reference, see §60.17).

Avenal Power Center is proposing to periodically determine the sulfur content of the fuel combusted in each of these turbines when valid purchase contracts, tariff sheets or transportation contract is not available. The sulfur content will be determined using the methods specified above. Therefore, the proposed turbines will be operating in compliance with the requirements of this section. The following condition will ensure continued compliance with the requirements of this section:

- Fuel sulfur content shall be monitored using one of the following methods: ASTM Methods D1072, D3246, D4084, D4468, D4810, D6228, D6667 or Gas Processors Association Standard 2377. [40 CFR 60.4415(a)(1)(i)]

Methodologies (2) and (3) are applicable to operators that elect to measure the $SO_2$ concentration in the exhaust stream. Avenal Power Center is not proposing to measure the $SO_2$ in the exhaust stream of the turbines. Therefore, the requirements of these methodologies are not applicable and no further discussion is required.

Conclusion:

Conditions will be incorporated into these permits in order to ensure compliance with each applicable section of this subpart. Therefore, compliance with the requirements of Subpart KKKK is expected and no further discussion is required.

### *Rule 4002 National Emissions Standards for Hazardous Air Pollutants (NESHAP)*

**40 CFR 63 Subpart ZZZZ**

Subpart ZZZZ establishes national emission limitations and operating limitations for hazardous air pollutants (HAP) emitted from stationary reciprocating internal combustion engines (RICE) located at major and area sources of HAP emissions. This subpart also establishes requirements to demonstrate initial and continuous compliance with the emission limitations and operating limitations.

§6585(b) states, "A major source of HAP emissions is a plant site that emits or has the potential to emit any single HAP at a rate of 10 tons (9.07 megagrams) or more per year or any combination of HAP at a rate of 25 tons (22.68 megagrams) or more per year, except that for oil and gas production facilities, a major source of HAP emissions is determined for each surface site."

§6585(c) states, "An area source of HAP emissions is a source that is not a major source."

The facility is not a major source as defined in §6585(b). Therefore, this facility is an area source of HAP emissions.

§6590(a) states, "An affected source is any existing, new, or reconstructed stationary RICE located at a major or area source of HAP emissions, excluding stationary RICE being tested at a stationary RICE test cell/stand." Since the engines in this project are new stationary RICE's at an area source of HAP emissions, they are defined as affected sources.

§6590(a)(2) defines the criteria for an new stationary RICE as follows:

> (i) A stationary RICE with a site rating of more than 500 brake HP located at a major source of HAP emissions is new if you commenced construction of the stationary RICE on or after December 19, 2002.
>
> (ii) A stationary RICE with a site rating of equal to or less than 500 brake HP located at a major source of HAP emissions is new if you commenced construction of the stationary RICE on or after June 12, 2006.
>
> (iii) A stationary RICE located at an area source of HAP emissions is new if you commenced construction of the stationary RICE on or after June 12, 2006.

This facility is an area source of HAP emissions. The engines at this facility have not been constructed and therefore meets the definition of an new stationary RICE as defined in §6590(a)(2)(iii).

§6590(b)(1) states that an affected source which meets either of the criteria in paragraphs (b)(1)(i) through (ii) of this section does not have to meet the requirements of this subpart and of subpart A of this part except for the initial notification requirements of §63.6645(f).

> (i) The stationary RICE is a new or reconstructed emergency stationary RICE with a site rating of more than 500 brake HP located at a major source of HAP emissions.
>
> (ii) The stationary RICE is a new or reconstructed limited use stationary RICE with a site rating of more than 500 brake HP located at a major source of HAP emissions.

Since the enignes in this project are not located at a major source of HAP emissions they do not qualify for the limited requirements stated above.

§6590(b)(2) and (3) apply to landfill or digester gas fired RICE's and existing RICE's. Since the engines in ths project are not exsiting RICE's and are fired on diesel fuel or natural gas, these sections do not apply to the RICE's in this project.

§6590(c) states that an affected source that is listed below must meet the requirements of this part by meeting the requirements of 40 CFR part 60 subpart IIII, for compression ignition engines or 40 CFR part 60 subpart JJJJ, for spark ignition engines. No further requirements apply for such engines under this part.

- new or reconstructed stationary RICE located at an area source,
- new or reconstructed stationary RICE located at a major source of HAP emissions and is a spark ignition 2 stroke lean burn (2SLB) stationary RICE with a site rating of less than 500 brake HP, a spark ignition 4 stroke lean burn (4SLB) stationary RICE with a site rating of less than 250 brake HP, or a 4 stroke rich burn (4SRB) stationary RICE with a site rating of less than or equal to 500 brake HP, a stationary RICE with a site rating of less than or equal to 500 brake HP which combusts landfill or digester gas equivalent to 10 percent or more of the gross heat input on an annual basis, an emergency or limited use stationary RICE with a site rating of less than or equal to 500 brake HP,
- or a compression ignition (CI) stationary RICE with a site rating of less than or equal to 500 brake HP,

Since both the RICE's in this project are new stationary RICE's located at an area source, they will demonstrate compliance with this Subpart by demonstrating compliance with the requirements of 40 CFR part 60 subpart IIII and for compression ignition engines and 40 CFR part 60 subpart JJJJ for spark ignited engines. As shown previously in this evaluation, the RICE's in this project meet the requirements of 40 CFR part 60 subpart IIII and subpart JJJJ; therefore they meet the requirements of this subpart.

### *Rule 4101 Visible Emissions*

Per Section 5.0, no person shall discharge into the atmosphere emissions of any air contaminant aggregating more than 3 minutes in any hour which is as dark as or darker than Ringelmann 1 (or 20% opacity).

#### i. C-3953-10-1 and C-3953-11-1 (Turbines)

The following condition will be listed on the DOC to ensure compliance:

- {15} No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1 or 20% opacity. [District Rule 4101]

#### ii. C-3953-12-1 (Boiler)

Based on past experiences with natural gas-fired boilers, no visible emissions are expected to be as dark as or darker than Ringelmann 1 (or 20% opacity). The following condition will be placed on the DOC to assure compliance with this rule.

- {15} No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1 or 20% opacity. [District Rule 4101]

**iii. C-3953-13-1 (Diesel IC engine powering fire water pump)**

The following condition will be listed on the DOC to ensure compliance:

- {15} No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1 or 20% opacity. [District Rule 4101]

**iv. C-3953-14-1 (Natural gas IC engine electrical generator)**

The following condition will be listed on the DOC to ensure compliance:

- {15} No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1 or 20% opacity. [District Rule 4101]

***Rule 4102 Nuisance***

Section 4.0 prohibits discharge of air contaminants which could cause injury, detriment, nuisance or annoyance to the public. Public nuisance conditions are not expected as a result of these operations, provided the equipment is well maintained as required by permit conditions. Therefore, the following condition will be added to the permit to assure compliance with this rule.

- {98} No air contaminant shall be released into the atmosphere which causes a public nuisance. [District Rule 4102]

**A. California Health & Safety Code 41700 (Health Risk Analysis)**

A Health Risk Assessment (HRA) is required for any increase in hourly or annual emissions of hazardous air pollutants (HAPs). HAPs are limited to substances included on the list in CH&SC 44321 and that have an OEHHA approved health risk value. The installation of the permit units for the power plant results in increases in emissions of HAPs.

A health risk screening assessment was performed for the proposed project. The acute and chronic hazard indices were less than 1.0 and the cancer risk was less than one in a million. Under the District's risk management policy, Policy APR 1905, TBACT is not required for any proposed emissions unit as shown in the table below:

| Screen HRA Summary | | | | |
|---|---|---|---|---|
| | Acute Hazard Index | Chronic Hazard Index | 70 yr Cancer Risk | T-BACT Required? |
| C-3953-10-1 (Turbine #1) | 0.0 | 0.0 | 0.02 | No |
| C-3953-11-1 (Turbine #2) | 0.0 | 0.0 | 0.02 | No |
| C-3953-12-1 (Auxiliary Boiler) | 0.0 | 0.0 | 0.01 | No |
| C-3953-13-1 (Diesel-Fired IC Engine Fire Pump) | N/A* | N/A* | 0.01 | No |
| C-3953-14-1 (NG-Fired IC Engine Generator) | 0.2 | 0.0 | 0.0 | No |

* Acute and Chronic Hazard Indices were not calculated since there is not a risk factor or the risk factor is so low that it has been determined to be insignificant for this type of unit.

## B. Discussion of Toxics BACT (TBACT)

TBACT is triggered if the cancer risk exceeds one in one million and if either the chronic or acute hazard index exceeds 1. The results of the health risk assessment show that none of the TBACT thresholds are exceeded. TBACT is not triggered.

### *Rule 4201 Particulate Matter Concentration*

Section 3.1 prohibits discharge of dust, fumes, or total particulate matter into the atmosphere from any single source operation in excess of 0.1 grain per dry standard cubic foot.

### i. C-3953-10-1 and –11-1 (Turbines)

*PM Conc. (gr/scf) = (PM emission rate) x (7000 gr/lb)*

$PM_{10}$ emission rate = 11.78 lb/hr. Assuming 100% of PM is $PM_{10}$
Exhaust Gas Flow = 1,071,653 dscfm

PM Conc. (gr/scf)=[(11.78 lb/hr) * (7,000 gr/lb)] ÷ [(1,071,653 $ft^3$/min) * (60 min/hr)]
PM Conc. = 0.0012 gr/scf

Calculated emissions are well below the allowable emissions level. It can be assumed that emissions from all these turbines will not exceed the allowable 0.1 gr/scf. Therefore, compliance with Rule 4201 is expected.

- {14} Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201]

### ii. C-3953-12-1 (Boiler)

Section 3.1 prohibits discharge of dust, fumes, or total particulate matter into the atmosphere from any single source operation in excess of 0.1 grain per dry standard cubic foot.

F-Factor for NG: 8,578 dscf/MMBtu at 60 °F
PM10 Emission Factor: 0.005 lb-PM10/MMBtu
Percentage of PM as PM10 in Exhaust: 100%
Exhaust Oxygen ($O_2$) Concentration: 3%
Excess Air Correction to F Factor = $\frac{20.9}{(20.9 - 3)}$ = 1.17

$$GL = \left( \frac{0.005\ lb - PM}{MMBtu} \times \frac{7{,}000\ grain}{lb - PM} \right) / \left( \frac{8{,}578\ ft^3}{MMBtu} \times\ 1.17 \right)$$

$$GL = 0.0035\ grain/dscf < 0.1\ grain/dscf$$

Therefore, compliance with District Rule 4201 requirements is expected and a permit condition will be listed on the permit as follows:

- {14} Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201]

### iii. C-3953-13-1 (Diesel IC engine fire pump)

Particulate matter emissions from the engine will be less than or equal to the rule limit of 0.1 grain per cubic foot of gas at dry standard conditions as shown by the following:

$$0.059\ \frac{g - PM_{10}}{bhp - hr} \times \frac{1g - PM}{0.96g - PM_{10}} \times \frac{1\,bhp - hr}{2{,}542.5\ Btu} \times \frac{10^6\ Btu}{9{,}051\ dscf} \times \frac{0.35\ Btu_{out}}{1\ Btu_{in}} \times \frac{15.43\ grain}{g} = \quad 0.014\ \frac{grain - PM}{dscf}$$

Since 0.014 grain-PM/dscf is ≤ to 0.1 grain per dscf, compliance with Rule 4201 is expected.

Therefore, the following condition will be listed on the DOC to ensure compliance:

- {14} Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201]

**iv. C-3953-14-1 (Natural gas IC engine electrical generator)**

Particulate matter emissions from the engine will be less than or equal to the rule limit of 0.1 grain per cubic foot of gas at dry standard conditions as shown by the following:

$$0.034 \quad \frac{g-PM_{10}}{bhp-hr} \times \frac{1g-PM}{0.96g-PM_{10}} \times \frac{1\,bhp-hr}{2{,}542.5\,Btu} \times \frac{10^6\,Btu}{9{,}051\,dscf} \times \frac{0.35\,Btu_{out}}{1\,Btu_{in}} \times \frac{15.43\,grain}{g} = \quad 0.008 \quad \frac{grain-PM}{dscf}$$

Since 0.008 grain-PM/dscf is ≤ to 0.1 grain per dscf, compliance with Rule 4201 is expected.

Therefore, the following condition will be listed on the DOC to ensure compliance:

- {14} Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201]

***Rule 4202 Particulate Matter Emission Rate***

Rule 4202 establishes PM emission limits as a function of process weight rate in tons/hr. Gas and liquid fuels are excluded from the definition of process weight. Therefore, Rule 4202 does not apply to any of the permit units in this project, and no further discussion is required.

**Rule 4301 *Fuel Burning Equipment***

Rule 4301 limits air contaminant emissions from fuel burning equipment as defined in the rule. Section 3.1 defines fuel burning equipment as "any furnace, boiler, apparatus, stack, and all appurtenances thereto, used in the process of burning fuel for the primary purpose of producing heat or power by indirect heat transfer".

**i. C-3953-10-1 and C-3953-11-1 (Turbines)**

The CTG's primarily produce power mechanically, i.e. the products of combustion pass across the power turbine blades which causes the turbine shaft to rotate. The turbine shaft is coupled to an electrical generator shaft which is rotated to produce electricity. Because the CTG's primarily produce power by mechanical means, it does not meet the definition of fuel burning equipment. Therefore, Rule 4301 does not apply to the affected equipment and no further discussion is required.

**ii. C-3953-12-1 (Boiler)**

| District Rule 4301 Limits | | | |
|---|---|---|---|
| **Pollutant** | **$NO_2$** | **Total PM** | **$SO_2$** |
| C-3953-12-1 (lb/hr) | 0.41 | 0.19 | 0.10 |
| Rule Limit (lb/hr) | 140 | 10 | 200 |

The above table indicates compliance with the maximum lb/hr emissions in this rule; therefore, continued compliance is expected.

**iii. C-3953-13-1 (Diesel IC engine fire pump)**

Rule 4301 does not apply to the affected equipment and no further discussion is required.

**iv. C-3953-14-1 (Natural gas IC engine electrical generator)**

Rule 4301 does not apply to the affected equipment and no further discussion is required.

***Rule 4304 Tuning Procedure for Boilers, Steam Generators and Process Heaters***

This rule is only applicable to unit C-3953-12-1.

Pursuant to District Rules 4305 and 4306, Section 6.3.1, the boiler is not required to tune since it follows a District approved Alternate Monitoring scheme where the applicable emission limits are periodically monitored. Therefore, the unit is not subject to this rule.

***Rule 4305 Boilers Steam Generators and Process Heaters – Phase 2***

This rule is only applicable to unit C-3953-12-1.

The unit is natural gas-fired with a maximum heat input of 37.4 MMBtu/hr. Pursuant to Section 2.0 of District Rule 4305, the unit is subject to District Rule 4305, *Boilers, Steam Generators and Process Heaters – Phase 2.*

In addition, the unit is also subject to District Rule 4306, *Boilers, Steam Generators and Process Heaters – Phase 3.*

Since emissions limits of District Rule 4306 and all other requirements are equivalent or more stringent than District Rule 4305 requirements, compliance with District Rule 4306 requirements will satisfy requirements of District Rule 4305.

**Conclusion**

Therefore, compliance with District Rule 4305 requirements is expected and no further discussion is required.

***Rule 4306 Boilers Steam Generators and Process Heaters – Phase 3***

This rule is only applicable to unit C-3953-12-1.

The unit is natural gas-fired with a maximum heat input of 37.4 MMBtu/hr. Pursuant to Section 2.0 of District Rule 4306, the unit is subject to District Rule 4306.

**Section 5.1, $NO_X$ and CO Emissions Limits**

Section 5.1.1 requires that except for units subject to Sections 5.2, $NO_X$ and carbon monoxide (CO) emissions shall not exceed the limits specified in the following table. All ppmv emission limits specified in this section are referenced at dry stack gas conditions and 3.00 percent by volume stack gas oxygen. Emission concentrations shall be corrected to 3.00 percent oxygen in accordance with Section 8.1.

With a maximum heat input of 37.4 MMBtu/hr, the applicable emission limit category is listed in Section 5.1.1, Table 1, Category B, from District Rule 4306.

| Rule 4306 Emissions Limits | | | | |
|---|---|---|---|---|
| Category | Operated on gaseous fuel | | Operated on liquid fuel | |
| | $NO_X$ Limit | CO Limit | $NO_X$ Limit | CO Limit |
| B. Units with a rated heat input greater than 20.0 MMBtu/hr, except for categories C, D, E, F, G, H, and I units | 9 ppmv or 0.011 lb/MMBtu | 400 ppmv | 40 ppmv or 0.052 lb/MMBtu | 400 ppmv |

For the unit:

- the proposed $NO_x$ emission factor is 9 ppmvd @ 3% $O_2$ (0.011 lb/MMBtu), and
- the proposed CO emission factor is 50 ppmvd @ 3% $O_2$ (0.037 lb/MMBtu).

Therefore, compliance with Section 5.1 of District Rule 4306 is expected.

A permit condition listing the emissions limits will be listed on permit as shown in the DEL section above.

**Section 5.2, Low Use**

The unit annual heat input will exceed the 9 billion Btu heat input per calendar year criteria limit addressed by this section. Since the unit is not subject to Section 5.2, the requirements of this section do not apply to the unit.

**Section 5.3, Startup and Shutdown Provisions**

Section 5.3 states that on and after the full compliance schedule specified in Section 7.1, the applicable emission limits of Sections 5.1, 5.2.2 and 5.2.3 shall not apply during start-up or shutdown provided an operator complies with the requirements specified in Sections 5.3.1 through 5.3.4.

According to boiler manufacturers, low $NO_X$ burners will achieve their rated emissions within one to two minutes of initial startup and do not require a special shutdown procedure. Because of the short duration before achieving the rated emission factor following startup, the unit will be subject to the applicable emission limits of Sections 5.1, 5.2.2 and 5.2.3 while in operation.

**Section 5.4, Monitoring Provisions**

Section 5.4.2 requires that permit units subject to District Rule 4306, Section 5.1 emissions limits shall either install and maintain Continuous Emission Monitoring (CEM) equipment for $NO_X$, CO and $O_2$, or install and maintain APCO-approved alternate monitoring.

The facility has proposed to install a CEMS system to satisfy the requirements of this section. The following condition will assure compliance with this section.

- {1832} The exhaust stack shall be equipped with a continuous emissions monitor (CEM) for NOx, CO, and O2. The CEM shall meet the requirements of 40 CFR parts 60 and 75 and shall be capable of monitoring emissions during startups and shutdowns as well as during normal operating conditions. [District Rules 2201 and 1080]

Since the unit is not subject to the requirements listed in Section 5.2.1 or 5.2.2, it is not subject to Section 5.4.3 requirements.

Since the unit is not subject to the requirements of category H (maximum annual heat input between 9 billion and 30 billion Btu/year) listed in Section 5.1.1, it is not subject to Section 5.4.4 requirements.

**Section 5.5, Compliance Determination**

Section 5.5.1 requires that the operator of any unit shall have the option of complying with either the applicable heat input (lb/MMBtu) emission limits or the concentration (ppmv) emission limits specified in Section 5.1. The emission limits selected to demonstrate compliance shall be specified in the source test proposal pursuant to Rule 1081 (Source Sampling). Therefore, the following condition will be listed on the permit as follows:

- {2976} The source plan shall identify which basis (ppmv or lb/MMBtu) will be used to demonstrate compliance. [District Rules 4305 and 4306]

Section 5.5.2 requires that all emissions measurements shall be made with the unit operating either at conditions representative of normal operations or conditions specified in the Permit to Operate. No determination of compliance shall be established within two hours after a continuous period in which fuel flow to the unit is shut off for 30 minutes or longer, or within 30 minutes after a re-ignition as defined in Section 3.0. Therefore, the following permit condition will be listed on the permit as follows:

- {2972} All emissions measurements shall be made with the unit operating either at conditions representative of normal operations or conditions specified in the Permit to Operate. No determination of compliance shall be established within two hours after a continuous period in which fuel flow to the unit is shut off for 30 minutes or longer, or within 30 minutes after a re-ignition as defined in Section 3.0 of District Rule 4306. [District Rules 4305 and 4306]

Section 5.5.4 requires that for emissions monitoring pursuant to Sections 5.4.2, 5.4.2.1, and 6.3.1 using a portable $NO_X$ analyzer as part of an APCO approved Alternate Emissions Monitoring System, emission readings shall be averaged over a 15 consecutive-minute period by either taking a cumulative 15-consecutive-minute sample reading or by taking at least five (5) readings evenly spaced out over the 15-consecutive-minute period.

Since the applicant does not use a portable analyzer to satisfy the monitoring requirements of District Rule 4306 the requirements of Section 5.5.4 do not apply.

Section 5.5.5 requires that for emissions source testing performed pursuant to Section 6.3.1 for the purpose of determining compliance with an applicable standard or numerical limitation of this rule, the arithmetic average of three (3) 30-consecutive-minute test runs shall apply. If two (2) of three (3) runs are above an applicable limit the test cannot be used to demonstrate compliance with an applicable limit. Therefore, the following permit condition will be listed on the permit as follows:

- {2980} For emissions source testing, the arithmetic average of three 30-consecutive-minute test runs shall apply. If two of three runs are above an applicable limit the test cannot be used to demonstrate compliance with an applicable limit. [District Rules 4305 and 4306]

**Section 6.1, Recordkeeping**

Section 6.1 requires that the records required by Sections 6.1.1 through 6.1.3 shall be maintained for five calendar years and shall be made available to the APCO upon request. Failure to maintain records or information contained in the records that demonstrate noncompliance with the applicable requirements of this rule shall constitute a violation of this rule.

A permit condition will be listed on the permit as follows:

- {2983} All records shall be maintained and retained on-site for a minimum of five (5) years, and shall be made available for District inspection upon request. [District Rules 1070, 4305, and 4306]

Section 6.1.2 requires that the operator of a unit subject to Section 5.2 shall record the amount of fuel use at least on a monthly basis. Since the unit is not subject to the requirements listed in Section 5.2, it is not subject to Section 6.1.2 requirements.

Section 6.1.3 requires that the operator of a unit subject to Section 5.2.1 or 6.3.1 shall maintain records to verify that the required tune-up and the required monitoring of the operational characteristics have been performed. The unit is not subject to Section 6.1.3. Therefore, the requirements of this section do not apply to the unit.

**Section 6.2, Test Methods**

Section 6.2 identifies the following test methods as District-approved source testing methods for the pollutants listed:

| Pollutant | Units | Test Method Required |
|---|---|---|
| $NO_X$ | ppmv | EPA Method 7E or ARB Method 100 |
| $NO_X$ | lb/MMBtu | EPA Method 19 |
| CO | ppmv | EPA Method 10 or ARB Method 100 |
| Stack Gas $O_2$ | % | EPA Method 3 or 3A, or ARB Method 100 |
| Stack Gas Velocities | ft/min | EPA Method 2 |
| Stack Gas Moisture Content | % | EPA Method 4 |

The following permit conditions will be listed on the permit as follows:

- {109} Source testing shall be conducted using the methods and procedures approved by the District. The District must be notified at least 30 days prior to any compliance source test, and a source test plan must be submitted for approval at least 15 days prior to testing. [District Rule 1081]

- {2977} $NO_X$ emissions for source test purposes shall be determined using EPA Method 7E or ARB Method 100 on a ppmv basis, or EPA Method 19 on a heat input basis. [District Rules 4305 and 4306]

- {2978} CO emissions for source test purposes shall be determined using EPA Method 10 or ARB Method 100. [District Rules 4305 and 4306]

- {2979} Stack gas oxygen ($O_2$) shall be determined using EPA Method 3 or 3A or ARB Method 100. [District Rules 4305 and 4306]

**Section 6.3, Compliance Testing**

Section 6.3.1 requires that this unit be tested to determine compliance with the applicable requirements of section 5.1 and 5.2.3 not less than once every 12 months. Upon demonstrating compliance on two consecutive compliance source tests, the following source test may be deferred for up to thirty-six months.

The following permit conditions will be listed on the permit as follows:

- {3467} Source testing to measure NOx and CO emissions from this unit while fired on natural gas shall be conducted within 60 days of initial start-up. [District Rules 2201, 4305, and 4306]

- {3466} Source testing to measure NOx and CO emissions from this unit while fired on natural gas shall be conducted at least once every twelve (12) months. After demonstrating compliance on two (2) consecutive annual source tests, the unit shall be tested not less than once every thirty-six (36) months. If the result of the 36-month source test demonstrates that the unit does not meet the applicable emission limits, the source testing frequency shall revert to at least once every twelve (12) months. [District Rules 4305 and 4306]

- {110} The results of each source test shall be submitted to the District within 60 days thereafter. [District Rule 1081]

**Section 6.4, Emission Control Plan (ECP)**

Section 6.4.1 requires that the operator of any unit shall submit to the APCO for approval an Emissions Control Plan according to the compliance schedule in Section 7.0 of District Rule 4306.

The proposed modified unit will be in compliance with the emissions limits listed in table 1, Section 5.1 of this rule and with periodic monitoring and source testing requirements. Therefore, this current application for the new proposed unit satisfies the requirements of the Emission Control Plan, as listed in Section 6.4 of District Rule 4306. No further discussion is required.

**Section 7.0, Compliance Schedule**

Section 7.0 indicates that an operator with multiple units at a stationary source shall comply with this rule in accordance with the schedule specified in Table 2, Section 7.1 of District Rule 4306.

The unit will be in compliance with the emissions limits listed in table 1, Section 5.1 of this rule, and periodic monitoring and source testing as required by District Rule 4306. Therefore, requirements of the compliance schedule, as listed in Section 7.1 of District Rule 4306, are satisfied. No further discussion is required.

**Conclusion**

Conditions will be incorporated into the permit in order to ensure compliance with each section of this rule, see attached draft permit(s). Therefore, compliance with District Rule 4306 requirements is expected.

***Rule 4351 Boilers Steam Generators and Process Heaters – Phase 1***

This rule is only applicable to unit C-3953-12.

This rule applies to boilers, steam generators, and process heaters at $NO_x$ Major Sources that are not located west of Interstate 5 in Fresno, Kings, or Kern counties. If applicable, the emission limits, monitoring provisions, and testing requirements of this rule are satisfied when the unit is operated in compliance with Rule 4306. Therefore, compliance with this rule is expected.

***Rule 4701 Internal Combustion Engines – Phase 1***

This rule is only applicable to units C-3953-13-1 and –14-1.

Pursuant to Section 7.5.2.3 of District Rule 4702, as of June 1, 2006 District Rule 4701 is no longer applicable to diesel-fired emergency standby or emergency IC engines. Therefore, this diesel-fired emergency IC engine will comply with the requirements of District Rule 4702 and no further discussion is required.

***Rule 4702 Internal Combustion Engines – Phase 2***

This rule is only applicable to units C-3953-13-1 and –14-1.

The purpose of this rule is to limit the emissions of nitrogen oxides ($NO_X$), carbon monoxide (CO), and volatile organic compounds (VOC) from internal combustion engines.

This rule applies to any internal combustion engine with a rated brake horsepower greater than 50 horsepower.

Pursuant to Section 4.2, except for the requirements of Sections 5.7 and 6.2.3, the requirements of this rule shall not apply to an internal combustion engine that meets the following condition:

1) An emergency standby engine as defined in Section 3.0 of this rule, and provided that it is operated with a nonresettable elapsed operating time meter. In lieu of a nonresettable time meter, the owner of an emergency engine may use an alternative device, method, or technique, in determining operating time provided that the alternative is approved by the APCO. The owner of the engine shall properly maintain and operate the time meter or alternative device in accordance with the manufacturer's instructions.

Section 3.15 defines an "Emergency Standby Engine" as an internal combustion engine which operates as a temporary replacement for primary mechanical or electrical power during an unscheduled outage caused by sudden and reasonably unforeseen natural disasters or sudden and reasonably unforeseen events beyond the control of the operator. An engine shall be considered to be an emergency standby engine if it is used only for the following purposes: (1) periodic maintenance, periodic readiness testing, or readiness testing during and after repair work; (2) unscheduled outages, or to supply power while maintenance is performed or repairs are made to the primary power supply; and (3) if it is limited to operate 100 hours or less per calendar year for non-emergency purposes. An engine shall not be considered to be an emergency standby engine if it is used: (1) to reduce the demand for electrical power when normal electrical power line service has not failed, or (2) to produce power for the utility electrical distribution system, or (3) in conjunction with a voluntary utility demand reduction program or interruptible power contract.

Therefore, unit C-3953-14-1, the emergency standby IC engine powering an electrical generator involved with this project will only have to meet the requirements of Sections 5.7 and 6.2.3 of this Rule.

Pursuant to Section 4.3, except for the requirements of Section 6.2.3, the requirements of this rule shall not apply to an internal combustion engine that meets the following conditions:

1) The engine is operated exclusively to preserve or protect property, human life, or public health during a disaster or state of emergency, such as a fire or flood, and
2) Except for operations associated with Section 4.3.1.1, the engine is limited to operate no more than 100 hours per calendar year as determined by an operational nonresettable elapsed operating time meter, for periodic maintenance, periodic readiness testing, and readiness testing during and after repair work of the engine, and
3) The engine is operated with a nonresettable elapsed operating time meter. In lieu of installing a nonresettable time meter, the owner of an engine may use an alternative device, method, or technique, in determining operating time provided that the alternative is approved by the APCO. The owner of the engine shall properly maintain and operate the time meter or alternative device in accordance with the manufacturer's instructions.

Therefore, unit C-3953-13-1, the emergency IC engine powering a firewater pump involved with this project will only have to meet the requirements of Section 6.2.3 of this Rule.

Section 5.7 of this Rule requires that the owner of an emergency standby engine shall comply with the requirements specified in Section 5.7.2 through Section 5.7.5 below:

1) Properly operate and maintain each engine as recommended by the engine manufacturer or emission control system supplier.

2) Monitor the operational characteristics of each engine as recommended by the engine manufacturer or emission control system supplier.

3) Install and operate a nonresettable elapsed operating time meter. In lieu of installing a nonresettable time meter, the owner of an engine may use an alternative device, method, or technique, in determining operating time provided that the alternative is approved by the APCO and is allowed by Permit-to-Operate or Stationary Equipment Registration condition. The owner of the engine shall properly maintain and operate the time meter or alternative device in accordance with the manufacturer's instructions.

Therefore, the following conditions will be listed on the DOC to ensure compliance:

**C-3953-14-1 (Natural Gas IC engine electrical generator)**

- This engine shall be operated and maintained in proper operating condition as recommended by the engine manufacturer or emissions control system supplier. [District Rule 4702]

- During periods of operation for maintenance, testing, and required regulatory purposes, the permittee shall monitor the operational characteristics of the engine as recommended by the manufacturer or emission control system supplier (for example: check engine fluid levels, battery, cables and connections; change engine oil and filters; replace engine coolant; and/or other operational characteristics as recommended by the manufacturer or supplier). [District Rule 4702]

- This engine shall be equipped with an operational non-resettable elapsed time meter or other APCO approved alternative. [District Rule 4702 and 17 CCR 93115]

- An emergency situation is an unscheduled electrical power outage caused by sudden and reasonably unforeseen natural disasters or sudden and reasonably unforeseen events beyond the control of the permittee. [District Rule 4702]

- This engine shall not be used to produce power for the electrical distribution system, as part of a voluntary utility demand reduction program, or for an interruptible power contract. [District Rule 4702]

- This engine shall be operated only for testing and maintenance of the engine, required regulatory purposes, and during emergency situations. Operation of the engine for maintenance, testing, and required regulatory purposes shall not exceed 50 hours per calendar year. [District Rule 4702]

Section 6.2.3 requires that an owner claiming an exemption under Section 4.2 or Section 4.3 shall maintain annual operating records. This information shall be retained for at least five years, shall be readily available, and submitted to the APCO upon request and at the end of each calendar year in a manner and form approved by the APCO. Therefore, the following conditions will be listed on the DOC to ensure compliance:

**C-3953-13-1 (Diesel IC engine fire pump)**

- {3816} This engine shall be operated only for testing and maintenance of the engine, required regulatory purposes, and during emergency situations. For testing purposes, the engine shall only be operated the number of hours necessary to comply with the testing requirements of the National Fire Protection Association (NFPA) 25 - "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems", 1998 edition. Total hours of operation for all maintenance, testing, and required regulatory purposes shall not exceed 50 hours per calendar year. [District Rule 4702 and 17 CCR 93115]

- {3489} The permittee shall maintain monthly records of emergency and non-emergency operation. Records shall include the number of hours of emergency operation, the date and number of hours of all testing and maintenance operations, and the purpose of the operation (for example: load testing, weekly testing, rolling blackout, general area power outage, etc.). For units with automated testing systems, the operator may, as an alternative to keeping records of actual operation for testing purposes, maintain a readily accessible written record of the automated testing schedule. [District Rule 4702 and 17 CCR 93115]

- {3475} All records shall be maintained and retained on-site for a minimum of five (5) years, and shall be made available for District inspection upon request. [District Rule 4702 and 17 CCR 93115]

In addition, the following condition will be listed on the DOC to ensure compliance:

- {3404} This engine shall be equipped with an operational non-resettable elapsed time meter or other APCO approved alternative. [District Rule 4702]

- {3807} An emergency situation is an unscheduled electrical power outage caused by sudden and reasonably unforeseen natural disasters or sudden and reasonably unforeseen events beyond the control of the permittee. [District Rule 4702]

- {3808} This engine shall not be used to produce power for the electrical distribution system, as part of a voluntary utility demand reduction program, or for an interruptible power contract. [District Rule 4702]

**C-3953-14-1 (Natural Gas IC engine electrical generator)**

- The permittee shall maintain monthly records of emergency and non-emergency operation. Records shall include the number of hours of emergency operation, the date and number of hours of all testing and maintenance operations, the purpose of the operation (for example: load testing, weekly testing, rolling blackout, general area power outage, etc.) and records of operational characteristics monitoring. For units with automated testing systems, the operator may, as an alternative to keeping records of actual operation for testing purposes, maintain a readily accessible written record of the automated testing schedule. [District Rule 4702]

- All records shall be maintained and retained on-site for a minimum of five (5) years, and shall be made available for District inspection upon request. [District Rule 4702]

***Rule 4703 Stationary Gas Turbines***

This rule is only applicable to units C-3953-10-1 and -11-1.

Rule 4703 is applicable to stationary gas turbines with a rating greater than 0.3 megawatts. The facility proposes to install two 180 MW gas turbines. Therefore the requirements of this rule apply to the proposed turbines.

Section 5.1 – $NO_X$ Emission Requirements:

Section 5.1.1 (Tier I) of this rule limits the $NO_X$ emissions from stationary gas turbine systems greater than 10 MW, and equipped with Selective Catalytic Reduction (SCR). Since the proposed turbines will meet the more stringent Tier 2 emission equirements in Section 5.1.2, compliance with this section is assured.

Section 5.1.2 (Tier 2) of this rule limits the $NO_X$ emissions from combined cycle, stationary gas turbine systems rated at greater than 10 MW to 5 ppmv @ 15% $O_2$ (Standard option) and 3 ppmv @ 15% $O_2$ (Enhanced Option). Section 7.2.1 (Table 7-1) sets a compliance date of April 30, 2004 for the Standard Option and Section 7.2.4 sets a compliance date of April 30, 2008 for the Enhanced Option. As discussed above, the proposed turbines will be limited to 2.0 ppmv @ 15% $O_2$ (based on a 1-hour average), therefore compliance with this section is expected. The following conditions will ensure continued compliance with the requirements of this section:

- Emission rates from this unit (with duct burner firing), except during startup and shutdown periods, shall not exceed any of the following limits: NOx (as NO2) – 17.20 lb/hr and 2.0 ppmvd @ 15% O2; VOC (as methane) – 5.89 lb/hr and 2.0 ppmvd @ 15% O2; CO – 10.60 lb/hr and 2.0 ppmvd @ 15% O2; PM10 – 11.78 lb/hr; or SOx (as SO2) – 6.65 lb/hr. NOx (as NO2) emission limits are one hour rolling averages. All other emission limits are three hour rolling averages. [District Rules 2201, 4001, and 4703]

- Emission rates from this unit (without duct burner firing), except during startup and shutdown periods, shall not exceed any of the following limits: NOx (as NO2) - 13.55 lb/hr and 2.0 ppmvd @ 15% O2; VOC (as methane) - 3.34 lb/hr and 1.4 ppmvd @ 15% O2; CO – 8.35 lb/hr and 2.0 ppmvd @ 15% O2; PM10 – 8.91 lb/hr; or SOx (as SO2) – 5.23 lb/hr. NOx (as NO2) emission limits are one hour rolling averages. All other emission limits are three hour rolling averages. [District Rules 2201, 4001, and 4703]

Section 5.2 – CO Emission Requirements:

Per Table 5-3 of section 5.2, the CO emissions concentration from the proposed turbines (General Electric Frame 7) must be less than 25 ppmvd @ 15% $O_2$. Rule 4703 does not include a specific averaging period requirement for demonstrating compliance with the CO emission limit. However, District practice is to have an applicant demonstrate compliance with the CO emissions on a turbine with three hour averaging periods. Therefore, compliance with the CO emission limit shall be demonstrated by an average over a three hour period.

Avenal Power Center is proposing a CO emission concentration limit of 2 ppmvd @ 15% $O_2$ and will demonstrate compliance using three hour averaging periods. Therefore, the proposed turbines will be operating the turbine in compliance with the CO emission requirements of this rule. The DEL conditions shown in the Section 5.1.2 compliance section will ensure continued compliance with the requirements of this section.

Section 5.3 – Startup and Shutdown Requirements:

This section states that the emission limit requirements of Sections 5.1.1, 5.1.2 or 5.2 shall not apply during startup, shutdown, or a reduced load period provided an operator complies with the requirements specified below:

- The duration of each startup or each shutdown shall not exceed two hours, and the duration of each reduced load period shall not exceed one hour, except as provided below.
- The emission control system shall be in operation and emissions shall be minimized insofar as technologically feasible during startup, shutdown, or a reduced load period.
- An operator may submit an application to allow more than two hours for each startup or each shutdown or more than one hour for each reduced load period provided the operator meets all of the conditions specified in the rule.

Avenal Power Center is proposing to incorporate startup and shutdown provisions into the operating requirements for each of the proposed turbines. They have proposed that the duration of each startup or shutdown event will last no more than six hours per day. Since this proposed duration is longer than what is allowed in Section 5.3.1.1, the facility must meet the requirements of Section 5.3.3.2. Section 5.3.3.2 states that at a minimum, a justification for the increased duration shall include the following:

A clear identification of the control technologies or strategies to be utilized; and

The facility has identified the following control technologies:

- Dry low-NOx combustors in the turbines;
- Oxidation catalyst in the HRSGs;
- SCR in the HRSGs;
- Good combustion practices;

- Upon startup, the ammonia injection upstream of the SCR catalyst will be started as soon as the catalyst and ammonia injection system warm to their minimum operating temperatures specified by the SCR vendor.

A description of what physical conditions prevail during the period that prevent the controls from being effective; and

The combined-cycle equipment startup duration depends on how fast the thick steel walls of the common steam turbine can be warmed to operating temperature without generating stress cracks. Steam developed in the HRSG from the heated turbine exhaust is admitted into the steam turbine at a controlled temperature to heat it as rapidly as possible without causing stress cracking. The steam temperature is controlled by limiting the load on the gas turbine. The allowable rate of temperature increase at the steam turbine is the limiting factor determining how quickly the gas turbines can achieve higher loads. This, in turn, limits how quickly the gas turbine combustors can achieve the lowest emitting operating mode, and this latter step is necessary for the units to be able to comply with the limits of Rule 4703.

A reasonably precise estimate as to when the physical conditions will have reached a state that allows for the effective control of emissions; and

Startup information provided by the turbine and HRSG vendors indicates that for a cold startup, a minimum of four hours is required for the unit to come into compliance with the limits of Rule 4703. Depending on the temperature of the steam turbine at the time the start is initiated, shorter durations may be possible.

A detailed list of activities to be performed during the period and a reasonable explanation for the length of time needed to complete each activity; and

The facility has provided the District with a detailed list of activities to be performed during the period and a reasonable explanation for the length of time needed to complete each activity.

A description of the material process flow rates and system operating parameters, etc., the operator plans to evaluate during the process optimization; and an explanation of how the activities and process flow affect the operation of the emissions control equipment; and

The startup duration depends on the allowable ramp rate of the steam temperature to the steam turbine, which depends on the acceptable rate of increase of the metal temperature of the HRH and HP bowls at the steam turbine inlets. The maximum steam temperature is set by applying an allowable differential above the metal temperature. The differential is determined by the steam turbine supplier, and is imposed by the supplier's control system to avoid damage to the steam turbine from thermal stress. The control system limits gas turbine load to control the steam temperature. Manual override of the gas turbine load limit by the operator reduces the life expectancy of the steam turbine.

In addition, the time prior to initiation of ammonia flow to the SCR system depends on the temperature of the SCR catalyst. The catalyst bed is warmed by the exhaust flow from the gas turbine. The total mass of metal and water in the HRSG tubes, piping, and drums removes heat from the gas turbine exhaust as it warms. This extends the time required to heat the SCR catalyst to the minimum temperature at which ammonia may be injected upstream of the catalyst bed to begin reducing NOx to $N_2$. The steam turbine and SCR catalyst temperatures are all monitored by the plant control system, and the turbine ramp rate and SCR initiation sequence are governed by the equipment/system manufacturer's recommended procedures.

The basis for the requested additional duration.

The startup curve in Attachment I and the description of activities above demonstrate that the minimum time required for a cold startup of the plant as currently configured is approximately 4 hours. This startup time is contingent upon all of the activities being performed in time to support subsequent activities. Any delay in preparation of the supporting systems will result in a corresponding delay in startup and/or loading of the gas turbines. To be confident that the startup time allowed is adequate and will not be exceeded, one hour is added to the above startup time to account for possible delays.

Since the facility has demonstrated compliance and provided all the information asked for in Section 5.3.3.2, the proposed increase in startup and shutdown emissions is compliant with District Rule 4703. The following conditions will ensure continued compliance with the requirements of this section:

- During start-up and shutdown, CTG exhaust emission rates shall not exceed any of the following limits: $NO_X$ (as $NO_2$) – 160 lb/hr; CO – 1,000 lb/hr; VOC (as methane) – 16 lb/hr; $PM_{10}$ – 11.78 lb/hr; $SO_X$ (as $SO_2$) – 6.652 lb/hr; or $NH_3$ – 32.13 lb/hr. [District Rules 2201 and 4703]

- Startup shall be defined as the period of time during which a unit is brought from a shutdown status to its operating temperature and pressure, including the time required by the unit's emission control system to reach full operations. Shutdown shall be defined as the period of time during which a unit is taken from an operational to a non-operational status by allowing it to cool down from its operating temperature to ambient temperature as the fuel supply to the unit is completely turned off. [District Rules 2201 and 4703]

- The duration of each startup or shutdown shall not exceed six hours. Startup and shutdown emissions shall be counted toward all applicable emission limits. [District Rules 2201 and 4703]

- The emission control systems shall be in operation and emissions shall be minimized insofar as technologically feasible during startup and shutdown. [District Rule 4703]

Section 6.2 - Monitoring and Recordkeeping:

Section 6.2.1 requires the owner to operate and maintain continuous emissions monitoring equipment for $NO_X$ and oxygen, or install and maintain APCO-approved alternate monitoring. As discussed earlier in this evaluation, the applicant operates a Continuous Emissions Monitoring System (CEMS) that monitors the $NO_X$ and oxygen content of the turbine exhaust. Therefore, the requirements of this section have been satisfied. The following condition will ensure continued compliance with the requirements of this section:

- The owner or operator shall install, certify, maintain, operate and quality-assure a Continuous Emission Monitoring System (CEMS) which continuously measures and records the exhaust gas $NO_X$, CO and $O_2$ concentrations. Continuous emissions monitor(s) shall be capable of monitoring emissions during normal operating conditions, and during startups and shutdowns, provided the CEMS pass the relative accuracy requirement for startups and shutdowns specified herein. If relative accuracy of CEMS cannot be demonstrated during startup conditions, CEMS results during startup and shutdown events shall be replaced with startup emission rates obtained from source testing to determine compliance with emission limits contained in this document. [District Rules 1080 and 4703 and 40 CFR 60.4335(b)(1)]

Section 6.2.2 specifies monitoring requirements for turbines without exhaust-gas $NO_X$ control devices. Each of the proposed turbines will be equipped with an SCR system that is designed to control $NO_X$ emissions. Therefore, the requirements of this section are not applicable and no further discussion is required.

Section 6.2.3 requires that for units 10 MW and greater that operated an average of more than 4,000 hours per year over the last three years before August 18, 1994, the owner or operator shall monitor the exhaust gas $NO_X$ emissions. The proposed turbines have not been installed. Therefore, they were not in operation prior to August 18, 1994 and the requirements of this section are not applicable. No further discussion is required.

Section 6.2.4 requires the facility to maintain all records for a period of five years from the date of data entry and shall make such records available to the APCO upon request. Avenal Power Center will be required to maintain all records for at least five years and make them available to the APCO upon request. Therefore, the proposed turbines will be operating in compliance with the five year recordkeeping requirements of this rule. The following condition will ensure continued compliance with the requirements of this section:

- The owner or operator of a stationary gas turbine system shall maintain all records of required monitoring data and support information for inspection at any time for a period of five years. [District Rules 2201 and 4703]

Section 6.2.5 requires that the owner or operator shall submit to the APCO, before issuance of the Permit to Operate, information correlating the control system operating to the associated measure $NO_X$ output. This information may be used by the APCO to determine compliance when there is no continuous emission monitoring system for $NO_X$ available or when the continuous emissions monitoring system is not operating properly. Avenal Power Center will be required, by permit condition, to submit information correlating the $NO_X$ control system operating parameters to the associated measured $NO_X$ output. Therefore, the proposed turbines will be operating in compliance with the control system operating parameter requirements of this rule. The following condition will ensure continued compliance with the requirements of this section:

- The permittee shall submit to the District information correlating the $NO_X$ control system operating parameters to the associated measured $NO_X$ output. The information must be sufficient to allow the District to determine compliance with the $NO_X$ emission limits of this permit during times that the CEMS is not functioning properly. [District Rule 4703]

Section 6.2.6 requires the facility to maintain a stationary gas turbine system operating log that includes, on a daily basis, the actual local startup and stop time, length and reason for reduced load periods, total hours of operation, and the type and quantity of fuel used. Avenal Power Center will be required to maintain records of each item listed above. Therefore, the proposed turbines will be operating in compliance with the recordkeeping requirements of this rule. The following conditions will ensure continued compliance with the requirements of this section:

- The permittee shall maintain the following records: date and time, duration, and type of any startup, shutdown, or malfunction; performance testing, evaluations, calibrations, checks, adjustments, any period during which a continuous monitoring system or monitoring device was inoperative, and maintenance of any continuous emission monitor. [District Rules 2201 and 4703]

- The permittee shall maintain the following records: hours of operation, fuel consumption (scf/hr and scf/rolling twelve month period), continuous emission monitor measurements, calculated ammonia slip, and calculated NOx mass emission rates (lb/hr and lb/twelve month rolling period). [District Rules 2201 and 4703]

Section 6.2.7 establishes recordkeeping requirements for units that are exempt pursuant to the requirements of Section 4.2. Each of the proposed turbines is subject to the requirements of this rule. Therefore, the requirements of this section are not applicable and no further discussion is required.

Section 6.2.8 requires owners or operators performing startups or shutdowns to keep records of the duration of each startup and shutdown. As discussed in the Section 6.2.6 discussion above for this rule, Avenal Power Center will be required, by permit condition, to maintain records of the date, time and duration or each startup and shutdown. Therefore, the proposed turbines will be operating in compliance with the recordkeeping requirements of this rule.

Sections 6.3 and 6.4 - Compliance Testing:

Section 6.3.1 states that the owner or operator of any stationary gas turbine system subject to the provisions of Section 5.0 of this rule shall provide source test information annually regarding the exhaust gas $NO_X$ and CO concentrations. The turbines operated by Avenal Power Center are subject to the provisions of Section 5.0 of this rule. Therefore, each turbine is required to test annually to demonstrate compliance with the exhaust gas $NO_X$ and CO concentrations. The following condition will ensure continued compliance with the requirements of this section:

- Source testing to determine compliance with the NOx, CO and VOC emission rates (lb/hr and ppmvd @ 15% $O_2$), NH3 emission rate (ppmvd @ 15% $O_2$) and $PM_{10}$ emission rate (lb/hr) shall be conducted at least once every 12 months. [District Rules 1081, 2201 and 4703 and 40 CFR 60.4400(a)]

Section 6.3.2 specifies source testing requirements for units operating less than 877 hours per year. As discussed above, the proposed turbines will be allowed to operate in excess of 877 hours per year. Therefore, the requirements of this section are not applicable and no further discussion is required.

Section 6.3.3 states that units with intermittently operated auxiliary burners shall demonstrate compliance with the auxiliary burner both on and off. The following condition will ensure continued compliance with the requirements of this section:

- Compliance with the $NO_X$ and CO emission limits shall be demonstrated with the auxiliary burner both on and off. [District Rule 4703]

Section 6.4 states that the facility must demonstrate compliance annually with the $NO_X$ and CO emission limits using the following test methods, unless otherwise approved by the APCO and EPA:

- Oxides of nitrogen emissions for compliance tests shall be determined by using EPA Method 7E or EPA Method 20.

- Carbon monoxide emissions for compliance tests shall be determined by using EPA Test Methods 10 or 10B.

- Oxygen content of the exhaust gas shall be determined by using EPA Methods 3, 3A, or 20.

- HHV and LHV of gaseous fuels shall be determined by using ASTM D3588-91, ASTM 1826-88, or ASTM 1945-81.

The following condition will ensure continued compliance with the test method requirements of this section:

- The following test methods shall be used: $NO_X$ - EPA Method 7E or 20; CO - EPA Method 10 or 10B; VOC - EPA Method 18 or 25; PM10 - EPA Method 5 (front half and back half) or 201 and 202a; ammonia - BAAQMD ST-1B; and $O_2$ - EPA Method 3, 3A, or 20. EPA approved alternative test methods as approved by the District may also be used to address the source testing requirements of this permit. [District Rules 1081 and 4703 and 40 CFR 60.4400(1)(i)]

Conclusion:

Conditions will be incorporated into these permits in order to ensure compliance with each applicable section of this rule. Therefore, compliance with the requirements of Rule 4703 is expected and no further discussion is required.

### *Rule 4801 Sulfur Compounds*

Per Section 3.1, a person shall not discharge into the atmosphere sulfur compounds, which would exist as a liquid or gas at standard conditions, exceeding in concentration at the point of discharge: 0.2 % by volume calculated as $SO_2$ on a dry basis averaged over 15 consecutive minutes:

**i. C-3953-10-1 and –11-1 (Turbines)**

The sulfur of the natural gas fuel is 1.0 gr/100 dscf.

The ratio of the volume of the $SO_x$ exhaust to the entire exhaust for one MMBtu of fuel combusted is:

Volume of $SO_x$: $V = \frac{n \cdot R \cdot T}{P}$

Where:

- n = number of moles of $SO_x$ produced per MMBtu of fuel.
- Weight of $SO_x$ as $SO_2$ is 64 lb/(lb-mol)
- $n = \frac{0.00282\ lb}{MMBtu} \times \frac{1\ (lb-mol)}{64\ lb} = 0.000045\ (lb-mol)$

- $R = \frac{0.7302\, ft^3 \cdot atm}{(lb-mol)°R}$
- T = 500 °R
- P = 1 atm

Thus, volume of $SO_X$ per MMBtu is:

$$V = \frac{n \cdot R \cdot T}{P}$$

$$V = \frac{0.000045\ (lb-mol) \cdot \frac{0.7302\ ft^3 \cdot atm}{(lb-mol)\ °R} \cdot 500\ °R}{1\ atm}$$

$$V = 0.016\ ft^3$$

Since the total volume of exhaust per MMBtu is 8,578 scf, the ratio of $SO_X$ volume to exhaust volume is

$$= \frac{0.016}{8{,}578} = 0.0000019 = 1.9\ ppmv = 0.00019\%\ by\ volume$$

1.9 ppmv ≤ 2000 ppmv, therefore the turbines, the boiler, and the gas engine are expected to comply with Rule 4801.

**ii. C-3953-12-1 (Boiler)**

Using the ideal gas equation and the emission factors presented in Section VII, the sulfur compound emissions are calculated as follows:

Volume $SO_2 = \frac{n\,RT}{P}$

With:

N = moles $SO_2$
T (Standard Temperature) = 60°F = 520°R
P (Standard Pressure) = 14.7 psi
R (Universal Gas Constant) = $\frac{10.73\,psi \cdot ft^3}{lb \cdot mol \cdot °R}$

$$\frac{0.00282\,lb-SOx}{MMBtu} \times \frac{MMBtu}{8{,}578\,dscf} \times \frac{1\,lb \cdot mol}{64\,lb} \times \frac{10.73\ psi \cdot ft^3}{lb \cdot mol \cdot °R} \times \frac{520°R}{14.7\,psi} \times \frac{1{,}000{,}000 \cdot parts}{million} = 1.97\,\frac{parts}{million}$$

$$SulfurConcentration = 1.97 \frac{parts}{million} < 2{,}000 \text{ ppmv (or 0.2\%)}$$

Therefore, compliance with District Rule 4801 requirements is expected.

**iii. C-3953-13-1 (Diesel IC engine powering a fire water pump)**

Using the ideal gas equation, the sulfur compound emissions are calculated as follows:

Volume $SO_2$ = (n x R x T) ÷ P
n = moles $SO_2$
T (standard temperature) = 60 °F or 520 °R
R (universal gas constant) = $\frac{10.73 \text{ psi} \cdot \text{ft}^3}{\text{lb} \cdot \text{mol} \cdot {}^\circ\text{R}}$

$$\frac{0.000015\ lb-S}{lb-fuel} \times \frac{7.1 \text{ lb}}{\text{gal}} \times \frac{64 \text{ lb} - SO_2}{32 \text{ lb} - \text{S}} \times \frac{1 \text{ MMBtu}}{9{,}051 \text{ scf}} \times \frac{1 \text{ gal}}{0.137 \text{ MMBtu}} \times \frac{\text{lb} - \text{mol}}{64 \text{ lb} - SO_2} \times \frac{10.73 \text{ psi} - \text{ft}^3}{\text{lb} - \text{mol} - {}^\circ\text{R}} \times \frac{520^\circ\text{R}}{14.7 \text{ psi}} \times 1{,}000{,}000 = 1.0 \text{ ppmv}$$

Since 1.0 ppmv is ≤ 2,000 ppmv, this engine is expected to comply with Rule 4801. Therefore, the following condition (previously proposed in this engineering evaluation) will be listed on the DOC to ensure compliance:

- {3395} Only CARB certified diesel fuel containing not more than 0.0015% sulfur by weight is to be used. [District Rules 2201 and 4801 and 17 CCR 93115]

**iv. C-3953-14-1 (Natural gas IC engine powering an electrical generator)**

Volume $SO_2$ = (n x R x T) ÷ P
n = moles $SO_2$
T (standard temperature) = 60 °F or 520 °R
R (universal gas constant) = $\frac{10.73 \text{ psi} \cdot \text{ft}^3}{\text{lb} \cdot \text{mol} \cdot {}^\circ\text{R}}$

$$2.85 \quad \frac{lb-S}{MMscf-gas} \times \frac{1\,scf-gas}{1{,}000\,Btu} \times \frac{1\,MMBtu}{8{,}578\,scf} \times \frac{1\,lb-mol}{64\,lb-S} \times \frac{10.73\,psi-ft^3}{lb-mol-{}^\circ R} \times \frac{520^\circ R}{14.7\,psi} \times 1{,}000{,}000 = \quad 1.97 \quad \text{ppmv}$$

Since 1.97 ppmv is ≤ 2,000 ppmv, this engine is expected to comply with Rule 4801. Therefore, the following condition (previously proposed in this engineering evaluation) will be listed on the DOC to ensure compliance:

- {3491} This IC engine shall be fired on Public Utility Commission (PUC) regulated natural gas only. [District Rules 2201 and 4801]

***District Rule 8011 General Requirements***
***District Rule 8021 Construction, Demolition, Excavation, Extraction And Other Earthmoving Activities***
***District Rule 8031 Bulk Materials***
***District Rule 8041 Carryout And Trackout***
***District Rule 8051 Open Areas***
***District Rule 8061 Paved And Unpaved Roads***
***District Rule 8071 Unpaved Vehicle/Equipment Traffic Areas***
***District Rule 8081 Agricultural Sources***

The construction of this new facility will involve excavation, extraction, construction, demolition, outdoor storage piles, paved and unpaved roads.

The regulations from the 8000 Series District Rules contain requirements for the control of fugitive dust. These requirements apply to various sources, including construction, demolition, excavation, extraction, mining activities, outdoor storage piles, paved and unpaved roads. Compliance with these regulations will be required by the following permit conditions, which will be listed on each permit as follows:

- Disturbances of soil related to any construction, demolition, excavation, extraction, or other earthmoving activities shall comply with the requirements for fugitive dust control in District Rule 8021 unless specifically exempted under Section 4.0 of Rule 8021 or Rule 8011. [District Rules 8011 and 8021]

- An owner/operator shall submit a Dust Control Plan to the APCO prior to the start of any construction activity on any site that will include 10 acres or more of disturbed surface area for residential developments, or 5 acres or more of disturbed surface area for non-residential development, or will include moving, depositing, or relocating more than 2,500 cubic yards per day of bulk materials on at least three days. [District Rules 8011 and 8021]

- An owner/operator shall prevent or cleanup any carryout or trackout in accordance with the requirements of District Rule 8041 Section 5.0, unless specifically exempted under Section 4.0 of Rule 8041 (8/19/04) or Rule 8011(8/19/04). [District Rules 8011 and 8021]

- Whenever open areas are disturbed, or vehicles are used in open areas, the facility shall comply with the requirements of Section 5.0 of District Rule 8051, unless specifically exempted under Section 4.0 of Rule 8051 or Rule 8011. [District Rules 8011 and 8051]

- Any paved road or unpaved road shall comply with the requirements of District Rule 8061 unless specifically exempted under Section 4.0 of Rule 8061 or Rule 8011. [District Rules 8011 and 8061]

- Water, gravel, roadmix, or chemical/organic dust stabilizers/suppressants, vegetative materials, or other District-approved control measure shall be applied to unpaved vehicle travel areas as required to limit Visible Dust Emissions to 20% opacity and comply with the requirements for a stabilized unpaved road as defined in Section 3.59 of District Rule 8011. [District Rule 8011 and 8071]

- Where dusting materials are allowed to accumulate on paved surfaces, the accumulation shall be removed daily or water and/or chemical/organic dust stabilizers/suppressants shall be applied to the paved surface as required to maintain continuous compliance with the requirements for a stabilized unpaved road as defined in Section 3.59 of District Rule 8011 and limit Visible Dust Emissions (VDE) to 20% opacity. [District Rule 8011 and 8071]

- On each day that 50 or more Vehicle Daily Trips or 25 or more Vehicle Daily Trips with 3 axles or more will occur on an unpaved vehicle/equipment traffic area, permittee shall apply water, gravel, roadmix, or chemical/organic dust stabilizers/suppressants, vegetative materials, or other District-approved control measure as required to limit Visible Dust Emissions to 20% opacity and comply with the requirements for a stabilized unpaved road as defined in Section 3.59 of District Rule 8011. [District Rule 8011 and 8071]

- Whenever any portion of the site becomes inactive, Permittee shall restrict access and periodically stabilize any disturbed surface to comply with the conditions for a stabilized surface as defined in Section 3.58 of District Rule 8011. [District Rules 8011 and 8071]

- Records and other supporting documentation shall be maintained as required to demonstrate compliance with the requirements of the rules under Regulation VIII only for those days that a control measure was implemented. Such records shall include the type of control measure(s) used, the location and extent of coverage, and the date, amount, and frequency of application of dust suppressant, manufacturer's dust suppressant product information sheet that identifies the name of the dust suppressant and application instructions. Records shall be kept for one year following project completion that results in the termination of all dust generating activities. [District Rules 8011, 8031, and 8071]

**California Environmental Quality Act (CEQA)**

The District determined that the California Energy Commission (CEC) is the public agency having principal responsibility for approving the project, therefore establishing the CEC as the Lead Agency (CEQA Guidelines §15051(b). The District is a Responsible Agency for the project because of its discretionary approval power over the project via its Permits Rule (Rule 2010) and New Source Review Rule (Rule 2201), (CEQA Guidelines §15381). The District's engineering evaluation of the project (this document) demonstrates that compliance with District rules and permit conditions would reduce Stationary Source emissions from the project to levels below the District's significance thresholds for criteria pollutants. The District has determined that no additional findings are required (CEQA Guidelines §15096(h)).

**California Health & Safety Code, Section 42301.6 (School Notice)**

As discussed in Section III of this evaluation, this site is not located within 1,000 feet of a school. Therefore, pursuant to California Health and Safety Code 42301.6, a school notice is not required.

**California Health & Safety Code, Section 44300 (Air Toxic "Hot Spots")**

Section 44300 of the California Health and Safety Code requires submittal of an air toxics "Hot Spot" information and assessment report for sources with criteria pollutant emissions greater than 10 tons per year. However, Section 44344.5 (b) states that a new facility shall not be required to submit such a report if all of the following conditions are met:

1. The facility is subject to a district permit program established pursuant to Section 42300.

2. The district conducts an assessment of the potential emissions or their associated risks, and finds that the emissions will not result in a significant risk.

3. The district issues a permit authorizing construction or operation of the new facility.

A health risk screening assessment was performed for the proposed project. The acute and chronic hazard indices are less than 1.0 and the cancer risk is less than ten (10) in a million, which are the thresholds of significance for toxic air contaminants. This project qualifies for exemption per the above exemption criteria.

**Title 13 California Code of Regulations (CCR), Section 2423 – Exhaust Emission Standards and Test Procedures, Off-Road Compression-Ignition Engines and Equipment (Required by Title 17 CCR, Section 93115 for New Emergency Diesel IC Engines)**

The requirements of this section are only applicable to C-3953-13-1.

Particulate Matter and VOC + $NO_X$, and CO Exhaust Emissions Standards:

This regulation stipulates that off-road compression-ignition engines shall not exceed the following applicable emissions standards.

Title 13 CCR, Section 2423 lists a diesel particulate emission standard of 0.15 g/bhp-hr (with 1.341 bhp/kW, equivalent to 0.20 g/kW-hr) for 2003 - 2005 model year engines with maximum power ratings of 174.3 - 301.6 bhp (equivalent to 130 - 225 kW). The PM standards given in Title 13 CCR, Section 2423 are less stringent than the PM standards given in Title 17 CCR, Section 93115 (ATCM), thus the ATCM standards are the required standards and will be discussed in the following section.

Title 17 CCR, Section 93115, (e)(2)(A)(3)(b) stipulates that new stationary emergency diesel-fueled CI engines (> 50 bhp) must meet the VOC + $NO_X$, and CO standards for off-road engines of the same model year and maximum rated power as specified in the Off-Road Compression-Ignition Engine Standards (Title 13 CCR, Section 2423) or the Tier 1 standards for an off-road engine if no standards have been established for an off-road engine of the same model year and maximum rated power.

In addition, Title 17 CCR, Section 93115, (e)(2)(A)(4)(a)(II) allows new direct-drive emergency fire pump engines to meet the Tier 2 emission standards specified in the Off-Road Compression Ignition Engine Standards for off-road engines with the same maximum rated power (title 13 CCR, section 2423) until three years after the date the Tier 3 standards are applicable for off-road engines with the same maximum rated power. At that time, new direct-drive emergency diesel-fueled fire-pump engines (>50 bhp) are required to meet the Tier 3 emission standards, until three years after the date the Tier 4 standards are applicable for off-road engines with the same maximum rated power. At that time, new direct-drive emergency diesel-fueled fire-pump engines (>50 bhp) are required to meet the Tier 4 emission standards; and not operate more than the number of hours necessary to comply with the testing requirements of the National Fire Protection Association (NFPA) 25 – "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems," 1998 edition, which is incorporated herein by reference. In addition, this subsection does not limit engine operation for emergency use and for emission testing to show compliance with (e)(2)(A)4. For this project the proposed emergency diesel IC engine will be used to power a firewater pump and is therefore allowed to meet the Tier 2 emission standards specified in the Off-Road Compression Ignition Engine Standards for off-road engines three years after the applicable dates specified. This additional three-year allowance is reflected in the following table.

The engine involved with this project is a certified 2007 model engine. The following table compares the requirements of Title 13 CCR, Section 2423 to the emissions factors for the 288 bhp Cummins Model #CFP83-F40 diesel-fired emergency IC engine as given by the manufacturer (for $NO_X$ + VOC and PM emissions).

| Requirements of Title 13 CCR, Section 2423 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Source | Maximum Rated Power | Model Year | $NO_X$ | VOC | $NO_X$ + VOC | CO | PM |
| Title 13 CCR, §2423 | 174.3 – 301.6 bhp (130 - 225 kW) | 1996-2002 (Tier 1) | 6.9 g/bhp-hr (9.2 g/kW-hr) | 1.0 g/bhp-hr (1.3 g/kW-hr) | -- | 8.5 g/bhp-hr (11.4 g/kW-hr) | 0.40 g/bhp-hr (0.54 g/kW-hr) |
| **Title 13 CCR, §2423** | **174.3 – 301.6 bhp (130 - 225 kW)** | **2003-2005, extended to 2008 (Tier 2)** | **--** | **--** | **4.9 g/bhp-hr (6.6 g/kW-hr)** | **2.6 g/bhp-hr (3.5 g/kW-hr)** | **0.15 g/bhp-hr (0.20 g/kW-hr)** |
| Title 13 CCR, §2423 | 174.3 – 301.6 bhp (130 - 225 kW) | 2006 and later, extended to 2009 (Tier 3) | -- | -- | 3.0 g/bhp-hr (4.0 g/kW-hr) | 2.6 g/bhp-hr (3.5 g/kW-hr) | 0.15 g/bhp-hr (0.20 g/kW-hr) |
| Cummins, Model #CFP83-F40 | 288 bhp | 2007 | -- | -- | 3.8g/bhp-hr (5.1 g/kW-hr) | 0.447 g/bhp-hr (0.60 g/kW-hr) | 0.059 g/bhp-hr (0.079 g/kW-hr) |
| | | Meets Standard? | N/A | N/A | Yes | Yes | Yes |

As presented in the table above, the proposed engine will satisfy the requirements of this section and compliance is expected.

The engine manufacturer's data and/or CARB/EPA engine certification for this engine lists a $NO_X$ emissions factor of 3.4 g/bhp-hr, a VOC emissions factor of 0.38 g/bhp-hr, a $NO_X$ + VOC emission factor of 3.8 g/bhp-hr, a CO emission factor of 0.447 g/bhp-hr, and a $PM_{10}$ emissions factor of 0.059 g/bhp-hr, all of which satisfy the requirements of 13 CCR, Section 2423. Therefore, the following conditions (previously proposed in this engineering evaluation) will be listed on the DOC to ensure compliance:

- Emissions from this IC engine shall not exceed any of the following limits: 3.4 g-NOx/bhp-hr, 0.447 g-CO/bhp-hr, or 0.38 g-VOC/bhp-hr. [District Rule 2201 and 13 CCR 2423 and 17 CCR 93115]

- Emissions from this IC engine shall not exceed 0.059 g-PM10/bhp-hr based on USEPA certification using ISO 8178 test procedure. [District Rules 2201 and 4102 and 13 CCR 2423 and 17 CCR 93115]

<u>Right of the District to Establish More Stringent Standards:</u>

This regulation also stipulates that the District:

1. May establish more stringent diesel PM, $NO_X$ + VOC, VOC, $NO_X$, and CO emission rate standards; and

2. May establish more stringent limits on hours of maintenance and testing on a site-specific basis; and
3. Shall determine an appropriate limit on the number of hours of operation for demonstrating compliance with other District rules and initial start-up testing

The District has not established more stringent standards at this time. Therefore, the standards previously established in this Section will be utilized.

**Title 17 California Code of Regulations (CCR), Section 93115 - Airborne Toxic Control Measure (ATCM) for Stationary Compression-Ignition (CI) Engines**

The requirements of this section are only applicable to C-3953-13-1.

Emergency Operating Requirements:

This regulation stipulates that no owner or operator shall operate any new or in-use stationary diesel-fueled compression ignition (CI) emergency standby engine, in response to the notification of an impending rotating outage, unless specific criteria are met.

This section applies to emergency standby IC engines that are permitted to operate during non-emergency conditions for the purpose of providing electrical power. However, District Rule 4702 states that emergency standby IC engines may only be operated during non-emergency conditions for the purposes of maintenance and testing. Therefore, this section does not apply and no further discussion is required.

Fuel and Fuel Additive Requirements:

This regulation also stipulates that as of January 1, 2006 an owner or operator of a new or in-use stationary diesel-fueled CI emergency standby engine shall fuel the engine with CARB Diesel Fuel.

Since the engine involved with this project is a new or in-use stationary diesel-fueled CI emergency standby engine, these fuel requirements are applicable. Therefore, the following condition (previously proposed in this engineering evaluation) will be listed on the DOC to ensure compliance:

- {3395} Only CARB certified diesel fuel containing not more than 0.0015% sulfur by weight is to be used. [District Rules 2201 and 4801 and 17 CCR 93115]

At-School and Near-School Provisions:

This regulation stipulates that no owner or operator shall operate a new stationary emergency diesel-fueled CI engine, with a $PM_{10}$ emissions factor > than 0.01 g/bhp-hr, for non-emergency use, including maintenance and testing, during the following periods:

1. Whenever there is a school sponsored activity, if the engine is located on school grounds, and
2. Between 7:30 a.m. and 3:30 p.m. on days when school is in session, if the engine is located within 500 feet of school grounds.

The District has verified that the engine is not located within 500 feet of a K-12 school. Therefore, conditions prohibiting non-emergency usage of the engine during school hours will not be placed on the permit.

Recordkeeping Requirements:

This regulation stipulates that as of January 1, 2005, each owner or operator of an emergency diesel-fueled CI engine shall keep a monthly log of usage that shall list and document the nature of use for each of the following:

a. Emergency use hours of operation;
b. Maintenance and testing hours of operation;
c. Hours of operation for emission testing;
d. Initial start-up hours; and
e. If applicable, hours of operation to comply with the testing requirements of National Fire Protection Association (NFPA) 25 — "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems," 1998 edition;
f. Hours of operation for all uses other than those specified in sections 'a' through 'd' above; and
g. For in-use emergency diesel-fueled engines, the fuel used. The owner or operator shall document fuel use through the retention of fuel purchase records that account for all fuel used in the engine and all fuel purchased for use in the engine, and, at a minimum, contain the following information for each individual fuel purchase transaction:
    I. Identification of the fuel purchased as either CARB Diesel, or an alternative diesel fuel that meets the requirements of the Verification Procedure, or an alternative fuel, or CARB Diesel fuel used with additives that meet the requirements of the Verification Procedure, or any combination of the above;
    II. Amount of fuel purchased;
    III. Date when the fuel was purchased;
    IV. Signature of owner or operator or representative of owner or operator who received the fuel; and
    V. Signature of fuel provider indicating fuel was delivered.

The proposed new emergency diesel IC engine powering a firewater pump is exempt from the operating hours limitation provided the engine is only operated the amount of hours necessary to satisfy National Fire Protection Association (NFPA) regulations. Therefore, the following conditions (previously proposed in this engineering evaluation) will be listed on the DOC to ensure compliance:

- {3489} The permittee shall maintain monthly records of emergency and non-emergency operation. Records shall include the number of hours of emergency operation, the date and number of hours of all testing and maintenance operations, and the purpose of the operation (for example: load testing, weekly testing, rolling blackout, general area power outage, etc.). For units with automated testing systems, the operator may, as an alternative to keeping records of actual operation for testing purposes, maintain a readily accessible written record of the automated testing schedule. [District Rule 4702 and 17 CCR 93115]

- {3475} All records shall be maintained and retained on-site for a minimum of five (5) years, and shall be made available for District inspection upon request. [District Rule 4702 and 17 CCR 93115]

PM Emissions and Hours of Operation Requirements for New Diesel Engines:

This regulation stipulates that as of January 1, 2005, no person shall operate any new stationary emergency diesel-fueled CI engine that has a rated brake horsepower greater than 50, unless it meets all of the following applicable emission standards and operating requirements.

1. Emits diesel PM at a rate greater than 0.01 g/bhp-hr or less than or equal to 0.15 g/bhp-hr; or
2. Meets the current model year diesel PM standard specified in the Off-Road Compression Ignition Engine Standards for off-road engines with the same maximum rated power (Title 13 CCR, Section 2423), whichever is more stringent; and
3. Does not operate more than 50 hours per year for maintenance and testing purposes. Engine operation is not limited during emergency use and during emissions source testing to show compliance with the ATCM.

The proposed emergency diesel IC engine powering a firewater pump is exempt from the operating hours limitation provided the engine is only operated the amount of hours necessary to satisfy National Fire Protection Association (NFPA) regulations. Therefore, the following conditions (previously proposed in this engineering evaluation) will be listed on the DOC to ensure compliance:

- Emissions from this IC engine shall not exceed 0.059 g-PM10/bhp-hr based on USEPA certification using ISO 8178 test procedure. [District Rules 2201 and 4102 and 13 CCR 2423 and 17 CCR 93115]

- {3816} This engine shall be operated only for testing and maintenance of the engine, required regulatory purposes, and during emergency situations. For testing purposes, the engine shall only be operated the number of hours necessary to comply with the testing requirements of the National Fire Protection Association (NFPA) 25 - "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems", 1998 edition. Total hours of operation for all maintenance, testing, and required regulatory purposes shall not exceed 50 hours per calendar year. [District Rule 4702 and 17 CCR 93115]

## IX. RECOMMENDATION:

Compliance with all applicable prohibitory rules and regulations is expected. Issue the Final Determination of Compliance for the facility subject to the conditions presented in Attachment A.

## X. BILLING INFORMATION:

| Annual Permit Fees | | | |
|---|---|---|---|
| Permit Number | Fee Schedule | Fee Description | Annual Fee |
| C-3953-10-1 | 3020-08B-B | 180,000 kW | $12,229.00 |
| C-3953-11-1 | 3020-08B-B | 180,000 kW | $12,229.00 |
| C-3953-12-1 | 3020-02-H | 37.4 MMBtu/hr boiler | $953.00 |
| C-3953-13-1 | 3020-10-C | 288 bhp IC engine | $222.00 |
| C-3953-14-1 | 3020-10-E | 860 bhp IC engine | $557.00 |

# ATTACHMENT A

## *FDOC CONDITIONS*

**EQUIPMENT DESCRIPTION, UNIT C-3953-10-1:**
**180 MW NOMINALLY RATED COMBINED-CYCLE POWER GENERATING SYSTEM #1 CONSISTING OF A GENERAL ELECTRIC FRAME 7 MODEL PG7241FA NATURAL GAS-FIRED COMBUSTION TURBINE GENERATOR WITH DRY LOW $NO_X$ COMBUSTOR, A SELECTIVE CATALYTIC REDUCTION (SCR) SYSTEM, AN OXIDATION CATALYST, HEAT RECOVERY STEAM GENERATOR #1 (HRSG) WITH A 562 MMBTU/HR DUCT BURNER AND A 300 MW NOMINALLY RATED STEAM TURBINE SHARED WITH C-3953-11**

1. Permittee shall submit an application to comply with SJVUAPCD District Rule 2520 - Federally Mandated Operating Permits within twelve months of commencing operation. [District Rule 2520]

2. Permittee shall submit an application to comply with SJVUAPCD District Rule 2540 - Acid Rain Program. [District Rule 2540]

3. Prior to initial operation of C-3953-10-1, C-3953-11-1, and C-3953-12-1, permittee shall provide NOx (as NO2) emission reduction credits for the following quantities of emissions: 1st quarter – 67,103 lb; 2nd quarter – 67,104 lb; 3rd quarter – 67,104 lb; and 4th quarter – 67,104 lb. Offsets shall be provided at the appropriate distance ratio specified in Rule 2201. [District Rule 2201]

4. Prior to initial operation of C-3953-10-1, C-3953-11-1, and C-3953-12-1, permittee shall provide VOC emission reduction credits for the following quantities of emissions: 1st quarter – 12,294 lb; 2nd quarter – 12,295 lb; 3rd quarter – 12,295 lb; and 4th quarter – 12,295 lb. Offsets shall be provided at the appropriate distance ratio specified in Rule 2201. [District Rule 2201]

5. Prior to initial operation of C-3953-10-1, C-3953-11-1, and C-3953-12-1, permittee shall provide $PM_{10}$ emission reduction credits for the following quantities of emissions: 1st quarter – 33,087 lb; 2nd quarter – 33,086 lb; 3rd quarter – 33,086 lb; and 4th quarter – 33,086 lb. Offsets shall be provided at the appropriate distance ratio specified in Rule 2201. SOx ERC's may be used to offset PM10 increases at an interpollutant ratio of 1.0 lb-SOx : 1.0 lb-PM10. [District Rule 2201]

6. ERC certificate numbers (or any splits from these certificates) C-897-1, C-898-1, N-724-1, N-725-1, S-2812-1, S-2813-1, S-2817-1, C-899-2, C-902-2, N-720-2, N-722-2, N-726-2, N-728-2, S-2814-2, S-2321-2, C-896-4, N-721-4, N-723-4, S-2791-5, S-2790-5, S-2789-5, S-2788-5, or N-762-5 shall be used to supply the required offsets, unless a revised offsetting proposal is received and approved by the District, upon which this determination of compliance (DOC) shall be reissued, administratively specifying the new offsetting proposal. Original public noticing requirements, if any, shall be duplicated prior to reissuance of the DOC. [District Rule 2201]

7. Annual emissions from the facility, calculated on a twelve month rolling basis, shall not exceed any of the following limits: $NO_X$ (as $NO_2$) – 198,840 lb/year; CO – 197,928 lb/year. [District Rule 2201]

8. {15} No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1 or 20% opacity. [District Rule 4101]

9. {98} No air contaminant shall be released into the atmosphere which causes a public nuisance. [District Rule 4102]

10. {14} Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201]

11. The CTG shall be fired exclusively on PUC-regulated natural gas with a sulfur content of no greater than 1.0 grains of sulfur compounds (as S) per 100 dry scf of natural gas. [District Rule 2201 and 40 CFR 60.4330(a)(2)]

12. Annual average of the sulfur content of the CTG shall not exceed 0.36 grain of sulfur compounds (as S) per 100 dry scf of natural gas. [District Rule 2201]

13. The owner or operator shall install, certify, maintain, operate and quality-assure a Continuous Emission Monitoring System (CEMS) which continuously measures and records the exhaust gas $NO_X$, CO and $O_2$ concentrations. Continuous emissions monitor(s) shall be capable of monitoring emissions during normal operating conditions, and during startups and shutdowns, provided the CEMS passes the relative accuracy requirement for startups and shutdowns specified herein. If relative accuracy of CEMS cannot be demonstrated during startup conditions, CEMS results during startup and shutdown events shall be replaced with startup emission rates obtained from source testing to determine compliance with emission limits contained in this document. [District Rules 1080 and 4703 and 40 CFR 60.4340(b)(1)]

14. The CEMS shall complete a minimum of one cycle of operation (sampling, analyzing, and data recording) for each successive 15-minute period or shall meet equivalent specifications established by mutual agreement of the District, the ARB and the EPA. [District Rule 1080 and 40 CFR 60.4345(b)]

15. The $NO_X$, CO and $O_2$ CEMS shall meet the requirements in 40 CFR 60, Appendix F Procedure 1 and Part 60, Appendix B Performance Specification 2 (PS 2), or shall meet equivalent specifications established by mutual agreement of the District, the ARB, and the EPA. [District Rule 1080 and 40 CFR 60.4345(a)]

16. Audits of continuous emission monitors shall be conducted quarterly, except during quarters in which relative accuracy and compliance source testing are both performed, in accordance with EPA guidelines. The District shall be notified prior to completion of the audits. Audit reports shall be submitted along with quarterly compliance reports to the District. [District Rule 1080]

17. The owner/operator shall perform a relative accuracy test audit (RATA) for $NO_X$, CO and $O_2$ as specified by 40 CFR Part 60, Appendix F, 5.11, at least once every four calendar quarters. The permittee shall comply with the applicable requirements for quality assurance testing and maintenance of the continuous emission monitor equipment in

accordance with the procedures and guidance specified in 40 CFR Part 60, Appendix F. [District Rule 1080]

18. APCO or an authorized representative shall be allowed to inspect, as determined to be necessary, the required monitoring devices to ensure that such devices are functioning properly. [District Rule 1080]

19. Results of the CEM system shall be averaged over a one hour period for $NO_X$ emissions and a three hour period for CO emissions using consecutive 15-minute sampling periods in accordance with all applicable requirements of CFR 60.13. [District Rule 4703 and 40 CFR 60.13]

20. Results of continuous emissions monitoring shall be reduced according to the procedures established in 40 CFR, Part 51, Appendix P, paragraphs 5.0 through 5.3.3, or by other methods deemed equivalent by mutual agreement with the District, the ARB, and the EPA. [District Rule 1080]

21. The owner or operator shall, upon written notice from the APCO, provide a summary of the data obtained from the CEM systems. This summary shall be in the form and the manner prescribed by the APCO. [District Rule 1080]

22. The facility shall install and maintain equipment, facilities, and systems compatible with the District's CEM data polling software system and shall make CEM data available to the District's automated polling system on a daily basis. [District Rule 1080]

23. Upon notice by the District that the facility's CEM system is not providing polling data, the facility may continue to operate without providing automated data for a maximum of 30 days per calendar year provided the CEM data is sent to the District by a District-approved alternative method. [District Rule 1080]

24. The owner or operator shall submit a written report of CEM operations for each calendar quarter to the APCO. The report is due on the 30th day following the end of the calendar quarter and shall include the following: Time intervals, data and magnitude of excess NOx emissions, nature and the cause of excess (if known), corrective actions taken and preventive measures adopted; Averaging period used for data reporting corresponding to the averaging period specified in the emission test period used to determine compliance with an emission standard; Applicable time and date of each period during which the CEM was inoperative (monitor downtime), except for zero and span checks, and the nature of system repairs and adjustments; A negative declaration when no excess emissions occurred. [District Rule 1080 and 40 CFR 60.4375(a) and 60.4395]

25. Permittee shall notify the District of any breakdown condition as soon as reasonably possible, but no later than one hour after its detection, unless the owner or operator demonstrates to the District's satisfaction that the longer reporting period was necessary. [District Rule 1100, 6.1]

26. The District shall be notified in writing within ten days following the correction of any breakdown condition. The breakdown notification shall include a description of the equipment malfunction or failure, the date and cause of the initial failure, the estimated

emissions in excess of those allowed, and the methods utilized to restore normal operations. [District Rule 1100, 7.0]

27. Emission rates from this unit (with duct burner firing), except during startup and shutdown periods, shall not exceed any of the following limits: NOx (as NO2) – 17.20 lb/hr and 2.0 ppmvd @ 15% O2; VOC (as methane) – 5.89 lb/hr and 2.0 ppmvd @ 15% O2; CO – 10.60 lb/hr and 2.0 ppmvd @ 15% O2; PM10 – 11.78 lb/hr; or SOx (as SO2) – 6.65 lb/hr. NOx (as NO2) emission limits are one hour rolling averages. All other emission limits are three hour rolling averages. [District Rules 2201, 4001, and 4703]

28. Emission rates from this unit (without duct burner firing), except during startup and shutdown periods, shall not exceed any of the following limits: NOx (as NO2) - 13.55 lb/hr and 2.0 ppmvd @ 15% O2; VOC (as methane) - 3.34 lb/hr and 1.4 ppmvd @ 15% O2; CO – 8.35 lb/hr and 2.0 ppmvd @ 15% O2; PM10 – 8.91 lb/hr; or SOx (as SO2) – 5.23 lb/hr. NOx (as NO2) emission limits are one hour rolling averages. All other emission limits are three hour rolling averages. [District Rules 2201, 4001, and 4703]

29. During start-up and shutdown, CTG exhaust emission rates shall not exceed any of the following limits: $NO_X$ (as $NO_2$) – 160 lb/hr; CO – 1,000 lb/hr; VOC (as methane) – 16 lb/hr; $PM_{10}$ – 11.78 lb/hr; $SO_X$ (as $SO_2$) – 6.652 lb/hr; or $NH_3$ – 32.13 lb/hr. [District Rules 2201 and 4703]

30. Daily emissions from the CTG shall not exceed the following limits: $NO_X$ (as $NO_2$) – 412.8 lb/day; CO – 254.4 lb/day; VOC – 141.4 lb/day; $PM_{10}$ – 282.7 lb/day; $SO_X$ (as $SO_2$) – 159.6 lb/day, or $NH_3$ – 771.1 lb/day. [District Rule 2201]

31. Emissions from this unit, on days when a startup and/or shutdown occurs, shall not exceed the following limits: NOx (as NO2) – 789.6 lb/day; VOC – 202.0 lb/day; CO – 5,590.8 lb/day; PM10 – 282.7 lb/day; SOx (as SO2) – 159.6 lb/day, or $NH_3$ – 771.1 lb/day. [District Rule 2201]

32. The ammonia (NH3) emissions shall not exceed 10 ppmvd @ 15% O2 over a 24 hour rolling average. [District Rule 2201]

33. The CTG shall be fired exclusively on PUC-regulated natural gas with a sulfur content no greater than 1.0 grain of sulfur compounds (as S) per 100 dry scf of natural gas. [District Rule 2201 and 40 CFR 60.4330(a)(2)]

34. Annual emissions from the CTG, calculated on a twelve month rolling basis, shall not exceed any of the following limits: $NO_X$ (as $NO_2$) – 143,951 lb/year; CO – 197,928 lb/year; VOC – 34,489 lb/year; $PM_{10}$ – 80,656 lb/year; or $SO_X$ (as $SO_2$) – 16,694 lb/year; or $NH_3$ – 208,708 lb/year. [District Rule 2201]

35. The duration of each startup or shutdown shall not exceed six hours. Startup and shutdown emissions shall be counted toward all applicable emission limits. [District Rules 2201 and 4703]

36. Each one hour period shall commence on the hour. Each one hour period in a three hour rolling average will commence on the hour. The three hour average will be compiled from

the three most recent one hour periods. Each one hour period in a twenty-four hour average for ammonia slip will commence on the hour. [District Rule 2201]

37. Daily emissions will be compiled for a twenty-four hour period starting and ending at twelve-midnight. Each month in the twelve consecutive month rolling average emissions shall commence at the beginning of the first day of the month. The twelve consecutive month rolling average emissions to determine compliance with annual emissions limitations shall be compiled from the twelve most recent calendar months. [District Rule 2201]

38. Startup shall be defined as the period of time during which a unit is brought from a shutdown status to its operating temperature and pressure, including the time required by the unit's emission control system to reach full operations. Shutdown shall be defined as the period of time during which a unit is taken from an operational to a non-operational status by allowing it to cool down from its operating temperature to ambient temperature as the fuel supply to the unit is completely turned off. [District Rules 2201 and 4703]

39. The emission control systems shall be in operation and emissions shall be minimized insofar as technologically feasible during startup and shutdown. [District Rule 4703]

40. The exhaust stack shall be equipped with permanent provisions to allow collection of stack gas samples consistent with EPA test methods and shall be equipped with safe permanent provisions to sample stack gases with a portable NOx, CO, and O2 analyzer during District inspections. The sampling ports shall be located in accordance with the CARB regulation titled California Air Resources Board Air Monitoring Quality Assurance Volume VI, Standard Operating Procedures for Stationary Emission Monitoring and Testing. [District Rule 1081]

41. Source testing to measure startup NOx, CO, and VOC mass emission rates shall be conducted for one of the gas turbines (C-3953-10 or C-3953-11) prior to the end of the commissioning period and at least once every seven years thereafter. CEM relative accuracy shall be determined during startup source testing in accordance with 40 CFR 60, Appendix B. [District Rule 1081]

42. Source testing (with and without duct burner firing) to measure the NOx, CO, and VOC emission rates (lb/hr and ppmvd @ 15% O2) shall be conducted within 60 days after the end of the commissioning period and at least once every twelve months thereafter. [District Rules 1081 and 4703]

43. Source testing (with and without duct burner firing) to measure the PM10 emission rate (lb/hr) and the ammonia emission rate shall be conducted within 60 days after the end of the commissioning period and at least once every twelve months thereafter. [District Rule 1081]

44. Compliance with natural gas sulfur content limit shall be demonstrated within 60 days after the end of the commissioning period and weekly thereafter. After demonstrating compliance with the fuel sulfur content limit for 8 consecutive weeks for a fuel source, then the testing frequency shall not be less than monthly. If a test shows noncompliance

with the sulfur content requirement, the source must return to weekly testing until eight consecutive weeks show compliance. [District Rules 1081, 2540, and 4001].

45. Demonstration of compliance with the annual average sulfur content limit shall be demonstrated by a 12 month rolling average of the sulfur content either (i) documented in a valid purchase contract, a supplier certification, a tariff sheet or transportation contract or (ii) tested using ASTM Methods D1072, D3246, D4084, D4468, D4810, D6228, D6667 or Gas Processors Association Standard 2377. [District Rules 1081 and 2201]

46. Source testing to determine compliance with the NOx, CO and VOC emission rates (lb/hr and ppmvd @ 15% $O_2$), NH3 emission rate (ppmvd @ 15% $O_2$) and $PM_{10}$ emission rate (lb/hr) shall be conducted at least once every 12 months. [District Rules 1081, 2201 and 4703 and 40 CFR 60.4400(a)]

47. Compliance with the $NO_X$ and CO emission limits shall be demonstrated with the auxiliary burner both on and off. [District Rule 4703]

48. Compliance demonstration (source testing) shall be District witnessed, or authorized and samples shall be collected by a California Air Resources Board certified testing laboratory. Source testing shall be conducted using the methods and procedures approved by the District. The District must be notified 30 days prior to any compliance source test, and a source test plan must be submitted for approval 15 days prior to testing. The results of each source test shall be submitted to the District within 60 days thereafter. [District Rule 1081]

49. The following test methods shall be used: $NO_X$ - EPA Method 7E or 20; CO - EPA Method 10 or 10B; VOC - EPA Method 18 or 25; PM10 - EPA Method 5 (front half and back half) or 201 and 202a; ammonia - BAAQMD ST-1B; and $O_2$ - EPA Method 3, 3A, or 20. EPA approved alternative test methods as approved by the District may also be used to address the source testing requirements of this permit. [District Rules 1081 and 4703 and 40 CFR 60.4400(1)(i)]

50. The sulfur content of each fuel source shall be: (i) documented in a valid purchase contract, a supplier certification, a tariff sheet or transportation contract or (ii) monitored within 60 days of the end of the commission period and weekly thereafter. If the sulfur content is demonstrated to be less than 1.0 gr/100 scf for eight consecutive weeks, then the monitoring frequency shall be every six months. If the result of any six month monitoring demonstrates that the fuel does not meet the fuel sulfur content limit, weekly monitoring shall resume. [District Rule 2201 and 40 CFR 60.4360, 60.4365(a) and 60.4370(c)]

51. Excess emissions shall be defined as any operating hour in which the 4-hour or 30-day rolling average $NO_X$ concentration exceeds applicable emissions limit and a period of monitor downtime shall be any unit operating hour in which sufficient data are not obtained to validate the hour for either $NO_X$ or O2 (or both). [40 CFR 60.4380(b)(1)]

52. Fuel sulfur content shall be monitored using one of the following methods: ASTM Methods D1072, D3246, D4084, D4468, D4810, D6228, D6667 or Gas Processors Association Standard 2377. [40 CFR 60.4415(a)(1)(i)]

53. The permittee shall submit to the District information correlating the $NO_X$ control system operating parameters to the associated measured $NO_X$ output. The information must be sufficient to allow the District to determine compliance with the $NO_X$ emission limits of this permit during times that the CEMS is not functioning properly. [District Rule 4703]

54. The permittee shall maintain the following records: the date, time and duration of any malfunction of the continuous monitoring equipment; dates of performance testing; dates of evaluations, calibrations, checks, and adjustments of the continuous monitoring equipment; date and time period which a continuous monitoring system or monitoring device was inoperative. [District Rules 1080 and 2201 and 40 CFR 60.8(d)]

55. The permittee shall maintain the following records: date and time, duration, and type of any startup, shutdown, or malfunction; performance testing, evaluations, calibrations, checks, adjustments, any period during which a continuous monitoring system or monitoring device was inoperative, and maintenance of any continuous emission monitor. [District Rules 2201 and 4703]

56. The permittee shall maintain the following records: hours of operation, fuel consumption (scf/hr and scf/rolling twelve month period), continuous emission monitor measurements, calculated ammonia slip, and calculated NOx mass emission rates (lb/hr and lb/twelve month rolling period). [District Rules 2201 and 4703]

57. The owner or operator of a stationary gas turbine system shall maintain all records of required monitoring data and support information for inspection at any time for a period of five years. [District Rules 2201 and 4703]

58. Disturbances of soil related to any construction, demolition, excavation, extraction, or other earthmoving activities shall comply with the requirements for fugitive dust control in District Rule 8021 unless specifically exempted under Section 4.0 of Rule 8021 or Rule 8011. [District Rules 8011 and 8021]

59. An owner/operator shall submit a Dust Control Plan to the APCO prior to the start of any construction activity on any site that will include 10 acres or more of disturbed surface area for residential developments, or 5 acres or more of disturbed surface area for non-residential development, or will include moving, depositing, or relocating more than 2,500 cubic yards per day of bulk materials on at least three days. [District Rules 8011 and 8021]

60. An owner/operator shall prevent or cleanup any carryout or trackout in accordance with the requirements of District Rule 8041 Section 5.0, unless specifically exempted under Section 4.0 of Rule 8041 (8/19/04) or Rule 8011(8/19/04). [District Rules 8011 and 8021]

61. Whenever open areas are disturbed, or vehicles are used in open areas, the facility shall comply with the requirements of Section 5.0 of District Rule 8051, unless specifically exempted under Section 4.0 of Rule 8051 or Rule 8011. [District Rules 8011 and 8051]

62. Any paved road or unpaved road shall comply with the requirements of District Rule 8061 unless specifically exempted under Section 4.0 of Rule 8061 or Rule 8011. [District Rules 8011 and 8061]

63. Water, gravel, roadmix, or chemical/organic dust stabilizers/suppressants, vegetative materials, or other District-approved control measure shall be applied to unpaved vehicle travel areas as required to limit Visible Dust Emissions to 20% opacity and comply with the requirements for a stabilized unpaved road as defined in Section 3.59 of District Rule 8011. [District Rule 8011 and 8071]

64. Where dusting materials are allowed to accumulate on paved surfaces, the accumulation shall be removed daily or water and/or chemical/organic dust stabilizers/suppressants shall be applied to the paved surface as required to maintain continuous compliance with the requirements for a stabilized unpaved road as defined in Section 3.59 of District Rule 8011 and limit Visible Dust Emissions (VDE) to 20% opacity. [District Rule 8011 and 8071]

65. On each day that 50 or more Vehicle Daily Trips or 25 or more Vehicle Daily Trips with 3 axles or more will occur on an unpaved vehicle/equipment traffic area, permittee shall apply water, gravel, roadmix, or chemical/organic dust stabilizers/suppressants, vegetative materials, or other District-approved control measure as required to limit Visible Dust Emissions to 20% opacity and comply with the requirements for a stabilized unpaved road as defined in Section 3.59 of District Rule 8011. [District Rule 8011 and 8071]

66. Whenever any portion of the site becomes inactive, Permittee shall restrict access and periodically stabilize any disturbed surface to comply with the conditions for a stabilized surface as defined in Section 3.58 of District Rule 8011. [District Rules 8011 and 8071]

67. Records and other supporting documentation shall be maintained as required to demonstrate compliance with the requirements of the rules under Regulation VIII only for those days that a control measure was implemented. Such records shall include the type of control measure(s) used, the location and extent of coverage, and the date, amount, and frequency of application of dust suppressant, manufacturer's dust suppressant product information sheet that identifies the name of the dust suppressant and application instructions. Records shall be kept for one year following project completion that results in the termination of all dust generating activities. [District Rules 8011, 8031, and 8071]

**EQUIPMENT DESCRIPTION, UNIT C-3953-11-1:**
**180 MW NOMINALLY RATED COMBINED-CYCLE POWER GENERATING SYSTEM #2 CONSISTING OF A GENERAL ELECTRIC FRAME 7 MODEL PG7241FA NATURAL GAS-FIRED COMBUSTION TURBINE GENERATOR WITH DRY LOW $NO_X$ COMBUSTOR, A SELECTIVE CATALYTIC REDUCTION (SCR) SYSTEM, AN OXIDATION CATALYST, HEAT RECOVERY STEAM GENERATOR #2 (HRSG) WITH A 562 MMBTU/HR DUCT BURNER AND A 300 MW NOMINALLY RATED STEAM TURBINE SHARED WITH C-3953-10**

1. Permittee shall submit an application to comply with SJVUAPCD District Rule 2520 - Federally Mandated Operating Permits within twelve months of commencing operation. [District Rule 2520]

2. Permittee shall submit an application to comply with SJVUAPCD District Rule 2540 - Acid Rain Program within 12 months of commencing operation. [District Rule 2540]

3. Prior to initial operation of C-3953-10-1, C-3953-11-1, and C-3953-12-1, permittee shall provide NOx (as NO2) emission reduction credits for the following quantities of emissions: 1st quarter – 67,103 lb; 2nd quarter – 67,104 lb; 3rd quarter – 67,104 lb; and 4th quarter – 67,104 lb. Offsets shall be provided at the appropriate distance ratio specified in Rule 2201. [District Rule 2201]

4. Prior to initial operation of C-3953-10-1, C-3953-11-1, and C-3953-12-1, permittee shall provide VOC emission reduction credits for the following quantities of emissions: 1st quarter – 12,294 lb; 2nd quarter – 12,295 lb; 3rd quarter – 12,295 lb; and 4th quarter – 12,295 lb. Offsets shall be provided at the appropriate distance ratio specified in Rule 2201. [District Rule 2201]

5. Prior to initial operation of C-3953-10-1, C-3953-11-1, and C-3953-12-1, permittee shall provide $PM_{10}$ emission reduction credits for the following quantities of emissions: 1st quarter – 33,086 lb; 2nd quarter – 33,086 lb; 3rd quarter – 33,086 lb; and 4th quarter – 33,086 lb. Offsets shall be provided at the appropriate distance ratio specified in Rule 2201. SOx ERC's may be used to offset PM10 increases at an interpollutant ratio of 1.0 lb-SOx : 1.0 lb-PM10. [District Rule 2201]

6. ERC certificate numbers (or any splits from these certificates) C-897-1, C-898-1, N-724-1, N-725-1, S-2812-1, S-2813-1, S-2817-1, C-899-2, C-902-2, N-720-2, N-722-2, N-726-2, N-728-2, S-2814-2, S-2321-2, C-896-4, N-721-4, N-723-4, S-2791-5, S-2790-5, S-2789-5, S-2788-5, or N-762-5 shall be used to supply the required offsets, unless a revised offsetting proposal is received and approved by the District, upon which this determination of compliance (DOC) shall be reissued, administratively specifying the new offsetting proposal. Original public noticing requirements, if any, shall be duplicated prior to reissuance of the DOC. [District Rule 2201]

7. Annual emissions from the facility, calculated on a twelve month rolling basis, shall not exceed any of the following limits: $NO_X$ (as $NO_2$) – 198,840 lb/year; CO – 197,928 lb/year. [District Rule 2201

8. {15} No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1 or 20% opacity. [District Rule 4101]

9. {98} No air contaminant shall be released into the atmosphere which causes a public nuisance. [District Rule 4102]

10. {14} Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201]

11. The CTG shall be fired exclusively on PUC-regulated natural gas with a sulfur content of no greater than 1.0 grains of sulfur compounds (as S) per 100 dry scf of natural gas. [District Rule 2201 and 40 CFR 60.4330(a)(2)]

12. Annual average of the sulfur content of the CTG shall not exceed 0.36 grain of sulfur compounds (as S) per 100 dry scf of natural gas. [District Rule 2201]

13. The owner or operator shall install, certify, maintain, operate and quality-assure a Continuous Emission Monitoring System (CEMS) which continuously measures and records the exhaust gas $NO_X$, CO and $O_2$ concentrations. Continuous emissions monitor(s) shall be capable of monitoring emissions during normal operating conditions, and during startups and shutdowns, provided the CEMS passes the relative accuracy requirement for startups and shutdowns specified herein. If relative accuracy of CEMS cannot be demonstrated during startup conditions, CEMS results during startup and shutdown events shall be replaced with startup emission rates obtained from source testing to determine compliance with emission limits contained in this document. [District Rules 1080 and 4703 and 40 CFR 60.4340(b)(1)]

14. The CEMS shall complete a minimum of one cycle of operation (sampling, analyzing, and data recording) for each successive 15-minute period or shall meet equivalent specifications established by mutual agreement of the District, the ARB and the EPA. [District Rule 1080 and 40 CFR 60.4345(b)]

15. The $NO_X$, CO and $O_2$ CEMS shall meet the requirements in 40 CFR 60, Appendix F Procedure 1 and Part 60, Appendix B Performance Specification 2 (PS 2), or shall meet equivalent specifications established by mutual agreement of the District, the ARB, and the EPA. [District Rule 1080 and 40 CFR 60.4345(a)]

16. Audits of continuous emission monitors shall be conducted quarterly, except during quarters in which relative accuracy and compliance source testing are both performed, in accordance with EPA guidelines. The District shall be notified prior to completion of the audits. Audit reports shall be submitted along with quarterly compliance reports to the District. [District Rule 1080]

17. The owner/operator shall perform a relative accuracy test audit (RATA) for $NO_X$, CO and $O_2$ as specified by 40 CFR Part 60, Appendix F, 5.11, at least once every four calendar quarters. The permittee shall comply with the applicable requirements for quality

assurance testing and maintenance of the continuous emission monitor equipment in accordance with the procedures and guidance specified in 40 CFR Part 60, Appendix F. [District Rule 1080]

18. APCO or an authorized representative shall be allowed to inspect, as determined to be necessary, the required monitoring devices to ensure that such devices are functioning properly. [District Rule 1080]

19. Results of the CEM system shall be averaged over a one hour period for $NO_X$ emissions and a three hour period for CO emissions using consecutive 15-minute sampling periods in accordance with all applicable requirements of CFR 60.13. [District Rule 4703 and 40 CFR 60.13]

20. Results of continuous emissions monitoring shall be reduced according to the procedures established in 40 CFR, Part 51, Appendix P, paragraphs 5.0 through 5.3.3, or by other methods deemed equivalent by mutual agreement with the District, the ARB, and the EPA. [District Rule 1080]

21. The owner or operator shall, upon written notice from the APCO, provide a summary of the data obtained from the CEM systems. This summary shall be in the form and the manner prescribed by the APCO. [District Rule 1080]

22. The facility shall install and maintain equipment, facilities, and systems compatible with the District's CEM data polling software system and shall make CEM data available to the District's automated polling system on a daily basis. [District Rule 1080]

23. Upon notice by the District that the facility's CEM system is not providing polling data, the facility may continue to operate without providing automated data for a maximum of 30 days per calendar year provided the CEM data is sent to the District by a District-approved alternative method. [District Rule 1080]

24. The owner or operator shall submit a written report of CEM operations for each calendar quarter to the APCO. The report is due on the 30th day following the end of the calendar quarter and shall include the following: Time intervals, data and magnitude of excess NOx emissions, nature and the cause of excess (if known), corrective actions taken and preventive measures adopted; Averaging period used for data reporting corresponding to the averaging period specified in the emission test period used to determine compliance with an emission standard; Applicable time and date of each period during which the CEM was inoperative (monitor downtime), except for zero and span checks, and the nature of system repairs and adjustments; A negative declaration when no excess emissions occurred. [District Rule 1080 and 40 CFR 60.4375(a) and 60.4395]

25. Permittee shall notify the District of any breakdown condition as soon as reasonably possible, but no later than one hour after its detection, unless the owner or operator demonstrates to the District's satisfaction that the longer reporting period was necessary. [District Rule 1100, 6.1]

26. The District shall be notified in writing within ten days following the correction of any breakdown condition. The breakdown notification shall include a description of the

equipment malfunction or failure, the date and cause of the initial failure, the estimated emissions in excess of those allowed, and the methods utilized to restore normal operations. [District Rule 1100, 7.0]

27. Emission rates from this unit (with duct burner firing), except during startup and shutdown periods, shall not exceed any of the following limits: NOx (as NO2) – 17.20 lb/hr and 2.0 ppmvd @ 15% O2; VOC (as methane) – 5.89 lb/hr and 2.0 ppmvd @ 15% O2; CO – 10.60 lb/hr and 2.0 ppmvd @ 15% O2; PM10 – 11.78 lb/hr; or SOx (as SO2) – 6.65 lb/hr. NOx (as NO2) emission limits are one hour rolling averages. All other emission limits are three hour rolling averages. [District Rules 2201, 4001, and 4703]

28. Emission rates from this unit (without duct burner firing), except during startup and shutdown periods, shall not exceed any of the following limits: NOx (as NO2) - 13.55 lb/hr and 2.0 ppmvd @ 15% O2; VOC (as methane) - 3.34 lb/hr and 1.4 ppmvd @ 15% O2; CO – 8.35 lb/hr and 2.0 ppmvd @ 15% O2; PM10 – 8.91 lb/hr; or SOx (as SO2) – 5.23 lb/hr. NOx (as NO2) emission limits are one hour rolling averages. All other emission limits are three hour rolling averages. [District Rules 2201, 4001, and 4703]

29. During start-up and shutdown, CTG exhaust emission rates shall not exceed any of the following limits: $NO_X$ (as $NO_2$) – 160 lb/hr; CO – 1,000 lb/hr; VOC (as methane) – 16 lb/hr; $PM_{10}$ – 11.78 lb/hr; $SO_X$ (as $SO_2$) – 6.652 lb/hr; or $NH_3$ – 32.13 lb/hr. [District Rules 2201 and 4703]

30. Daily emissions from the CTG shall not exceed the following limits: $NO_X$ (as $NO_2$) – 412.8 lb/day; CO – 254.4 lb/day; VOC – 141.4 lb/day; $PM_{10}$ – 282.7 lb/day; $SO_X$ (as $SO_2$) – 159.6 lb/day, or $NH_3$ – 771.1 lb/day. [District Rule 2201]

31. Emissions from this unit, on days when a startup and/or shutdown occurs, shall not exceed the following limits: NOx (as NO2) – 789.6 lb/day; VOC – 202.0 lb/day; CO – 5,590.8 lb/day; PM10 – 282.7 lb/day; SOx (as SO2) – 159.6 lb/day, or $NH_3$ – 771.1 lb/day. [District Rule 2201]

32. The ammonia (NH3) emissions shall not exceed 10 ppmvd @ 15% O2 over a 24 hour rolling average. [District Rule 2201]

33. The CTG shall be fired exclusively on PUC-regulated natural gas with a sulfur content no greater than 1.0 grain of sulfur compounds (as S) per 100 dry scf of natural gas. [District Rule 2201 and 40 CFR 60.4330(a)(2)]

34. Annual emissions from the CTG, calculated on a twelve month rolling basis, shall not exceed any of the following limits: $NO_X$ (as $NO_2$) – 143,951 lb/year; CO – 197,928 lb/year; VOC – 34,489 lb/year; $PM_{10}$ – 80,656 lb/year; or $SO_X$ (as $SO_2$) – 16,694 lb/year; or $NH_3$ – 208,708 lb/year. [District Rule 2201]

35. The duration of each startup or shutdown shall not exceed six hours. Startup and shutdown emissions shall be counted toward all applicable emission limits. [District Rules 2201 and 4703]

36. Each one hour period shall commence on the hour. Each one hour period in a three hour rolling average will commence on the hour. The three hour average will be compiled from the three most recent one hour periods. Each one hour period in a twenty-four hour average for ammonia slip will commence on the hour. [District Rule 2201]

37. Daily emissions will be compiled for a twenty-four hour period starting and ending at twelve-midnight. Each month in the twelve consecutive month rolling average emissions shall commence at the beginning of the first day of the month. The twelve consecutive month rolling average emissions to determine compliance with annual emissions limitations shall be compiled from the twelve most recent calendar months. [District Rule 2201]

38. Startup shall be defined as the period of time during which a unit is brought from a shutdown status to its operating temperature and pressure, including the time required by the unit's emission control system to reach full operations. Shutdown shall be defined as the period of time during which a unit is taken from an operational to a non-operational status by allowing it to cool down from its operating temperature to ambient temperature as the fuel supply to the unit is completely turned off. [District Rules 2201 and 4703]

39. The emission control systems shall be in operation and emissions shall be minimized insofar as technologically feasible during startup and shutdown. [District Rule 4703]

40. The exhaust stack shall be equipped with permanent provisions to allow collection of stack gas samples consistent with EPA test methods and shall be equipped with safe permanent provisions to sample stack gases with a portable NOx, CO, and O2 analyzer during District inspections. The sampling ports shall be located in accordance with the CARB regulation titled California Air Resources Board Air Monitoring Quality Assurance Volume VI, Standard Operating Procedures for Stationary Emission Monitoring and Testing. [District Rule 1081]

41. Source testing to measure startup NOx, CO, and VOC mass emission rates shall be conducted for one of the gas turbines (C-3953-10 or C-3953-11) prior to the end of the commissioning period and at least once every seven years thereafter. CEM relative accuracy shall be determined during startup source testing in accordance with 40 CFR 60, Appendix B. [District Rule 1081]

42. Source testing (with and without duct burner firing) to measure the NOx, CO, and VOC emission rates (lb/hr and ppmvd @ 15% O2) shall be conducted within 60 days after the end of the commissioning period and at least once every twelve months thereafter. [District Rules 1081 and 4703]

43. Source testing (with and without duct burner firing) to measure the PM10 emission rate (lb/hr) and the ammonia emission rate shall be conducted within 60 days after the end of the commissioning period and at least once every twelve months thereafter. [District Rule 1081]

44. Compliance with natural gas sulfur content limit shall be demonstrated within 60 days after the end of the commissioning period and weekly thereafter. After demonstrating compliance with the fuel sulfur content limit for 8 consecutive weeks for a fuel source, then the testing frequency shall not be less than monthly. If a test shows noncompliance with

the sulfur content requirement, the source must return to weekly testing until eight consecutive weeks show compliance. [District Rules 1081, 2540, and 4001].

45. Demonstration of compliance with the annual average sulfur content limit shall be demonstrated by a 12 month rolling average of the sulfur content either (i) documented in a valid purchase contract, a supplier certification, a tariff sheet or transportation contract or (ii) tested using ASTM Methods D1072, D3246, D4084, D4468, D4810, D6228, D6667 or Gas Processors Association Standard 2377. [District Rules 1081 and 2201]

46. Source testing to determine compliance with the NOx, CO and VOC emission rates (lb/hr and ppmvd @ 15% $O_2$), NH3 emission rate (ppmvd @ 15% $O_2$) and $PM_{10}$ emission rate (lb/hr) shall be conducted at least once every 12 months. [District Rules 1081, 2201 and 4703 and 40 CFR 60.4400(a)]

47. Compliance with the $NO_X$ and CO emission limits shall be demonstrated with the auxiliary burner both on and off. [District Rule 4703]

48. Compliance demonstration (source testing) shall be District witnessed, or authorized and samples shall be collected by a California Air Resources Board certified testing laboratory. Source testing shall be conducted using the methods and procedures approved by the District. The District must be notified 30 days prior to any compliance source test, and a source test plan must be submitted for approval 15 days prior to testing. The results of each source test shall be submitted to the District within 60 days thereafter. [District Rule 1081]

49. The following test methods shall be used: $NO_X$ - EPA Method 7E or 20; CO - EPA Method 10 or 10B; VOC - EPA Method 18 or 25; PM10 - EPA Method 5 (front half and back half) or 201 and 202a; ammonia - BAAQMD ST-1B; and $O_2$ - EPA Method 3, 3A, or 20. EPA approved alternative test methods as approved by the District may also be used to address the source testing requirements of this permit. [District Rules 1081 and 4703 and 40 CFR 60.4400(1)(i)]

50. The sulfur content of each fuel source shall be: (i) documented in a valid purchase contract, a supplier certification, a tariff sheet or transportation contract or (ii) monitored within 60 days of the end of the commission period and weekly thereafter. If the sulfur content is demonstrated to be less than 1.0 gr/100 scf for eight consecutive weeks, then the monitoring frequency shall be every six months. If the result of any six month monitoring demonstrates that the fuel does not meet the fuel sulfur content limit, weekly monitoring shall resume. [District Rule 2201 and 40 CFR 60.4360, 60.4365(a) and 60.4370(c)]

51. Excess emissions shall be defined as any operating hour in which the 4-hour or 30-day rolling average $NO_X$ concentration exceeds applicable emissions limit and a period of monitor downtime shall be any unit operating hour in which sufficient data are not obtained to validate the hour for either $NO_X$ or O2 (or both). [40 CFR 60.4380(b)(1)]

52. Fuel sulfur content shall be monitored using one of the following methods: ASTM Methods D1072, D3246, D4084, D4468, D4810, D6228, D6667 or Gas Processors Association Standard 2377. [40 CFR 60.4415(a)(1)(i)]

53. The permittee shall submit to the District information correlating the $NO_X$ control system operating parameters to the associated measured $NO_X$ output. The information must be sufficient to allow the District to determine compliance with the $NO_X$ emission limits of this permit during times that the CEMS is not functioning properly. [District Rule 4703]

54. The permittee shall maintain the following records: the date, time and duration of any malfunction of the continuous monitoring equipment; dates of performance testing; dates of evaluations, calibrations, checks, and adjustments of the continuous monitoring equipment; date and time period which a continuous monitoring system or monitoring device was inoperative. [District Rules 1080 and 2201 and 40 CFR 60.8(d)]

55. The permittee shall maintain the following records: date and time, duration, and type of any startup, shutdown, or malfunction; performance testing, evaluations, calibrations, checks, adjustments, any period during which a continuous monitoring system or monitoring device was inoperative, and maintenance of any continuous emission monitor. [District Rules 2201 and 4703]

56. The permittee shall maintain the following records: hours of operation, fuel consumption (scf/hr and scf/rolling twelve month period), continuous emission monitor measurements, calculated ammonia slip, and calculated NOx mass emission rates (lb/hr and lb/twelve month rolling period). [District Rules 2201 and 4703]

57. The owner or operator of a stationary gas turbine system shall maintain all records of required monitoring data and support information for inspection at any time for a period of five years. [District Rules 2201 and 4703]

**EQUIPMENT DESCRIPTION, UNIT C-3953-12-1:**
**37.4 MMBTU/HR CLEAVER BROOKS MODEL CBL-700-900-200#ST NATURAL GAS-FIRED BOILER WITH A CLEAVER BROOKS MODEL PROFIRE, OR DISTRICT APPROVED EQUIVALENT, ULTRA LOW NOX BURNER**

1. Permittee shall submit an application to comply with SJVUAPCD District Rule 2520 - Federally Mandated Operating Permits within twelve months of commencing operation. [District Rule 2520]

2. Prior to initial operation of C-3953-10-1, C-3953-11-1, and C-3953-12-1, permittee shall provide NOx (as NO2) emission reduction credits for the following quantities of emissions: 1st quarter – 67,103 lb; 2nd quarter – 67,104 lb; 3rd quarter – 67,104 lb; and 4th quarter – 67,104 lb. Offsets shall be provided at the appropriate distance ratio specified in Rule 2201. [District Rule 2201]

3. Prior to initial operation of C-3953-10-1, C-3953-11-1, and C-3953-12-1, permittee shall provide VOC emission reduction credits for the following quantities of emissions: 1st quarter – 12,294 lb; 2nd quarter – 12,295 lb; 3rd quarter – 12,295 lb; and 4th quarter – 12,295 lb. Offsets shall be provided at the appropriate distance ratio specified in Rule 2201. [District Rule 2201]

4. Prior to initial operation of C-3953-10-1, C-3953-11-1, and C-3953-12-1, permittee shall provide $PM_{10}$ emission reduction credits for the following quantities of emissions: 1st quarter – 33,086 lb; 2nd quarter – 33,086 lb; 3rd quarter – 33,086 lb; and 4th quarter – 33,086 lb. Offsets shall be provided at the appropriate distance ratio specified in Rule 2201. SOx ERC's may be used to offset PM10 increases at an interpollutant ratio of 1.0 lb-SOx : 1.0 lb-PM10. [District Rule 2201]

5. ERC certificate numbers (or any splits from these certificates) C-897-1, C-898-1, N-724-1, N-725-1, S-2812-1, S-2813-1, S-2817-1, C-899-2, C-902-2, N-720-2, N-722-2, N-726-2, N-728-2, S-2814-2, S-2321-2, C-896-4, N-721-4, N-723-4, S-2791-5, S-2790-5, S-2789-5, S-2788-5, or N-762-5 shall be used to supply the required offsets, unless a revised offsetting proposal is received and approved by the District, upon which this determination of compliance (DOC) shall be reissued, administratively specifying the new offsetting proposal. Original public noticing requirements, if any, shall be duplicated prior to reissuance of the DOC. [District Rule 2201]

6. The permittee shall obtain written District approval for the use of any equivalent equipment not specifically approved by this DOC. Approval of the equivalent equipment shall be made only after the District's determination that the submitted design and performance of the proposed alternate equipment is equivalent to the specifically authorized equipment. [District Rule 2201]

7. The permittee's request for approval of equivalent equipment shall include the make, model, manufacturer's maximum rating, manufacturer's guaranteed emission rates, equipment drawing(s), and operational characteristics/parameters. [District Rule 2010]

8. Alternate equipment shall be of the same class and category of source as the equipment authorized by the DOC. [District Rule 2201]

9. No emission factor and no emission shall be greater for the alternate equipment than for the proposed equipment. No changes in the hours of operation, operating rate, throughput, or firing rate may be authorized for any alternate equipment. [District Rule 2201]

10. Annual emissions from the facility, calculated on a twelve month rolling basis, shall not exceed any of the following limits: $NO_X$ (as $NO_2$) – 198,840 lb/year; CO – 197,928 lb/year. [District Rule 2201

11. {1407} All equipment shall be maintained in good operating condition and shall be operated in a manner to minimize emissions of air contaminants into the atmosphere. [District Rule 2201]

12. {98} No air contaminant shall be released into the atmosphere which causes a public nuisance. [District Rule 4102]

13. {15} No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1 or 20% opacity. [District Rule 4101]

14. {14} Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201]

15. {2964} The unit shall only be fired on PUC-regulated natural gas. [District Rule 2201]

16. Emission rates from this unit shall not exceed any of the following limits: NOx (as NO2) - 9.0 ppmvd @ 3% O2 or 0.011 lb/MMBtu; VOC (as methane) - 10.0 ppmvd @ 3% O2; CO - 50.0 ppmvd @ 3% O2 or 0.037 lb/MMBtu; PM10 - 0.005 lb/MMBtu; or SOx (as SO2) - 0.00285 lb/MMBtu. [District Rules 2201, 4305, and 4306]

17. {2972} All emissions measurements shall be made with the unit operating either at conditions representative of normal operations or conditions specified in the Permit to Operate. No determination of compliance shall be established within two hours after a continuous period in which fuel flow to the unit is shut off for 30 minutes or longer, or within 30 minutes after a re-ignition as defined in Section 3.0 of District Rule 4306. [District Rules 4305 and 4306]

18. {3467} Source testing to measure NOx and CO emissions from this unit while fired on natural gas shall be conducted within 60 days of initial start-up. [District Rules 2201, 4305, and 4306]

19. {3466} Source testing to measure NOx and CO emissions from this unit while fired on natural gas shall be conducted at least once every twelve (12) months. After demonstrating compliance on two (2) consecutive annual source tests, the unit shall be tested not less than once every thirty-six (36) months. If the result of the 36-month source test demonstrates that the unit does not meet the applicable emission limits, the source testing frequency shall revert to at least once every twelve (12) months. [District Rules 4305 and 4306]

20. {2976} The source test plan shall identify which basis (ppmv or lb/MMBtu) will be used to demonstrate compliance. [District Rules 4305 and 4306]

21. {109} Source testing shall be conducted using the methods and procedures approved by the District. The District must be notified at least 30 days prior to any compliance source test, and a source test plan must be submitted for approval at least 15 days prior to testing. [District Rule 1081]

22. {2977} NOx emissions for source test purposes shall be determined using EPA Method 7E or ARB Method 100 on a ppmv basis, or EPA Method 19 on a heat input basis. [District Rules 4305 and 4306]

23. {2978} CO emissions for source test purposes shall be determined using EPA Method 10 or ARB Method 100. [District Rules 4305 and 4306]

24. {2979} Stack gas oxygen (O2) shall be determined using EPA Method 3 or 3A or ARB Method 100. [District Rules 4305 and 4306]

25. {2980} For emissions source testing, the arithmetic average of three 30-consecutive-minute test runs shall apply. If two of three runs are above an applicable limit the test cannot be used to demonstrate compliance with an applicable limit. [District Rules 4305 and 4306]

26. {110} The results of each source test shall be submitted to the District within 60 days thereafter. [District Rule 1081]

27. A non-resettable, totalizing mass or volumetric fuel flow meter to measure the amount of fuel combusted in the unit shall be installed, utilized and maintained. [District Rules 2201 and 40 CFR 60.48 (c)(g)]

28. Permittee shall maintain daily records of the type and quantity of fuel combusted by the boiler. [District Rules 2201 and 40 CFR 60.48 (c)(g)]

29. {2983} All records shall be maintained and retained on-site for a minimum of five (5) years, and shall be made available for District inspection upon request. [District Rules 1070, 4305, and 4306]

30. {1832} The exhaust stack shall be equipped with a continuous emissions monitor (CEM) for NOx, CO, and O2. The CEM shall meet the requirements of 40 CFR parts 60 and 75 and shall be capable of monitoring emissions during startups and shutdowns as well as during normal operating conditions. [District Rules 2201 and 1080]

27. {1833} The facility shall install and maintain equipment, facilities, and systems compatible with the District's CEM data polling software system and shall make CEM data available to the District's automated polling system on a daily basis. [District Rule 1080]

28. {1834} Upon notice by the District that the facility's CEM system is not providing polling data, the facility may continue to operate without providing automated data for a maximum of 30 days per calendar year provided the CEM data is sent to the District by a District-approved alternative method. [District Rule 1080]

29. {1835} The exhaust stack shall be equipped with permanent provisions to allow collection of stack gas samples consistent with EPA test methods and shall be equipped with safe permanent provisions to sample stack gases with a portable NOx, CO, and O2 analyzer during District inspections. The sampling ports shall be located in accordance with the CARB regulation titled California Air Resources Board Air Monitoring Quality Assurance Volume VI, Standard Operating Procedures for Stationary Source Emission Monitoring and Testing. [District Rule 1081]

30. {1836} Results of continuous emissions monitoring shall be reduced according to the procedure established in 40 CFR, Part 51, Appendix P, paragraphs 5.0 through 5.3.3, or by other methods deemed equivalent by mutual agreement with the District, the ARB, and the EPA. [District Rule 1080]

31. {1837} Audits of continuous emission monitors shall be conducted quarterly, except during quarters in which relative accuracy and total accuracy testing is performed, in accordance with EPA guidelines. The District shall be notified prior to completion of the audits. Audit reports shall be submitted along with quarterly compliance reports to the District. [District Rule 1080]

32. {1838} The owner/operator shall perform a relative accuracy test audit (RATA) as specified by 40 CFR Part 60, Appendix F, 5.11, at least once every four calendar quarters. The permittee shall comply with the applicable requirements for quality assurance testing and maintenance of the continuous emission monitor equipment in accordance with the procedures and guidance specified in 40 CFR Part 60, Appendix F. [District Rule 1080]

33. {1839} The permittee shall submit a written report to the APCO for each calendar quarter, within 30 days of the end of the quarter, including: time intervals, data and magnitude of excess emissions, nature and cause of excess emissions (if known), corrective actions taken and preventive measures adopted; averaging period used for data reporting shall correspond to the averaging period for each respective emission standard; applicable time and date of each period during which the CEM was inoperative (except for zero and span checks) and the nature of system repairs and adjustments; and a negative declaration when no excess emissions occurred. [District Rule 1080]

**EQUIPMENT DESCRIPTION, UNIT C-3953-13-1:**
**288 BHP CLARKE MODEL JW6H-UF40 DIESEL-FIRED EMERGENCY IC ENGINE POWERING A FIRE PUMP**

1. Permittee shall submit an application to comply with SJVUAPCD District Rule 2520 - Federally Mandated Operating Permits within twelve months of commencing operation. [District Rule 2520]

2. Annual emissions from the facility, calculated on a twelve month rolling basis, shall not exceed any of the following limits: $NO_X$ (as $NO_2$) – 198,840 lb/year; CO – 197,928 lb/year. [District Rule 2201

3. {98} No air contaminant shall be released into the atmosphere which causes a public nuisance. [District Rule 4102]

4. {14} Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201]

5. {15} No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1 or 20% opacity. [District Rule 4101]

6. {1898} The exhaust stack shall vent vertically upward. The vertical exhaust flow shall not be impeded by a rain cap, roof overhang, or any other obstruction. [District Rule 4102]

7. {3395} Only CARB certified diesel fuel containing not more than 0.0015% sulfur by weight is to be used. [District Rules 2201 and 4801 and 17 CCR 93115]

8. {3403} This engine shall be equipped with an operational non-resettable elapsed time meter or other APCO approved alternative. [District Rule 4702 and 17 CCR 93115]

9. Emissions from this IC engine shall not exceed any of the following limits: 3.4 g-NOx/bhp-hr, 0.447 g-CO/bhp-hr, or 0.38 g-VOC/bhp-hr. [District Rule 2201 and 13 CCR 2423 and 17 CCR 93115]

10. Emissions from this IC engine shall not exceed 0.059 g-PM10/bhp-hr based on USEPA certification using ISO 8178 test procedure. [District Rules 2201 and 4102 and 13 CCR 2423 and 17 CCR 93115]

11. This engine shall be operated only for testing and maintenance of the engine, required regulatory purposes, and during emergency situations. For testing purposes, the engine shall only be operated the number of hours necessary to comply with the testing requirements of the National Fire Protection Association (NFPA) 25 - "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems", 1998 edition. Total hours of operation for all maintenance, testing, and required regulatory purposes shall not exceed 50 hours per calendar year. [District Rule 4702 and 17 CCR 93115]

12. {3807} An emergency situation is an unscheduled electrical power outage caused by sudden and reasonably unforeseen natural disasters or sudden and reasonably unforeseen events beyond the control of the permittee. [District Rule 4702]

13. {3489} The permittee shall maintain monthly records of emergency and non-emergency operation. Records shall include the number of hours of emergency operation, the date and number of hours of all testing and maintenance operations, and the purpose of the operation (for example: load testing, weekly testing, rolling blackout, general area power outage, etc.). For units with automated testing systems, the operator may, as an alternative to keeping records of actual operation for testing purposes, maintain a readily accessible written record of the automated testing schedule. [District Rule 4702 and 17 CCR 93115]

14. {3475} All records shall be maintained and retained on-site for a minimum of five (5) years, and shall be made available for District inspection upon request. [District Rule 4702 and 17 CCR 93115]

**EQUIPMENT DESCRIPTION, UNIT C-3953-14-1:**
860 BHP CATERPILLAR MODEL 3456 NATURAL GAS-FIRED EMERGENCY IC ENGINE POWERING WITH NON-SELECTIVE CATALYTIC REDUCTION (NSCR) POWERING A 500 KW ELECTRICAL GENERATOR

1. Permittee shall submit an application to comply with SJVUAPCD District Rule 2520 - Federally Mandated Operating Permits within twelve months of commencing operation. [District Rule 2520]

2. Permittee shall submit an application to comply with SJVUAPCD District Rule 2540 - Acid Rain Program within 12 months of commencing operation. [District Rule 2540]

3. Annual emissions from the facility, calculated on a twelve month rolling basis, shall not exceed any of the following limits: $NO_X$ (as $NO_2$) – 198,840 lb/year; CO – 197,928 lb/year. [District Rule 2201

4. {98} No air contaminant shall be released into the atmosphere which causes a public nuisance. [District Rule 4102]

5. {14} Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201]

6. {15} No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1 or 20% opacity. [District Rule 4101]

7. {1898} The exhaust stack shall vent vertically upward. The vertical exhaust flow shall not be impeded by a rain cap, roof overhang, or any other obstruction. [District Rule 4102]

8. {3492} This IC engine shall be equipped with a three-way catalyst. [District Rule 2201]

9. {3404} This engine shall be equipped with an operational non-resettable elapsed time meter or other APCO approved alternative. [District Rule 4702]

10. Emissions from this IC engine shall not exceed any of the following limits: 1.0 g-NOx/bhp-hr, 0.034 g-PM10/bhp-hr, 0.6 g-CO/bhp-hr, or 0.33 g-VOC/bhp-hr. [District Rule 2201]

11. {3405} This engine shall be operated and maintained in proper operating condition as recommended by the engine manufacturer or emissions control system supplier. [District Rule 4702]

12. {3478} During periods of operation for maintenance, testing, and required regulatory purposes, the permittee shall monitor the operational characteristics of the engine as recommended by the manufacturer or emission control system supplier (for example: check engine fluid levels, battery, cables and connections; change engine oil and filters; replace engine coolant; and/or other operational characteristics as recommended by the manufacturer or supplier). [District Rule 4702]

13. This engine shall be operated only for testing and maintenance of the engine, required regulatory purposes, and during emergency situations. Operation of the engine for maintenance, testing, and required regulatory purposes shall not exceed 50 hours per calendar year. [District Rule 4702]

14. {3807} An emergency situation is an unscheduled electrical power outage caused by sudden and reasonably unforeseen natural disasters or sudden and reasonably unforeseen events beyond the control of the permittee. [District Rule 4702]

15. {3808} This engine shall not be used to produce power for the electrical distribution system, as part of a voluntary utility demand reduction program, or for an interruptible power contract. [District Rule 4702]

16. {3496} The permittee shall maintain monthly records of emergency and non-emergency operation. Records shall include the number of hours of emergency operation, the date and number of hours of all testing and maintenance operations, the purpose of the operation (for example: load testing, weekly testing, rolling blackout, general area power outage, etc.) and records of operational characteristics monitoring. For units with automated testing systems, the operator may, as an alternative to keeping records of actual operation for testing purposes, maintain a readily accessible written record of the automated testing schedule. [District Rule 4702]

17. {3497} All records shall be maintained and retained on-site for a minimum of five (5) years, and shall be made available for District inspection upon request. [District Rule 4702]

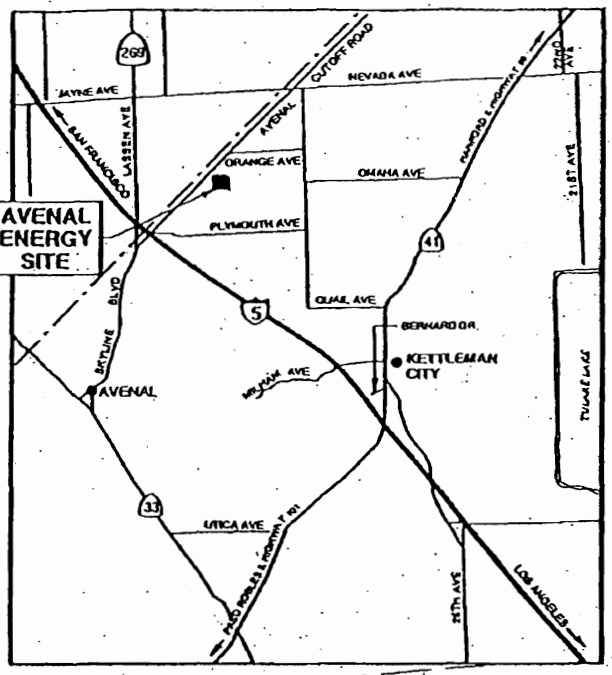
# ATTACHMENT B

***Project Location and Site Plan***

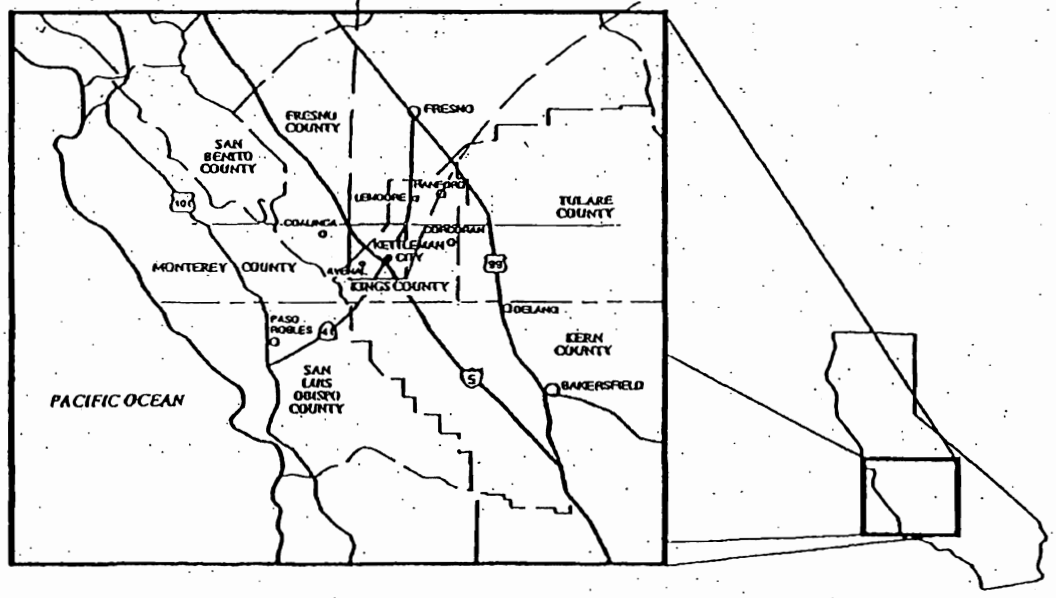
# ATTACHMENT C

## *CTG Commissioning Period Emissions Data*

290317-AFC-2.0-1 REV1 09/05/08




VICINITY MAP
NOT TO SCALE




REGIONAL MAP

0 60 120 MILES

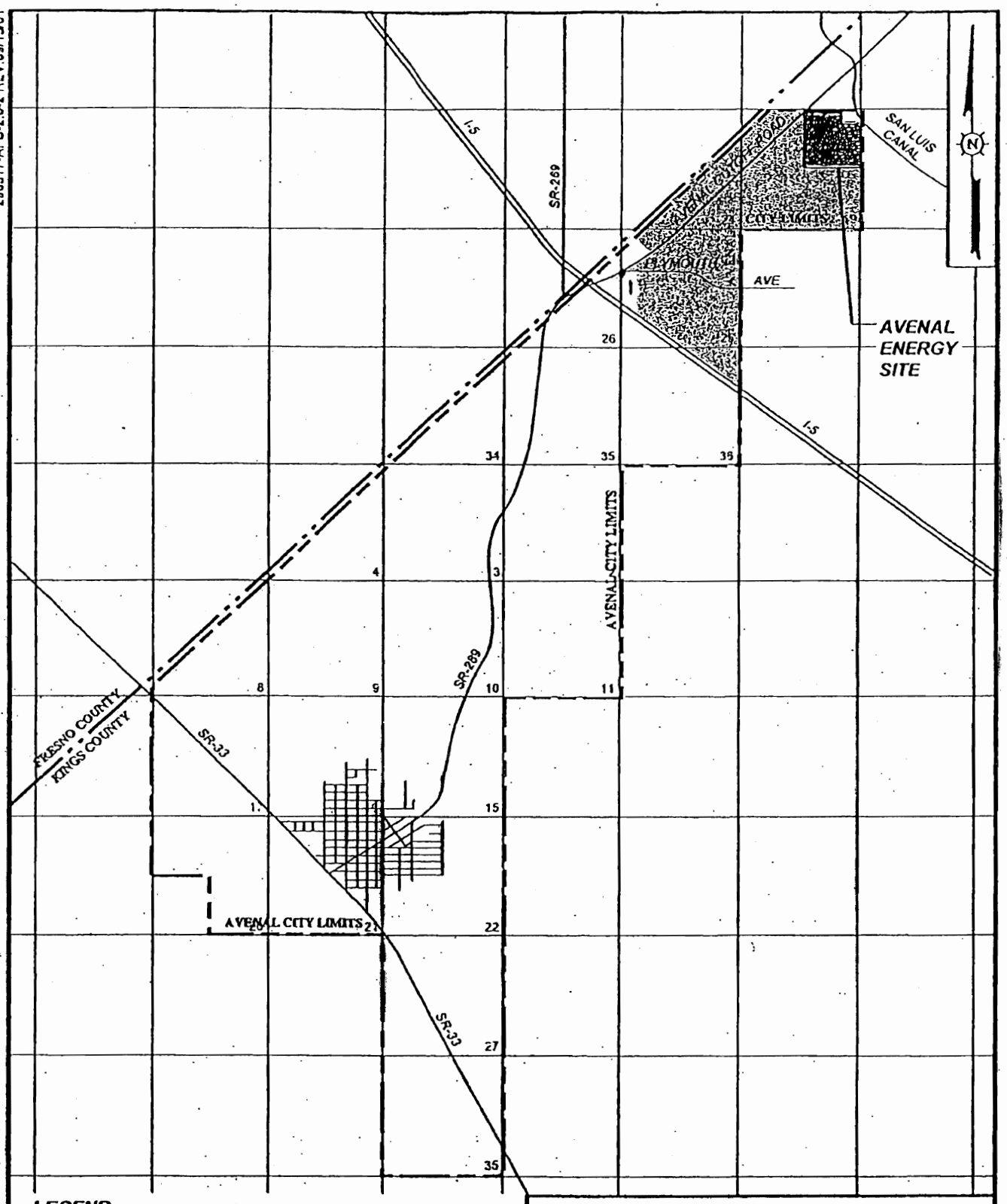
APPROXIMATE SCALE

REGIONAL LOCATION MAP

FEDERAL ENERGY AVENAL, LLC

AVENAL ENERGY | FIGURE 2.0-1

290317-AFC-2.0-2 REV.09/13/01




**LEGEND**

INDUSTRIAL ZONE (CITY OF AVENAL GENERAL PLAN AND ZONING ORDINANCE)

0 6,000 12,000 FEET

SCALE

REFERENCE: CITY OF AVENAL GENERAL PLAN.

1 36.074 -120.093

**SITE LOCATION**

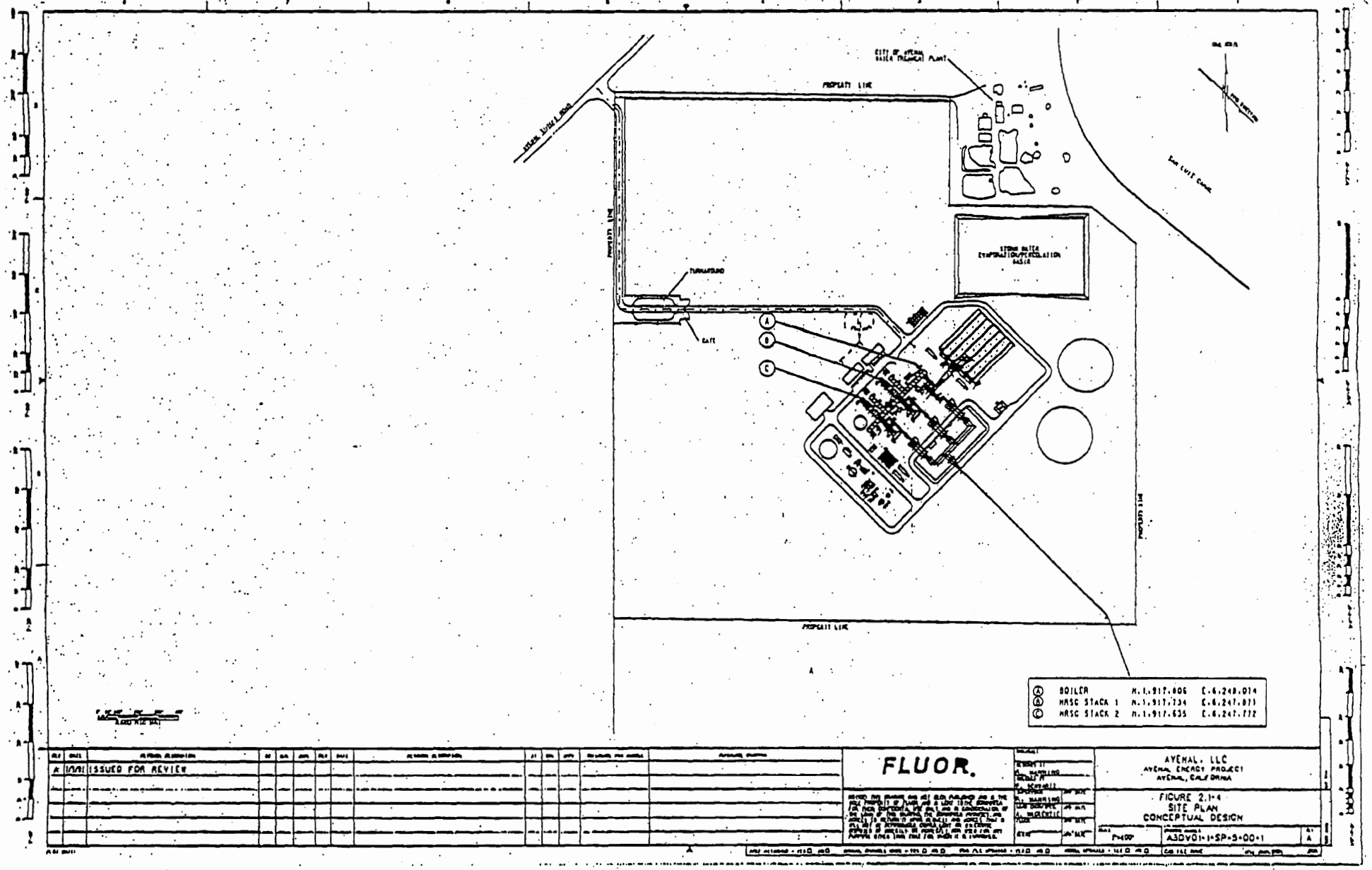
AV

② Rd crosses horizrd near development

36.109 -120.0486

**FEDERAL POWER AVENAL, LLC**

| *AVENAL ENERGY* | **FIGURE 2.0-2** |
|---|---|



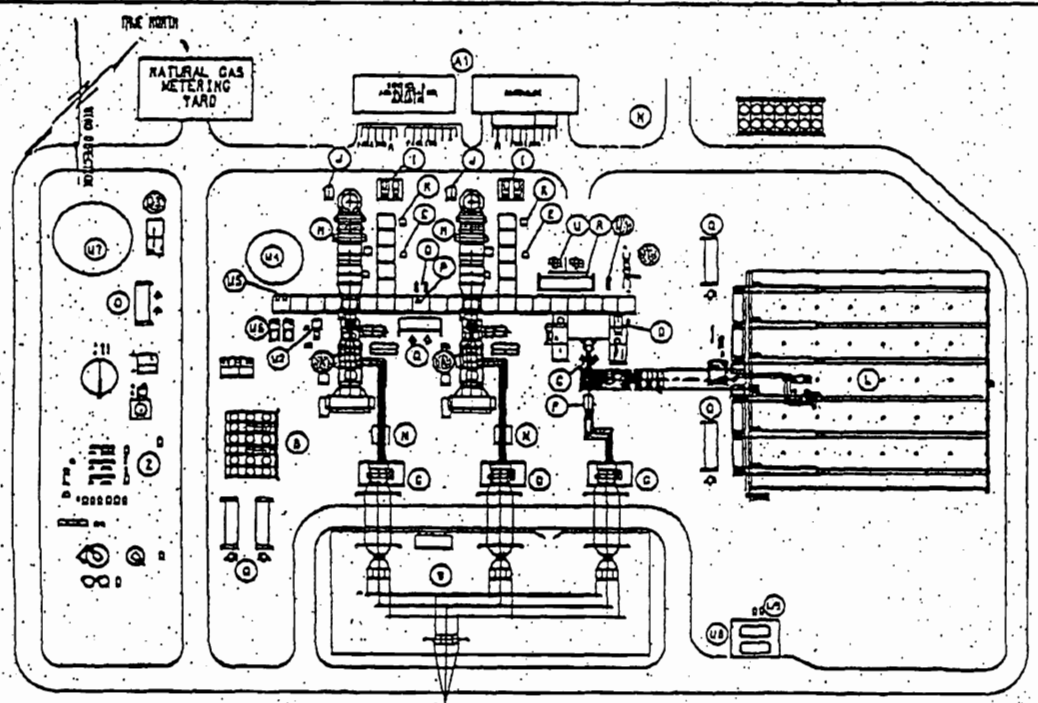

| REV | DATE | DESCRIPTION | BY | CHK | APP |
|---|---|---|---|---|---|
| A | 11/01 | ISSUED FOR REVIEW | | | |

FLUOR.

AYEHAL, LLC
AYEHAL ENERGY PROJECT
AYEHAL, CALIFORNIA

FIGURE 2.1-4
SITE PLAN
CONCEPTUAL DESIGN

A3DV01-1-SP-S-00-1




## MAJOR EQUIPMENT LIST

A GAS TURBINE GENERATOR
B INLET AIR CHILLERS
C STEAM TURBINE
D STG LUBE OIL SKID
E HRSG BLOW DOWN DRUM
F STG GENERATOR
G MAIN TRANSFORMERS
H HEAT RECOVERY STEAM GENERATOR
I HP/IP BOILER FEED WATER PUMPS
J CONTINUOUS EMISSIONS MONITORING SYSTEM
K HRSG BLOWDOWN SUMP
L AIR COOLED CONDENSER
M GENERATOR BREAKERS
N CLOSED COOLING WATER AIR COOLER
O CIRCULATING COOLING WATER PUMPS
P CLOSED COOLING WATER EXPANSION TANK
Q POWER DISTRIBUTION CENTER (480 V)
R POWER DISTRIBUTION CENTER (4160 V)
S
T AUXILIARY BOILER
U UNIT AUXILIARY TRANSFORMER
Y
W SWITCHYARD
X RAW WATER SOFTENER CLARIFIERS (RWSC)
Y RWSC FILTER PRESS
Z ZERO LIQUID DISCHARGE FACILITY (ZLDF)

A1 SEPTIC TANK & LEACH FIELD (IMMEDIATELY NW)
A2 STORM WATER EVAPORATION/PERCOLATION BASIN

## UTILITIES

U1 STANDBY DIESEL GENERATOR
U2 OIL/WATER SEPARATOR
U3 FIREWATER PUMP HOUSE
U4 DEMINERALIZED WATER STORAGE TANK
U5 DEMINERALIZED WATER PUMPS
U6 PLANT/INSTRUMENT AIR COMPRESSORS
U7 RAW WATER/FIREWATER STORAGE TANKS
U8 AMMONIA STORAGE TANKS
U9 AMMONIA TRANSFER PUMPS

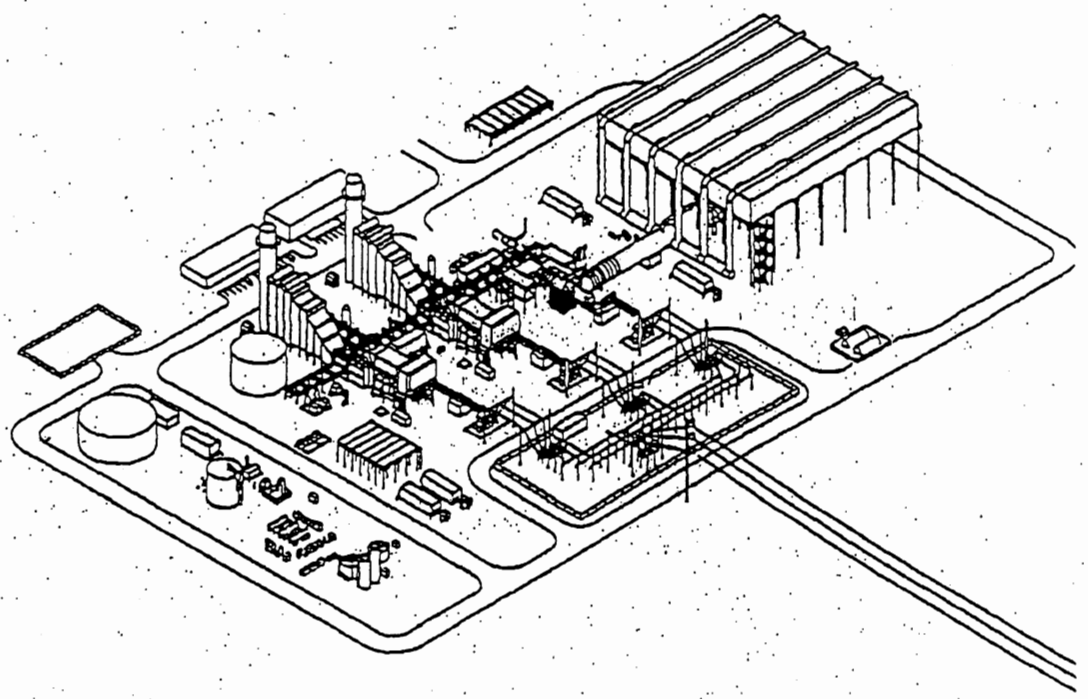
| | | |
|---|---|---|
| A | [illegible] | ISSUED FOR REVIEW |

FLUOR.

AVENAL, LLC
AVENAL ENERGY PROJECT
AVENAL, CALIFORNIA

FIGURE 2.3-3
PLOT PLAN
CONCEPTUAL DESIGN

P-125 | A3DV01-1-PP-0-00-1 | A



| REV | DATE | DESCRIPTION |
|---|---|---|
| A | 1/8/01 | ISSUED FOR REVIEW |

FLUOR.

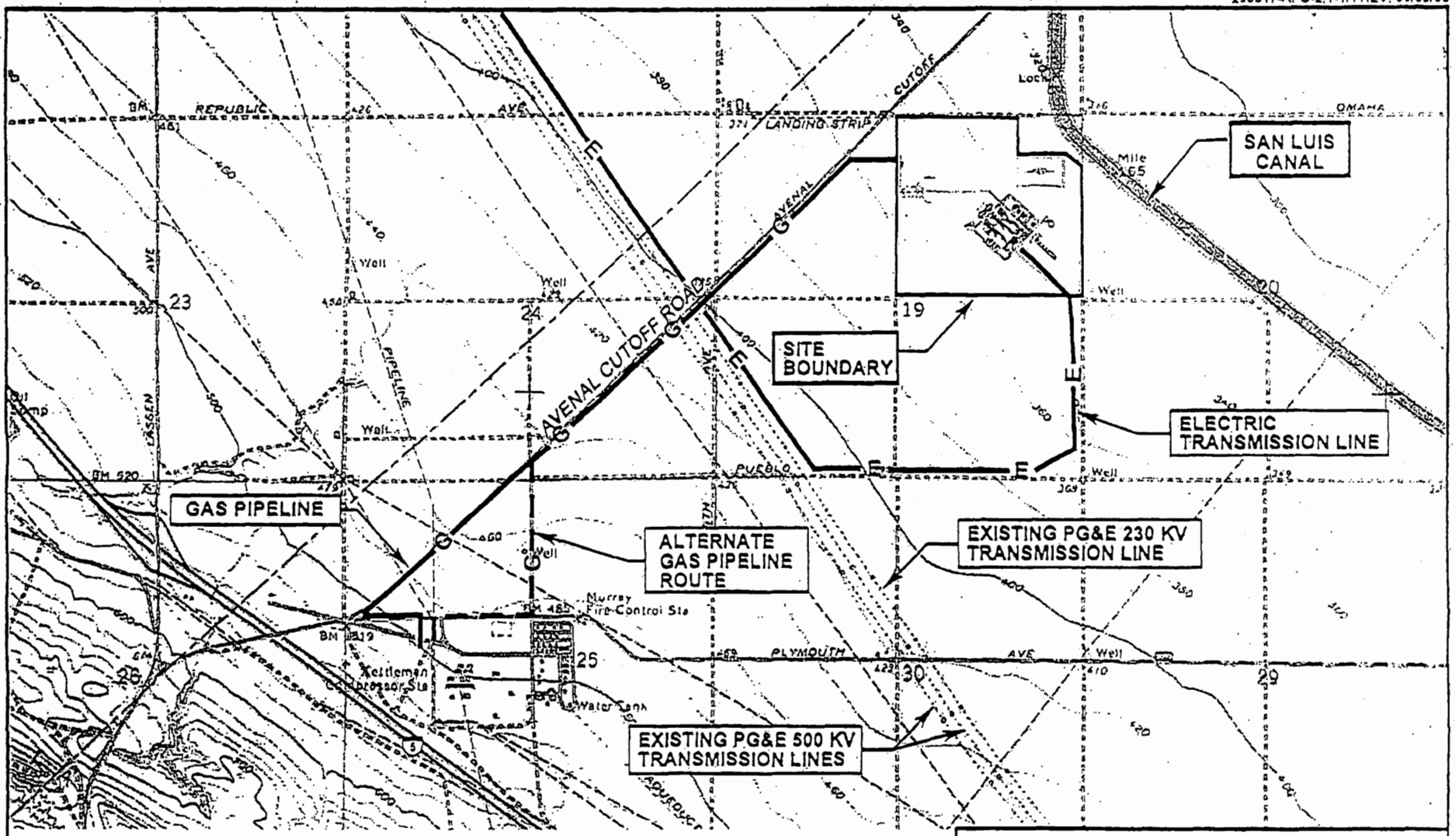
AVENAL, LLC
AVENAL ENERGY PROJECT
AVENAL, CALIFORNIA

ISO VIEW
CONCEPTUAL DESIGN

NONE

A30V01-1-PP-0-00-2

A




REFERENCE:
U.S.G.S 7.5 MINUTE TOPOGRAPHIC SERIES MAP OF LA CIMA, CALIFORNIA, DATED 1978.

0 2,000 4,000 FEET
SCALE

# NATURAL GAS AND ELECTRICAL INTERCONNECTION ROUTES

FEDERAL POWER AVENAL LLC

AVENAL ENERGY | FIGURE 2.1-1A

# ATTACHMENT D

***CTG Emissions Data***

The maximum heat input rates (fuel consumption rates) for the gas turbines, duct burners, and auxiliary boiler are shown in Table 6.2-22.

TABLE 6.2-22
MAXIMUM FACILITY FUEL USE, MMBTU (HHV)

| Period | Gas Turbines and Duct Burners (each[a]) | Auxiliary Boiler | Total Fuel Use (all Units) |
|---|---|---|---|
| Per Hour | 2,356.5 | 37.4 | 4,750 |
| Per Day | 56,555[b] | 449[c] | 113,111[d] |
| Per Year | 16,176,000[e] | 46,650[f] | 32,353,000[g] |

Notes:
[a] Each of two trains.
[b] Based on 24 hours per day of duct firing.
[c] Based on a startup day, during which the auxiliary boiler would be used 12 hours.
[d] The maximum facility fuel use day, during which the turbines run 24 hours with duct firing, has no use of the auxiliary boiler (i.e., no startup).
[e] Based on maximum fuel use of 7,960 hours per year without duct firing, and 800 hours per year with duct firing, per turbine.
[f] Based on 1,248 hours of operation per year.
[g] Based on baseload scenario (see Footnote d) that includes no operation of the auxiliary boiler.

***CTG Emissions During Startup and Shutdown***

Maximum emission rates expected to occur during a startup or shutdown are shown in Table 6.2-23. $PM_{10}$ and $SO_2$ emissions have not been included in this table because emissions of these pollutants depend on fuel flow, which will be lower during a startup period than during baseload facility operation.

TABLE 6.2-23
FACILITY STARTUP/SHUTDOWN EMISSION RATES[a]

| | NOx | CO | VOC |
|---|---|---|---|
| Startup/Shutdown, lb/hour, average | 80 | 900 | 16 |
| Startup/Shutdown, lb/~~start~~ hour, maximum | 160 | 1,000 | 16 |

[a] Estimated based on vendor data and source test data. See Appendix 6.2-1, Table 6.2-1.6 and -1.7.

The analysis of maximum facility emissions of each criteria pollutant was based on the turbine/HRSG and auxiliary boiler emission factors shown in Tables 6.2-19, 6.2-20, and 6.2-21; the startup emission rates shown in Table 6.2-23; the three operating scenarios described above, and the ambient conditions that result in the highest emission rates. The maximum annual, daily, and hourly emissions of each criteria pollutant for the Project are shown in Table 6.2-24 and are based on the following operating conditions and scenario parameters:

*CTG Emissions During Commissioning*

Gas turbine commissioning is the process of initial startup, tuning and adjustment of the new CTGs and auxiliary equipment and of the emission control systems. The commissioning process consists of sequential test operation of each of the two gas turbines up through increasing load levels, and with successive application of the air pollution control systems. The total set of commissioning tests will require approximately 410 operating hours for each CTG. With the planned sequential testing of the two gas turbines, the overall length of the commissioning period would be approximately 3 months. Commissioning of the proposed project may be phased into two commissioning periods each approximately 1.5 months long.

There are several commissioning modes. The first is the period prior to SCR system installation, when the combustor is being tuned. During this mode, the $NO_x$ emissions control system would not be functioning and the combustor would not be tuned for optimum performance. CO emissions would also be affected because combustor performance would not yet be optimized. The second emissions scenario will occur when the combustor has been tuned but the SCR installation is not complete, and other parts of the gas turbine operating system are being checked out. Because the combustor would be tuned but the emission control system installation would not be complete, $NO_x$ and CO levels could again be affected.

*Noncriteria Pollutant Emissions*

Noncriteria pollutants are compounds that have been identified as pollutants that pose a potential health hazard. Nine of these pollutants are regulated under the federal New Source Review program: lead, asbestos, beryllium, mercury, fluorides, sulfuric acid mist, hydrogen sulfide, total reduced sulfur, and reduced sulfur compounds.[24] In addition to these nine compounds, the federal Clean Air Act listed 187 to 189[25] substances at different times as potential hazardous air pollutants (Clean Air Act Sec. 112(b)(1)). The State of California defined a set of toxic air contaminants through Assembly Bill (AB) 2588, the Air Toxics "Hot Spots" Information and Assessment Act. The SJVAPCD published a list of compounds it defined as potential toxic air contaminants in its May 1991 Toxics Policy. Any pollutant that may be emitted from the Project and is on the federal New Source Review list, the federal Clean Air Act list, the AB2588 list or

[24] These pollutants are regulated under federal and state air quality programs; however, they are evaluated as noncriteria pollutants by the California Energy Commission.
[25] Currently 187 substances are listed.

# ATTACHMENT D

***CTG Emissions Data***

Table 8.2-1.1
Emissions and Operating Parameters for New Turbines
Avenal Energy Project

| | Case 1 | Case 5 | Case 9 | Case 2 | Case 6 | Case 10 | Case 4 | Case 8 | Case 12 |
|---|---|---|---|---|---|---|---|---|---|
| | 101°F | 63°F | 32°F | 101°F | 63°F | 32°F | 101°F | 63°F | 32°F |
| | Full Load w/ DB[1] | Full Load w/ DB[1] | Full Load w/ DB[1] | Full Load no DB | Full Load no DB | Full Load no DB | 50% Load | 50% Load | 50% Load |
| Ambient Temp, °F | 101 | 63 | 32 | 101 | 63 | 32 | 101 | 63 | 32 |
| GT Load, % | 100% | 100% | 100% | 100% | 100% | 100% | 50% | 50% | 50% |
| Both GTs Gross Power, MW | 344.8 | 345.0 | 359.0 | 345.5 | 345.8 | 369.5 | 144.1 | 168.8 | 183.2 |
| STG Gross Power, MW | 290.8 | 273.3 | 254.7 | 171.8 | 176.1 | 177.7 | 118.3 | 127.8 | 130.8 |
| Plant Gross Power Output, MW | 635.6 | 618.3 | 613.7 | 517.2 | 521.7 | 537.2 | 262.5 | 296.2 | 313.9 |
| Plant Net Power Output, MW | 600.0 | 600.0 | 600.0 | 483.7 | 506.5 | 525.5 | 250.3 | 286.3 | 304.8 |
| GTs Fuel Flow, kpph | 156.4 | 156.4 | 161.8 | 156.4 | 156.4 | 161.8 | 87.2 | 96.2 | 102.2 |
| DBs Fuel Flow, kpph | 49.0 | 39.8 | 31.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| GTs Heat Input, MMBtu/hr (HHV) | 1,794.2 | 1,794.3 | 1,855.4 | 1,795.6 | 1,795.4 | 1,856.3 | 1,001.4 | 1,104.3 | 1,171.9 |
| DBs Heat Input, MMBtu/hr (HHV) | 562.3 | 454.4 | 356.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Heat Input, MMBtu/hr (HHV) | 2,356.5 | 2,248.6 | 2,211.8 | 1,795.6 | 1,795.4 | 1,856.3 | 1,001.4 | 1,104.3 | 1,171.9 |
| Stack Flow, lb/hr | 3,653,000 | 3,650,000 | 3,759,000 | 3,628,000 | 3,630,000 | 3,743,000 | 2,232,700 | 2,336,800 | 2,413,300 |
| Stack Flow, acfm | 1,044,365 | 1,025,495 | 1,059,636 | 1,051,631 | 1,037,822 | 1,071,653 | 620,528 | 644,316 | 666,146 |
| Stack Temp, °F | 195.3 | 184.9 | 189.0 | 207.4 | 198.8 | 200.9 | 180.2 | 175.8 | 177.4 |
| Stack exhaust, vol% | | | | | | | | | |
| $O_2$ (dry) | 11.40% | 11.67% | 12.34% | 13.76% | 13.77% | 13.78% | 14.46% | 14.11% | 13.93% |
| $CO_2$ (dry) | 5.42% | 5.16% | 4.89% | 4.09% | 4.08% | 4.08% | 3.70% | 3.89% | 3.99% |
| $H_2O$ | 10.54% | 10.03% | 9.12% | 8.39% | 8.28% | 7.78% | 8.07% | 7.97% | 7.83% |
| Emissions | | | | | | | | | |
| $NO_x$, ppmvd @ 15% $O_2$ | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| $NO_x$, lb/hr[2] | 17.13 | 16.34 | 16.06 | 13.03 | 13.03 | 13.47 | 7.26 | 8.01 | 8.51 |
| $NO_x$, lb/MMBtu (HHV) | 0.0073 | 0.0073 | 0.0073 | 0.0073 | 0.0073 | 0.0073 | 0.0073 | 0.0073 | 0.0073 |
| $SO_2$, ppmvd @ 15% $O_2$ [3] | 0.139 | 0.139 | 0.140 | 0.140 | 0.140 | 0.140 | 0.140 | 0.140 | 0.140 |
| $SO_2$, lb/hr[2,3] | 1.66 | 1.59 | 1.56 | 1.27 | 1.27 | 1.31 | 0.71 | 0.78 | 0.83 |
| $SO_2$, lb/MMBtu (HHV)[3] | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 0.0007 |
| CO, ppmvd @ 15% $O_2$ | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| CO, lb/hr[2] | 20.86 | 19.90 | 19.56 | 15.86 | 15.86 | 16.39 | 8.84 | 9.75 | 10.35 |
| CO, lb/MMBtu (HHV) | 0.0089 | 0.0088 | 0.0088 | 0.0088 | 0.0088 | 0.0088 | 0.0088 | 0.0088 | 0.0088 |
| VOC, ppmvd @ 15% $O_2$ [4] | 2.0 | 2.0 | 2.0 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 |
| VOC, lb/hr[2,4] | 5.98 | 5.88 | 5.59 | 3.17 | 3.17 | 3.28 | 1.77 | 1.95 | 2.07 |
| VOC, lb/MMBtu (HHV)[4] | 0.0025 | 0.0025 | 0.0025 | 0.0018 | 0.0018 | 0.0018 | 0.0018 | 0.0018 | 0.0018 |
| $PM_{10}$, lb/hr[2,5] | 11.81 | 11.27 | 10.78 | 9.00 | 9.00 | 9.00 | 9.00 | 9.00 | 9.00 |
| $PM_{10}$, lb/MMBtu (HHV)[5] | 0.0050 | 0.0050 | 0.0049 | 0.0050 | 0.0050 | 0.0048 | 0.0090 | 0.0081 | 0.0077 |
| $PM_{10}$, gr/SCF (dry)[5] | 0.00189 | 0.00179 | 0.00165 | 0.00142 | 0.00142 | 0.00137 | 0.00230 | 0.00220 | 0.00212 |
| $NH_3$, ppmvd @ 15% $O_2$ | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 |
| $NH_3$, lb/hr[2] | 35.39 | 33.57 | 32.66 | 26.28 | 26.25 | 26.98 | 14.50 | 16.08 | 17.02 |
| $CO_2$, lb/MMBtu (HHV)[7] | 117.0 | 117.0 | 117.0 | 117.0 | 117.0 | 117.0 | 117.0 | 117.0 | 117.0 |
| $CH_4$, lb/MMBtu (HHV)[6] | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 |
| $N_2O$, lb/MMBtu (HHV)[6] | 0.00022 | 0.00022 | 0.00022 | 0.00022 | 0.00022 | 0.00022 | 0.00022 | 0.00022 | 0.00022 |
| $CO_2$, lb/hr[2] | 275,599 | 262,984 | 258,674 | 210,000 | 209,976 | 217,102 | 117,114 | 129,153 | 137,055 |
| $CH_4$, lb/hr[2] | 30.7 | 29.2 | 28.8 | 23.4 | 23.4 | 24.1 | 13.0 | 14.4 | 15.2 |
| $N_2O$, lb/hr[2] | 0.52 | 0.50 | 0.49 | 0.40 | 0.40 | 0.41 | 0.22 | 0.24 | 0.26 |

1) Includes duct burner firing only up to plant maximum output of 600 MW.

2) All mass flow values reported are on a per stack basis. Plant total mass flows are double these values.

3) All of the assumed 0.25 gr S in 100 scf of the fuel is assumed to be converted to $SO_2$ with no $SO_3$ conversion.

4) Based on an assumption that 20% of reported UHC emissions are VOCs.

5) Includes front-half (filterable) portion only. Back-half (condensable) portion is excluded.

6) $CH_4$ emission factor (kg/MMBtu) = 0.0059

ARB, *Draft Emission Factors for Mandatory Reporting Program*, Table of Methane and Nitrous Oxide Emission Factors for Stationary Combustion by Sector and Fuel Type, August 10, 2007.

7) $CO_2$ emission factor (kg/MMBtu) = 53.06

ARB, *Draft Emission Factors for Mandatory Reporting Program*, Table of Carbon Dioxide Emission Factors and Oxidation Rates for Stationary Combustion, August 10, 2007.

8) $N_2O$ emission factor (kg/MMBtu) = 0.0001

ARB, *Draft Emission Factors for Mandatory Reporting Program*, Table of Methane and Nitrous Oxide Emission Factors for Stationary Combustion by Sector and Fuel Type, August 10, 2007.

# ATTACHMENT E

## *SJVAPCD BACT Guidelines 1.1.2, 3.1.4, 3.1.8, and 3.4.2*

San Joaquin Valley
Unified Air Pollution Control District

## Best Available Control Technology (BACT) Guideline 1.1.2*

Last Update: 3/14/2002

## Boiler: > 20.0 MMBtu/hr, Natural gas fired, base-loaded or with small load swings.**

| Pollutant | Achieved in Practice or contained in the SIP | Technologically Feasible | Alternate Basic Equipment |
|---|---|---|---|
| CO | Natural gas fuel with LPG backup | | |
| NOx | 9.0 ppmvd @ 3% O2 (0.0108 lb/MMBtu/hr) Ultra-Low NOx main burner system burner system and a natural gas or LPG fired igniter system ( if the igniter system is used to heat the boiler at low fire). | 9.0 ppmvd @ 3% O2 (0.0108 lb/MMBtu/hr) Selective Catalytic Reduction, Low Temperature Oxidizer, or equal and a < 30 ppmv NOx@ 3% O2 igniter system ( if the igniter system is used to heat the boiler at low fire). | |
| PM10 | Natural gas fuel with LPG backup | | |
| SO | Natural gas fuel with LPG backup | | |
| VOC | Natural gas fuel with LPG backup | | |

** For the purpose of this determination, "small load swings" are defined as normal operational load fluctuations which are within the operational response range of an Ultra-Low NOx burner system(s).

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in s a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is requried for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

**This is a Summary Page for this Class of Source - Permit Specific BACT Determinations on Next Page(s)**

# San Joaquin Valley
# Unified Air Pollution Control District

## Best Available Control Technology (BACT) Guideline 3.1.4*

Last Update: 6/30/2001

## Emergency Diesel I.C. Engine Driving a Fire Pump

| Pollutant | Achieved in Practice or contained in the SIP | Technologically Feasible | Alternate Basic Equipment |
|---|---|---|---|
| CO | | Oxidation Catalyst | |
| NOx | Certified NOx emissions of 6.9 g/bhp-hr or less | | |
| PM10 | 0.1 grams/bhp-hr (if TBACT is triggered) (corrected 7/16/01) 0.4 grams/bhp-hr (if TBACT is not triggered) | | |
| SOx | Low-sulfur diesel fuel (500 ppmw sulfur or less) or Very Low-sulfur diesel fuel (15 ppmw sulfur or less), where available. | | |
| VOC | Positive crankcase ventilation [unless it voids the Underwriters Laboratories (UL) certification] | Catalytic Oxidation | |

1. Any engine model included in the ARB or EPA diesel engine certification lists and identified as having a PM10 emission rate of 0.149 grams/bhp-hr or less, based on ISO 8178 test procedure, shall be deemed to meet the 0.1 grams/bhp-hr requirement.
2. A site-specific Health Risk Analysis is used to determine if TBACT is triggered. (Clarification added 05/07/01)

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in s a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is requried for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

***This is a Summary Page for this Class of Source - Permit Specific BACT Determinations on Next Page(s)**

San Joaquin Valley
Unified Air Pollution Control District

## Best Available Control Technology (BACT) Guideline 3.1.8*

Last Update: 4/4/2002

### Emergency Gas-Fired IC Engine - > or = 250 hp, Lean Burn

| Pollutant | Achieved in Practice or contained in the SIP | Technologically Feasible | Alternate Basic Equipment |
|---|---|---|---|
| CO | = or < 2.75 g/bhp-hr (Lean burn natural gas fired engine, or equal) | 90% control efficiency (Oxidation catalyst, or equal) | > or = 80% control efficiency (Rich-burn engine with NSCR, or equal) |
| NOx | = or < 1.0 g/bhp-hr (Lean burn natural gas fired engine, or equal) | | = or > 90% control efficiency (Rich-burn engine with NSCR, or equal) |
| PM10 | Natural gas fuel | | |
| VOC | = or < 1.0 g/bhp-hr (Lean burn natural gas fired engine, or equal) | 90% control efficiency (Oxidation catalyst, or equal) | = or > 50% control efficiency (Rich-burn engine with NSCR, or equal) |

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in s a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is requried for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

***This is a Summary Page for this Class of Source - Permit Specific BACT Determinations on Next Page(s)**

# San Joaquin Valley
# Unified Air Pollution Control District

## Best Available Control Technology (BACT) Guideline 3.4.2*

Last Update: 10/1/2002

## Gas Turbine - = or > 50 MW, Uniform Load, with Heat Recovery

| Pollutant | Achieved in Practice or contained in the SIP | Technologically Feasible | Alternate Basic Equipment |
|---|---|---|---|
| CO | 6.0 ppmv @ 15% O2 (Oxidation catalyst, or equal) | 4.0 ppmv @ 15% O2 (Oxidation catalyst, or equal) | |
| NOx | 2.5 ppmv dry @ 15% O2 (1-hr average, excluding startup and shutdown), (Selective catalytic reduction, or equal) | 2.0 ppmv dry @ 15% O2 (1-hr average, exoluding startup and shutdown), (Selective catalytic reduction, or equal) | |
| PM10 | Air inlet filter cooler, lube oil vent coalescer and natural gas fuel, or equal | | |
| SOx | 1. PUC-regulated natural gas or 2. Non-PUC-regulated gas with no more that 0.75 grams S/100 dscf, or equal. | | |
| VOC | 2.0 ppmv @ 15% O2 | 1.5 ppmv @ 15% O2 | |

** Applicability lowered to > 50 MW pursuant to CARB Guidance for Permitting Electrical Generation Technologies. Change effective 10/1/02. Corrected error in applicability to read 50 MW not 50 MMBtu/hr effective 4/1/03.

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in s a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is requried for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

***This is a Summary Page for this Class of Source - Permit Specific BACT Determinations on Next Page(s)**

# ATTACHMENT F

***Top Down BACT Analysis***
***(C-3953-10-1, -11-1, -12-1, -13-1, and –14-1)***

**Units C-3953-10-1 and –11-1 (Turbines)**

## I. $NO_X$ Top-Down BACT Analysis

### Step 1 - Identify All Possible Control Technologies

SJVAPCD BACT Clearinghouse Guideline 3.4.2 identifies achieved in practice BACT as the following:

- 2.5 ppmvd @ 15% $O_2$ (1 hr average, excluding startup and shutdown), (Selective catalytic reduction, or equal)

SJVAPCD BACT Clearinghouse Guideline 3.4.2 identifies technologically feasible BACT as the following:

- 2.0 ppmvd @ 15% $O_2$ (1 hr average, excluding startup and shutdown), (Selective catalytic reduction, or equal)

SJVAPCD BACT Clearinghouse Guideline 3.4.2 does not identify any alternate basic equipment BACT control alternatives.

### Step 2 - Eliminate Technologically Infeasible Options

All control options listed in step 1 are technologically feasible.

### Step 3 - Rank Remaining Control Technologies by Control Effectiveness

The following options are ranked based on their emission factor:

1. 2.0 ppmvd @ 15% $O_2$ (1 hr average, excluding startup and shutdown), (Selective catalytic reduction, or equal)
2. 2.5 ppmvd @ 15% $O_2$ (1 hr average, excluding startup and shutdown), (Selective catalytic reduction, or equal)

### Step 4 - Cost Effective Analysis

A cost effective analysis must be performed for all control options in the list from step 3 in the order of their ranking to determine the cost effective option with the lowest emissions.

The applicant is proposing the use of a selective catalytic reduction system with $NO_X$ emissions of 2.0 ppmv @ 15% $O_2$ (1 hr average, excluding startup and shutdown), (Selective catalytic reduction, or equal). This is the highest ranking control option listed in Step 3 above. Therefore, in accordance with District policy APR 1305 (BACT), Section IX.D, a cost effective analysis is not necessary and no further discussion is required.

**Step 5 - Select BACT**

BACT for the emission unit is determined to be the use of a Selective Catalytic Reduction system with emissions of less than or equal to 2.0 ppmvd @ 15% $O_2$ (1 hr average, excluding startup and shutdown), (Selective catalytic reduction, or equal). The facility has proposed to use an inlet air filtration and cooling system, water injection, and a Selective Catalytic Reduction system on each of these turbines to achieve $NO_X$ emissions of less than or equal to 2.0 ppmv @ 15% $O_2$ (1 hr average, excluding startup and shutdown), (Selective catalytic reduction, or equal). Therefore, BACT is satisfied.

**Units C-3953-10-1 and –11-1 (Turbines)**

## II. VOC Top-Down BACT Analysis

### Step 1 - Identify All Possible Control Technologies

SJVAPCD BACT Clearinghouse Guideline 3.4.2 identifies achieved in practice BACT as the following:

- 2.0 ppmvd VOC @ 15% $O_2$

SJVAPCD BACT Clearinghouse Guideline 3.4.2 identifies technologically feasible BACT as the following:

- 1.5 ppmvd VOC @ 15% $O_2$

SJVAPCD BACT Clearinghouse Guideline 3.4.2 does not identify any alternate basic equipment BACT control alternatives.

### Step 2 - Eliminate Technologically Infeasible Options

All control options listed in step 1 are technologically feasible.

### Step 3 - Rank Remaining Control Technologies by Control Effectiveness

1. 1.5 ppmvd VOC @ 15% $O_2$
2. 2.0 ppmvd VOC @ 15% $O_2$

### Step 4 - Cost Effectiveness Analysis

A cost effective analysis must be performed for all control options in the list from step 3 in the order of their ranking to determine the cost effective option with the lowest emissions.

The applicant is proposing VOC emissions of 1.4 ppmvd @ 15% $O_2$ when the unit is fired without the duct burner and 2.0 ppmvd @ 15% $O_2$ when it is fired with the duct burner. The BACT analysis that established the Technologically Feasible BACT option of 1.5 ppmvd @ 15% $O_2$ did not take into account emissions from a duct burner. Therefore the applicants proposed 1.4 ppmvd VOC @ 15% $O_2$ emission factor will be determine to meet the highest ranking control option listed in Step 3 above. Therefore, in accordance with District policy APR 1305 (BACT), Section IX.D, a cost effective analysis is not necessary and no further discussion is required.

**Step 5 - Select BACT**

BACT for the emission unit is determined to be the use of natural gas fuel or LPG with emissions of less than or equal to 2.0 ppmv @ 15% $O_2$. The facility has proposed to use natural gas fuel with emissions of less than or equal to 2.0 ppmv @ 15% $O_2$; therefore, BACT is satisfied.

**Units C-3953-10-1 and –11-1 (Turbines)**

## III. $PM_{10}$ Top-Down BACT Analysis

**Step 1 - Identify All Possible Control Technologies**

**General control for $PM_{10}$ emissions include the following options:**

SJVAPCD BACT Clearinghouse Guideline 3.4.2 identifies achieved in practice BACT as the following:

- Air inlet filter, lube oil vent coalescer and natural gas fuel or equal

SJVAPCD BACT Clearinghouse Guideline 3.4.2 does not identify any technologically feasible BACT control alternatives.

SJVAPCD BACT Clearinghouse Guideline 3.4.2 does not identify any alternate basic equipment BACT control alternatives.

**Step 2 - Eliminate Technologically Infeasible Options**

All of the listed controls are considered technologically feasible for this application.

**Step 3 - Rank Remaining Control Technologies by Control Effectiveness**

1. Air inlet filter, lube oil vent coalescer and natural gas fuel or equal

**Step 4 - Cost Effectiveness Analysis**

A cost effective analysis must be performed for all control options in the list from step 3 in the order of their ranking to determine the cost effective option with the lowest emissions.

The applicant is proposing to use an air in inlet filter, lube oil vent coalescer and natural gas fuel or equal. This is the highest ranking control option listed in Step 3 above. Therefore, in accordance with District policy APR 1305 (BACT), Section IX.D, a cost effective analysis is not necessary and no further discussion is required.

**Step 5 - Select BACT**

BACT for the emission unit is determined to be the use of an air inlet filter, lube oil vent coalescer and natural gas fuel or equal. Avenal Power Center is proposing to use an air inlet filter, lube oil vent coalescer and natural gas fuel or equal; therefore, BACT is satisfied.

**Units C-3953-10-1 and –11-1 (Turbines)**

## IV. $SO_X$ Top-Down BACT Analysis

### Step 1 - Identify All Possible Control Technologies

SJVAPCD BACT Clearinghouse Guideline 3.4.2 identifies achieved in practice BACT as the following:

- PUC-regulated natural gas fuel; or
- Non-PUC-regulated gas with no more than 0.75 grains S/100 dscf, or equal

SJVAPCD BACT Clearinghouse Guideline 3.4.2 does not identify any technologically feasible BACT control alternatives.

SJVAPCD BACT Clearinghouse Guideline 3.4.2 does not identify any alternate basic equipment BACT control alternatives.

### Step 2 - Eliminate Technologically Infeasible Options

All of the listed controls are considered technologically feasible for this application.

### Step 3 - Rank Remaining Control Technologies by Control Effectiveness

1. PUC-regulated natural gas fuel
2. Non-PUC-regulated gas with no more than 0.75 grains S/100 dscf, or equal

### Step 4 - Cost Effectiveness Analysis

A cost effective analysis must be performed for all control options in the list from step 3 in the order of their ranking to determine the cost effective option with the lowest emissions.

The applicant is proposing to use PUC-regulated natural gas fuel. This is the highest ranking control option listed in Step 3 above. Therefore, in accordance with District policy APR 1305 (BACT), Section IX.D, a cost effective analysis is not necessary and no further discussion is required.

### Step 5 - Select BACT

BACT for the emission unit is determined to be the use of PUC-regulated natural gas fuel. Avenal Power Center has proposed to fire each of the turbines solely on PUC-regulated natural gas fuel; therefore, BACT is satisfied.

**Units C-3953-12-1 (Boiler)**

## I. $NO_X$ Top-Down BACT Analysis

### Step 1 - Identify All Possible Control Technologies

SJVAPCD BACT Clearinghouse Guideline 1.1.2 identifies achieved in practice BACT as the following:

- 9.0 ppmvd @ 3% O2 (0.0108 lb/MMBtu) Ultra-Low NOx main burner system and a natural gas or LPG fired igniter system (if the igniter system is used to heat the boiler at low fire)

SJVAPCD BACT Clearinghouse Guideline 1.1.2 identifies technologically feasible BACT as the following:

- 9.0 ppmvd @ 3% O2 (0.0108 lb/MMBtu) Selective Catalytic Reduction, Low Temperature Oxidizer, or equal and a < 30 ppmv $NO_X$ @ 3% O2 igniter system (if the igniter system is used to heat the boiler at low fire)

SJVAPCD BACT Clearinghouse Guideline 1.1.2 does not identify any alternate basic equipment BACT control alternatives.

### Step 2 - Eliminate Technologically Infeasible Options

All control options listed in step 1 are technologically feasible.

### Step 3 - Rank Remaining Control Technologies by Control Effectiveness

The following options are ranked based on their emission factor:

1. 9.0 ppmvd @ 3% O2 (0.0108 lb/MMBtu) Selective Catalytic Reduction, Low Temperature Oxidizer, or equal and a < 30 ppmv $NO_X$ @ 3% O2 igniter system (if the igniter system is used to heat the boiler at low fire)
2. 9.0 ppmvd @ 3% O2 (0.0108 lb/MMBtu) Ultra-Low NOx main burner system and a natural gas or LPG fired igniter system (if the igniter system is used to heat the boiler at low fire)

### Step 4 - Cost Effective Analysis

A cost effective analysis must be performed for all control options in the list from step 3 in the order of their ranking to determine the cost effective option with the lowest emissions.

The applicant has proposed the NOx emissions from the boiler will not exceed 9.0 ppmv @ 3% $O_2$. This is the highest ranking control option listed in Step 3 above. Therefore, in accordance with District policy APR 1305 (BACT), Section IX.D, a cost effective analysis is not necessary and no further discussion is required.

**Step 5 - Select BACT**

BACT for the emission unit is determined to be $NO_X$ emissions of less than 9.0 ppmvd @ 3% $O_2$. The facility has proposed $NO_X$ emissions of less than 9.0 ppmv @ 3% $O_2$. Therefore, BACT is satisfied.

**Units C-3953-12-1 (Boiler)**

## II. VOC Top-Down BACT Analysis

**Step 1 - Identify All Possible Control Technologies**

**General control for VOC emissions include the following options:**

SJVAPCD BACT Clearinghouse Guideline 1.1.2 identifies achieved in practice BACT as the following:

- Natural gas fuel with LPG backup

SJVAPCD BACT Clearinghouse Guideline 1.1.2 does not identify any technologically feasible BACT control alternatives.

SJVAPCD BACT Clearinghouse Guideline 1.1.2 does not identify any alternate basic equipment BACT control alternatives.

**Step 2 - Eliminate Technologically Infeasible Options**

All of the listed controls are considered technologically feasible for this application.

**Step 3 - Rank Remaining Control Technologies by Control Effectiveness**

1. Natural gas fuel with LPG backup

**Step 4 - Cost Effectiveness Analysis**

A cost effective analysis must be performed for all control options in the list from step 3 in the order of their ranking to determine the cost effective option with the lowest emissions.

The applicant is proposing to solely use natural gas fuel. This is the highest ranking control option listed in Step 3 above. Therefore, in accordance with District policy APR 1305 (BACT), Section IX.D, a cost effective analysis is not necessary and no further discussion is required.

**Step 5 - Select BACT**

BACT for the emission unit is determined to be the use of natural gas fuel. Avenal Power Center is proposing to use natural gas fuel; therefore, BACT is satisfied.

**Units C-3953-12-1 (Boiler)**

## III. $PM_{10}$ Top-Down BACT Analysis

**Step 1 - Identify All Possible Control Technologies**

**General control for $PM_{10}$ emissions include the following options:**

SJVAPCD BACT Clearinghouse Guideline 1.1.2 identifies achieved in practice BACT as the following:

- Natural gas fuel with LPG backup

SJVAPCD BACT Clearinghouse Guideline 1.1.2 does not identify any technologically feasible BACT control alternatives.

SJVAPCD BACT Clearinghouse Guideline 1.1.2 does not identify any alternate basic equipment BACT control alternatives.

**Step 2 - Eliminate Technologically Infeasible Options**

All of the listed controls are considered technologically feasible for this application.

**Step 3 - Rank Remaining Control Technologies by Control Effectiveness**

1. Natural gas fuel with LPG backup

**Step 4 - Cost Effectiveness Analysis**

A cost effective analysis must be performed for all control options in the list from step 3 in the order of their ranking to determine the cost effective option with the lowest emissions.

The applicant is proposing to solely use natural gas fuel. This is the highest ranking control option listed in Step 3 above. Therefore, in accordance with District policy APR 1305 (BACT), Section IX.D, a cost effective analysis is not necessary and no further discussion is required.

**Step 5 - Select BACT**

BACT for the emission unit is determined to be the use of natural gas fuel. Avenal Power Center is proposing to use natural gas fuel; therefore, BACT is satisfied.

**Units C-3953-13-1 (Diesel IC engine powering fire water pump)**

## I. $NO_X$ Top-Down BACT Analysis

### Step 1 - Identify All Possible Control Technologies

SJVAPCD BACT Clearinghouse Guideline 3.1.4 identifies achieved in practice BACT as the following:

- Certified $NO_X$ emissions of 6.9 g/bhp-hr or less

SJVAPCD BACT Clearinghouse Guideline 3.1.4 does not identify any technologically feasible BACT control alternatives.

SJVAPCD BACT Clearinghouse Guideline 3.1.4 does not identify any alternate basic equipment BACT control alternatives.

### Step 2 - Eliminate Technologically Infeasible Options

All control options listed in step 1 are technologically feasible.

### Step 3 - Rank Remaining Control Technologies by Control Effectiveness

The following options are ranked based on their emission factor:

1. Certified $NO_X$ emissions of 6.9 g/bhp-hr or less

### Step 4 - Cost Effective Analysis

A cost effective analysis must be performed for all control options in the list from step 3 in the order of their ranking to determine the cost effective option with the lowest emissions.

The applicant has proposed the NOx emissions from the engine will not exceed 3.4 g/bhp-hr. This is the highest ranking control option listed in Step 3 above. Therefore, in accordance with District policy APR 1305 (BACT), Section IX.D, a cost effective analysis is not necessary and no further discussion is required.

### Step 5 - Select BACT

BACT for the emission unit is determined to be Certified $NO_X$ emissions of 6.9 g/bhp-hr or less. The facility has proposed $NO_X$ emissions of less than 6.9 g/bhp-hr. Therefore, BACT is satisfied.

**Units C-3953-13-1 (Diesel IC engine powering fire water pump)**

## II. VOC Top-Down BACT Analysis

**Step 1 - Identify All Possible Control Technologies**

SJVAPCD BACT Clearinghouse Guideline 3.1.4 identifies achieved in practice BACT as the following:

- Positive crankcase ventilation [unless it voids the Underwriters Laboratories (UL) certification]

SJVAPCD BACT Clearinghouse Guideline 3.1.4 identifies technologically feasible BACT as the following:

- Catalytic Oxidation

SJVAPCD BACT Clearinghouse Guideline 3.1.4 does not identify any alternate basic equipment BACT control alternatives.

**Step 2 - Eliminate Technologically Infeasible Options**

All control options listed in step 1 are technologically feasible.

**Step 3 - Rank Remaining Control Technologies by Control Effectiveness**

The following options are ranked based on their control efficiency:

1. Catalytic Oxidation
2. Positive crankcase ventilation [unless it voids the Underwriters Laboratories (UL) certification]

**Step 4 - Cost Effective Analysis**

A cost effective analysis must be performed for all control options in the list from Step 3 in the order of their ranking to determine the cost effective option with the lowest emissions.

However, this engine has been UL Certified, and the UL certification does not include a catalytic oxidation system or a positive crankcase ventilation system, and the addition of a catalytic oxidation system or a positive crankcase ventilation system would void the UL certification, which is required for firewater pump engines. Therefore, both the catalytic oxidation system and the positive crankcase ventilation system options will not be required.

**Step 5 - Select BACT**

BACT for VOC emissions from this emergency diesel IC engine powering a firewater pump is having no control technology for VOC emissions. The applicant has proposed to install a 288 bhp emergency diesel IC engine powering a firewater pump with no control technology for VOC emissions; therefore BACT for VOC emissions is satisfied.

**Units C-3953-14-1 (Natural gas IC engine powering electrical generator)**

## I. $NO_X$ Top-Down BACT Analysis

### Step 1 - Identify All Possible Control Technologies

SJVAPCD BACT Clearinghouse Guideline 3.1.8 identifies achieved in practice BACT as the following:

- $NO_X$ emissions of ≤ 1.0 g/bhp-hr (lean-burn natural gas fired engine or equal)

SJVAPCD BACT Clearinghouse Guideline 3.1.8 does not identify any technologically feasible BACT control alternatives.

SJVAPCD BACT Clearinghouse Guideline 3.1.8 identifies alternate basic equipment BACT as the following:

- ≥ 90% control efficiency (rich-burn engine with NSCR or equal)

### Step 2 - Eliminate Technologically Infeasible Options

All control options listed in step 1 are technologically feasible.

### Step 3 - Rank Remaining Control Technologies by Control Effectiveness

The following options are ranked based on their control efficiency:

1. ≥ 90% control efficiency (rich-burn engine with NSCR or equal)
2. $NO_X$ emissions of ≤ 1.0 g/bhp-hr (lean-burn natural gas fired engine or equal)

### Step 4 - Cost Effective Analysis

A cost effective analysis must be performed for all control options in the list from step 3 in the order of their ranking to determine the cost effective option with the lowest emissions.

**1. ≥ 90% control efficiency (rich-burn engine with NSCR or equal)**

District Policy establishes annual cost thresholds for imposed control based upon the amount of pollutants abated by the controls. If the cost of control is at or below the threshold, it is considered a cost effective control. If the cost exceeds the threshold, it is not cost effective and the control is not required. Per District BACT Policy, the maximum cost limit for $NO_X$ reduction is $9,700 per ton of $NO_X$ reduced.

Based upon the fact that there are only a few existing IC engine installations within this class and category of source that operate with emissions of ≤ 1.0 g $NO_X$/hp-hr, the District will assume that the Industry Standard will be 2.8 g $NO_X$/hp-hr (lb/MMBtu converted to g/hp-hr, Attachment I), pursuant to a AP-42 (07/00) values of uncontrolled four-stroke lean burn IC engines (< 90% load).

AP-42 publishes an uncontrolled $NO_X$ value of 2.21 lb/MMBtu (90 – 105% load), which is approximately 13.4 g $NO_X$/hp-hr. Several major engine manufacturers were surveyed (Cummins, Caterpillar, and Waukesha) and the District found that lean burn engines sold by these engine manufacturers do not emit emissions close to the uncontrolled value for 90 – 105% load, published in AP-42. Based on the discussions with service representatives of each engine manufacturer, emissions were closer to the AP-42 value published for the < 90% load, which was around 2.5 g $NO_X$/hp-hr than it was for the value published for the 90 – 105% load. Therefore, industry standard for lean burn natural gas-fired emergency IC engine will be 2.8 g $NO_X$/hp-hr.

The proposed annual emissions from a lean burn IC engine using industry standard values can be calculated as:

$NO_X$ (annual):

$$\frac{2.8\ \text{g}}{\text{hp-hr}} \left| \frac{860\ \text{hp}}{1} \right| \frac{\text{lb}}{453.6\ \text{g}} \left| \frac{50\ \text{hr}}{\text{year}} \right. = 265\ \text{lb}\ NO_X/\text{year}$$

*$PE_{NOx}$ = 265 lb $NO_X$/year = 0.1325 tons $NO_X$/year*

The proposed annual emissions from a rich burn engine equipped the a Non-Selective Catalytic Reduction system with a $NO_X$ control efficiency of ≥ 90% can be calculated as:

$NO_X$ (annual):

$$\frac{7.4\ \text{g}^{(1)}}{\text{hp-hr}} \left| \frac{(1 - 0.9)}{1} \right| \frac{860\ \text{hp}}{1} \left| \frac{\text{lb}}{453.6\ \text{g}} \right| \frac{50\ \text{hr}}{\text{year}} = 70\ \text{lb}\ NO_X/\text{year}$$

*$PE_{NOx}$ = 70 lb $NO_X$/year = 0.035 tons $NO_X$/year*

District BACT policy demonstrates how to calculate the cost effectiveness of alternate basic equipment or process:

$$CE_{alt} = (Cost_{alt} - Cost_{basic}) \div (Emission_{basic} - Emission_{alt})$$

[1] Pursuant to AP-42 (07/00) the $NO_X$ value for uncontrolled four-stroke rich burn IC engines @ < 90% load. (lb/MMBtu converted to g/hp-hr, Attachment I)

where,

$CE_{alt}$ = the cost effectiveness of alternate basic equipment expressed as dollars per ton of emissions reduced

$Cost_{alt}$ = the equivalent annual capital cost of the alternate basic equipment plus its annual operating cost

$Cost_{basic}$ = the equivalent annual capital cost of the proposed basic equipment, without BACT, plus its annual operating cost

$Emission_{basic}$ = the emissions from the proposed basic equipment, without BACT.

$Emission_{alt}$ = the emissions from the alternate basic equipment

The District conducted research to determine the appropriate cost information for installing a rich burn IC engine with a Non-Selective Catalytic Reduction System versus the cost information for installing a uncontrolled lean burn IC engine. Based on information from various engine manufacturers, the initial costs for installing an uncontrolled rich burn engine versus an uncontrolled lean burn engine would be minimal. The main difference in cost would be incurred in the installation of the NSCR system and the air to fuel ratio controller to the rich burn IC engine.

According to the guidance document "RACT/BARCT for Stationary Spark-Ignited IC Engines" (pgs. V-2 & V-3), the approximate capital cost for installing a NSCR system for a 1,000 hp engine would be approximately $28,000, the capital cost for installing an air to fuel ratio controller would be $5,300, and the overall installation cost would be $2,500. The CARB RACT/BARCT document also states the annual cost for operating and maintenance is between $8,000 – 10,000, but these values are assuming full time operation. Since the proposed installation will be limited only to emergency operation and testing and maintenance, a conservative assumption of $1,000 per year will be utilized for this evaluation.

Per District BACT Policy, the equivalent annual capital cost is calculated as follows:

$$A (\$/yr) = P \times [i \times (1 + i)^n] \div [(1 + i)^n - 1]$$

Where:
- A = Equivalent annual capital cost of the control equipment
- P = Present value of the control equipment including installation
- i = interest rate (10% used as default value)
- n = equipment life (10 years used as default value)

Using a total capital cost of $35,800 in the above equation results in an equivalent annual cost of $5,826/year. Adding this equivalent annual cost to the annual operating cost of $1,000/year, the ($Cost_{alt}$ - $Cost_{basic}$) is equal to $6,826/year. It should be noted that the operating the rich burn IC engine versus a lean burn IC engine would result in an efficiency loss and would potentially result in higher annual fuel expenses. These costs will be set aside for the present and only a partial cost analysis will be performed.

District BACT policy also requires the use of a Multi-Pollutant Cost Effectiveness Threshold (MCET) for a BACT option controlling more than one pollutant. The installation of a NSCR system will control $NO_X$, CO, and VOC emissions. Therefore, the MCET is calculated as follows:

MCET ($/yr) = $(E_{NOx} \times T_{NOx}) + (E_{CO} \times T_{CO}) + (E_{VOC} \times T_{VOC})$

Where:
$E_{NOx}$ = tons-$NO_X$ controlled/yr
$E_{CO}$ = tons-CO controlled/yr
$E_{VOC}$ = tons-VOC controlled/yr
$T_{NOx}$ = District's cost effectiveness threshold for $NO_X$
= $9,700/ton-$NO_X$
$T_{CO}$ = District's cost effectiveness threshold for CO
= $300/ton-CO
$T_{VOC}$ = District's cost effectiveness threshold for VOCs
= $5,000/ton-VOCs

Since this BACT cost effectiveness analysis is analyzing alternate basic equipment with a control technology which controls multiple pollutants; in order to calculate the cost effectiveness for the alternate basic equipment, the District will take the MCET and compare that value with the ($Cost_{alt}$ – $Cost_{basic}$), to determine if this control technology is cost effective.

To determine $E_{CO}$, the District has to establish what Industry Standard is for CO emissions. As detailed above, engines with $NO_X$ emissions of 2.8 g/hp-hr (per AP-42) were deemed as the industry standard for this class and category of source. Therefore, the District will also take AP-42 values for CO emissions @ < 90% load (1.83 g CO/hp-hr) and deem that value as industry standard for this class and category of source.

Therefore, the proposed annual emissions from a lean burn IC engine using industry standard values can be calculated as:

CO (annual):

$$\frac{1.83\ \cancel{g}}{\cancel{hp\text{-}hr}} \left| \frac{860\ \cancel{hp}}{1} \right| \frac{lb}{453.6\ \cancel{g}} \left| \frac{50\ \cancel{hr}}{year} \right. = 173 \text{ lb CO/year}$$

*$PE_{CO}$ = 173 lb CO/year = 0.0865 ton CO/year*

Pursuant to the guidance document "RACT/BARCT for Stationary Spark-Ignited IC Engines" created by CARB (pg. B-20), the CO control effectiveness from a NSCR system is greater than 80%. Therefore, the proposed annual emissions from a rich burn engine equipped the a Non-Selective Catalytic Reduction system with a CO control efficiency of ≥ 80% can be calculated as:

CO (annual):

$$\frac{11.6\ \text{g}^{(2)}}{\text{hp-hr}} \times \frac{(1-0.8)}{1} \times \frac{860\ \text{hp}}{1} \times \frac{\text{lb}}{453.6\ \text{g}} \times \frac{50\ \text{hr}}{\text{year}} = 220\ \text{lb CO/year}$$

*$PE_{CO}$ = 220 lb CO/year = 0.11 ton CO/year*

As demonstrated above, the CO emissions from the rich burn IC engine with a NSCR system are higher than the uncontrolled CO emissions from the lean burn IC engine. Therefore, CO will not be included in the MCET calculations.

To determine $E_{VOC}$, the District has to establish what Industry Standard is for VOC emissions. Again, as detailed above, engines with $NO_X$ emissions of 2.8 g/hp-hr (per AP-42) were deemed as the industry standard for this class and category of source. Therefore, the District will also take AP-42 values for VOC emissions (0.39 g VOC/hp-hr) and deem that value as industry standard for this class and category of source.

Therefore, the proposed annual emissions from a lean burn IC engine using industry standard values can be calculated as:

VOC (annual):

$$\frac{0.39\ \text{g}}{\text{hp-hr}} \times \frac{860\ \text{hp}}{1} \times \frac{\text{lb}}{453.6\ \text{g}} \times \frac{50\ \text{hr}}{\text{year}} = 37\ \text{lb VOC/year}$$

*$PE_{VOC}$ = 37 lb VOC/year = 0.0185 ton VOC/year*

Pursuant to the guidance document "RACT/BARCT for Stationary Spark-Ignited IC Engines" created by CARB, the VOC control effectiveness from a NSCR system is greater than 50%. Therefore, the proposed annual emissions from a rich burn engine equipped the a Non-Selective Catalytic Reduction system with a VOC control efficiency of ≥ 50% can be calculated as:

VOC (annual):

$$\frac{0.10\ \text{g}^{(3)}}{\text{hp-hr}} \times \frac{(1-0.5)}{1} \times \frac{860\ \text{hp}}{1} \times \frac{\text{lb}}{453.6\ \text{g}} \times \frac{50\ \text{hr}}{\text{year}} = 5\ \text{lb VOC/year}$$

*$PE_{VOC}$ = 5 lb VOC/year = 0.0025 ton VOC/year*

[2] Pursuant to AP-42 (07/00) the CO value for uncontrolled four-stroke rich burn IC engines @ < 90% load. (lb/MMBtu converted to g/hp-hr, Attachment I)
[3] Pursuant to AP-42 (07/00) the VOC value for uncontrolled four-stroke rich burn IC engines. (lb/MMBtu converted to g/hp-hr, Attachment I)

Calculating for the MCET derives the following:

$E_{NOx}$ = 0.1325 tpy – 0.035 tpy = 0.0975 tpy
$E_{VOC}$ = 0.0185 tpy – 0.0025 tpy = 0.016 tpy

MCET ($/yr) = (0.0975 x $9,700) + (0.016 x $5,000) = $1,026/year

As presented above, ($Cost_{alt}$ – $Cost_{basic}$) is equal to $6,826/year.

This value is greater than the MCET; therefore, it has been determine that the installation of a rich burn IC engine with a NSCR system as alternate basic equipment is not cost effective using just the partial cost analysis.

**2. $NO_X$ emissions of ≤ 1.0 g/bhp-hr (lean-burn natural gas fired engine or equal)**

The applicant has proposed that the NOx emissions from the engine will not exceed 1.0 g/bhp-hr. This is the highest ranking remaining control option listed in Step 3 above. Therefore, in accordance with District policy APR 1305 (BACT), Section IX.D, a cost effective analysis is not necessary and no further discussion is required.

**Step 5 - <u>Select BACT</u>**

BACT for the emission unit is determined to be $NO_X$ emissions of 1.0 g/bhp-hr or less. The facility has proposed $NO_X$ emissions of less than 1.0 g/bhp-hr. Therefore, BACT is satisfied.

**Units C-3953-14-1 (Natural gas IC engine powering electrical generator)**

## II. VOC Top-Down BACT Analysis

### Step 1 - Identify All Possible Control Technologies

SJVAPCD BACT Clearinghouse Guideline 3.1.8 identifies achieved in practice BACT as the following:

- ≤ 1.0 g/bhp-hr (Lean burn natural gas fired engine, or equal)

SJVAPCD BACT Clearinghouse Guideline 3.1.8 identifies technologically feasible BACT as the following:

- 90% control efficiency (Oxidation catalyst, or equal)

SJVAPCD BACT Clearinghouse Guideline 3.1.8 identifies alternate basic equipment BACT as the following:

- ≥ 50% control efficiency catalyst (rich-burn engine with NSCR or equal)

### Step 2 - Eliminate Technologically Infeasible Options

All control options listed in step 1 are technologically feasible.

### Step 3 - Rank Remaining Control Technologies by Control Effectiveness

The following options are ranked based on their control efficiency:

1. 90% control efficiency (Oxidation catalyst, or equal)
2. ≥ 50% control efficiency catalyst (rich-burn engine with NSCR or equal)
3. ≤ 1.0 g/bhp-hr (Lean burn natural gas fired engine, or equal)

### Step 4 - Cost Effective Analysis

A cost effective analysis must be performed for all control options in the list from step 3 in the order of their ranking to determine the cost effective option with the lowest emissions.

The applicant has proposed the engine will be equipped with an oxidation catalyst with 90% control of VOC emissions. This is the highest ranking control option listed in Step 3 above. Therefore, in accordance with District policy APR 1305 (BACT), Section IX.D, a cost effective analysis is not necessary and no further discussion is required.

**Step 5 - Select BACT**

BACT for the emission unit is determined to be the used of an oxidation catalyst with 90% control of VOC emissions. The facility has proposed to install an oxidation catalyst with 90% control of VOC emission. Therefore, BACT is satisfied.

# ATTACHMENT G

## *Health Risk Assessment and Ambient Air Quality Analysis*

# San Joaquin Valley Unified Air Pollution Control District

## MEMORANDUM

**DATE:** June 14, 2014

**TO:** Derek Fukuda, AQE—Permit Services

**FROM:** Leland Villalvazo, SAQS—Technical Services

**SUBJECT:** Revised $NO_2$ 1-hour NAAQA Assessment for Avenal Power Center

Technical Services was requested to revise the RMR and AAQA assessment performed for project C-1011324, dated June 25, 2002, to lower the NOx and CO annual emission levels.

A review of the previous project indicated that the major item of concern was the 1-hour standard for $NO_2$. The previous assessment was based on the State standard of 339 ug/$m^3$ whereas the new federal standard 188.68 ug/$m^3$. The assessment contained in this memo will primarily address the new federal $NO_2$ NAAQS and any updates needed to the previous RMR assessment.

**Background:**
EPA has revised the primary $NO_2$ NAAQS in order to provide requisite protection of public health. Specifically, EPA has established a new 1-hour standard at a level of 100 ppb (188.68 ug/$m^3$), based on the 3-year average of the annual 98th percentile of the daily maximum 1-hour concentrations, to supplement the existing annual standard. EPA has also established requirements for $NO_2$ monitoring network that will include monitors at locations where maximum $NO_2$ concentrations are expected to occur, including within 50 meters of major roadways, as well as monitors sited to measure the area-wide $NO_2$ concentrations that occur more broadly across communities.

The final rule was signed on January 22, 2010. The effective date of the new 1 hour standard is 60 days after the final rule has been published in the Federal Register. The final rule was published in the Federal Register on Feb 9, 2010. The effective date is April 12, 2010.

**Results:**
Based on guidance from EPA dated February 25, 2010, the District has updated the AAQA assessment to include the new $NO_2$ 1-hour standard, see below. The results follow the procedure outlined in the District's interim draft guidance document entitled "Modeling Procedure to Address The New Federal 1 Hour $NO_2$ Standard".

| **Commissioning** | Modeling | Design Value | Impact | NAAQS Limit | Pass / Fail | Margin |
|---|---|---|---|---|---|---|
| District Tiers | ug/m3 | | | | | |
| Tier I (max yr) | **142.21** | **103.15** | 245.36 | 188.68 | F | -56.68 |
| Tier II (max 8th) | **90.10** | **103.15** | 193.25 | 188.68 | F | -4.57 |
| Tier III (ave.5yr) | **71.94** | **103.15** | 175.09 | 188.68 | **P** | 13.58 |
| Tier IV | **140.37** | | 140.37 | 188.68 | **P** | 48.31 |

| Year | 2004 | 2005 | 2006 | 2007 | 2008* | Max |
|---|---|---|---|---|---|---|
| Tier I (max yr) | **142.21398** | **107.17307** | **110.4651** | **109.99858** | **105.1162** | **142.21** |
| Tier II (max 8th) | **80.85338** | **85.86045** | **84.64008** | **88.85226** | **90.10016** | **90.1** |

*Ozone from Visalia

| **Operational** | Modeling | Design Value | Impact | NAAQS Limit | Pass / Fail | Margin |
|---|---|---|---|---|---|---|
| District Tiers | ug/m3 | | | | | |
| Tier I (max yr) | **152.79** | **103.15** | 255.94 | 188.68 | F | -67.26 |
| Tier II (max 8th) | **87.94** | **103.15** | 191.09 | 188.68 | F | -2.41 |
| Tier III (ave.5yr) | **82.43** | **103.15** | 185.58 | 188.68 | **P** | 3.10 |
| Tier IV | | | 0.00 | 188.68 | P | 188.68 |

| Year | 2004 | 2005 | 2006 | 2007 | 2008* | Max |
|---|---|---|---|---|---|---|
| Tier I (max yr) | **152.79148** | **91.1532** | **93.47387** | **93.23991** | **90.56206** | **152.79** |
| Tier II (max 8th) | **87.7931** | **86.3495** | **86.51813** | **87.38902** | **87.93997** | **87.94** |

*Ozone from Visalia

**Conclusion**

Based on the updated RMR, the risk from this facility is less than 10 in one million. **In accordance with the District's Risk Management Policy, the project is approved without Toxic Best Available Control Technology (T-BACT).**

To ensure that human health risks will not exceed District allowable levels; the permit conditions listed below must be included for the proposed unit(s).

These conclusions are based on the data provided by the applicant and the project engineer. Therefore, this analysis is valid only as long as the proposed data and parameters do not change.

The emissions from the proposed equipment will not cause or contribute significantly to a violation of the State and National AAQS.

**Conditions**

1. $PM_{10}$ emission rate shall not exceed **0.059 g/HP-hr (note method) for the 288 hp engine** (C-3953-13-1).

2. The 860 hp engine (C-3953-14-1) shall only be operated for maintenance, testing, required regulatory purposes, and during emergency situations. Operation of the engine for maintenance and testing purposes shall not exceed **50 hours per year**.

| **Commissioning** | Modeling | Design Value | Impact | NAAQS Limit | Pass / Fail | Margin |
|---|---|---|---|---|---|---|
| District Tiers | ug/m3 | | | | | |
| Tier I (max yr) | **142.21** | **103.15** | 245.36 | 188.68 | F | -56.68 |
| Tier II (max 8th) | **90.10** | **103.15** | 193.25 | 188.68 | F | -4.57 |
| Tier III (ave.5yr) | **71.94** | **103.15** | 175.09 | 188.68 | P | 13.58 |
| Tier IV | **140.37** | | 140.37 | 188.68 | P | 48.31 |

| Year | 2004 | 2005 | 2006 | 2007 | 2008* | Max |
|---|---|---|---|---|---|---|
| Tier I (max yr) | **142.21398** | **107.17307** | **110.4651** | **109.99858** | **105.1162** | **142.21** |
| Tier II (max 8th) | **80.85338** | **85.86045** | **84.64008** | **88.85226** | **90.10016** | **90.1** |

*Ozone from Visalia

| **Operational** | Modeling | Design Value | Impact | NAAQS Limit | Pass / Fail | Margin |
|---|---|---|---|---|---|---|
| District Tiers | ug/m3 | | | | | |
| Tier I (max yr) | **152.79** | **103.15** | 255.94 | 188.68 | F | -67.26 |
| Tier II (max 8th) | **87.94** | **103.15** | 191.09 | 188.68 | F | -2.41 |
| Tier III (ave.5yr) | **82.43** | **103.15** | 185.58 | 188.68 | P | 3.10 |
| Tier IV | | | 0.00 | 188.68 | P | 188.68 |

| Year | 2004 | 2005 | 2006 | 2007 | 2008* | Max |
|---|---|---|---|---|---|---|
| Tier I (max yr) | **152.79148** | **91.1532** | **93.47387** | **93.23991** | **90.56206** | **152.79** |
| Tier II (max 8th) | **87.7931** | **86.3495** | **86.51813** | **87.38902** | **87.93997** | **87.94** |

*Ozone from Visalia

# Diesel I.C. Engines (DICE)
## Screening Risk Tool

### Project Information

Region: C  Facility ID: 3953  Unit #: 13-1

Project #: 110751

Date: 7/14/2010

### Met Station

| | |
|---|---|
| District | SJVAPCD |
| Met Site | HANFORD |
| Model Type | RURAL |
| Year: | 2008 |

### Engine Data

| | |
|---|---|
| BHP: | 288 |
| % Load: | 100 |
| PM10 EF (g/BHP): | 0.059 |
| Hours / Yr: | 100 |
| Lbs / Yr: | 3.75 |

Convert to G/BHP

Convert to G/KW

Update Emissions

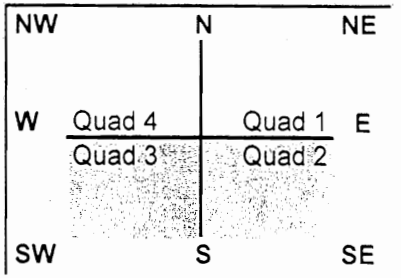
### Receptor Data

Quad: QUAD 1

Distance(m): 50

Miles:  Feet:

Yards:  10th Mi:




### Cancer Risk

| | Resident Risk: | Maximum Res. Risk |
|---|---|---|
| In a Million | 0.24 | 1.98 |

Worker Adjustment Factor %: 37.91

| | Worker Risk: | Maximum Worker Risk |
|---|---|---|
| In a Million | 0.09 | 0.75 |

Calculate Risk

Print Form

Quad: 2

Distance: 50

New | View Eng Data | SAVE | Close Form

14-1

Print Worksheet

# INTERNAL COMBUSTION (NG) EMISSION FACTORS (LBS. / MMCF)

FACILITY NAME:
DATE:

**Priority Score** 0.092999134

Receptor Distance: 1206

| Total hrs. of operation | 50.00 | MMCF/HR | 0.0071 | MMCF/YR | 0.36 |
|---|---|---|---|---|---|

| POLLUTANT | EMISSION FACTOR (MMCF/HR) <1000 | >1000 | TURBINE | Acute REL | Chronic REL | Cancer URF |
|---|---|---|---|---|---|---|
| Acetaldehyde | 0.944 | 1.1328 | 0.037 | 0 | 9 | 2.70E-06 |
| Acrolein | 0.3783 | 0.454 | 0.009 | 0.19 | 2.00E-02 | 0 |
| Benzene | 3.257 | 3.9084 | 0.0113 | 1300 | 71 | 2.90E-05 |
| Formaldehyde | 32.4963 | 38.9956 | 0.094 | 94 | 3.6 | 6.00E-06 |
| Naphthalene | 0.1785 | 0.1785 | 0.0008 | 0 | 14 | 0 |
| PAH's | 0.0179 | 0.0179 | 0.0002 | 0 | | 1.70E-03 |
| Propylene | 16.2259 | 19.4711 | 1.0522 | 0 | 0 | 0 |
| Toluene | 1.1145 | 1.3374 | 0.0726 | 37000 | 200 | 0 |
| Xylenes | 0.4048 | 0.4858 | 0.0289 | 22000 | 300 | 0 |
| Ethyl Benzene | 0.3257 | 0.3908 | 0.0132 | 0 | 0 | 0 |
| Hexane | 0.7491 | 0.8989 | 1.75 | 0 | 0 | 0 |

| | <1000 EMISSION FACTORS | LBS./HR. | G/SEC | LBS./YR. | G/SEC | Acute Score | Chronic Score | Carcinogenic Score | Non-Carcinogenic Score |
|---|---|---|---|---|---|---|---|---|---|
| Acetaldehyde | 0.944 | 6.70E-03 | **8.45E-04** | 3.35E-01 | **4.82E-06** | 0 | 0.11170667 | 0.001538201 | 0.111706667 |
| Acrolein | 0.3783 | 2.69E-03 | **3.39E-04** | 1.34E-01 | **1.93E-06** | 21.204711 | 20.144475 | 0 | 21.20471053 |
| Benzene | 3.257 | 2.31E-02 | **2.92E-03** | 1.16E+00 | **1.66E-05** | 0.0266823 | 0.048855 | 0.057002386 | 0.048855 |
| Formaldehyde | 32.4963 | 2.31E-01 | **2.91E-02** | 1.15E+01 | **1.66E-04** | 3.6817616 | 9.61348875 | 0.117669102 | 9.61348875 |
| Naphthalene | 0.1785 | 1.27E-03 | **1.60E-04** | 6.34E-02 | **9.12E-07** | 0 | 0.01357875 | 0 | 0.01357875 |
| PAH's | 0.0179 | 1.27E-04 | **1.60E-05** | 6.35E-03 | **9.15E-08** | 0 | 0 | 0.018364505 | 0 |
| Propylene | 16.2259 | 1.15E-01 | **1.45E-02** | 5.76E+00 | **8.29E-05** | 0 | 0 | 0 | 0 |
| Toluene | 1.1145 | 7.91E-03 | **9.98E-04** | 3.96E-01 | **5.70E-06** | 0.0003208 | 0.00593471 | 0 | 0.005934713 |
| Xylenes | 0.4048 | 2.87E-03 | **3.62E-04** | 1.44E-01 | **2.07E-06** | 0.000196 | 0.00143704 | 0 | 0.00143704 |
| Ethyl Benzene | 0.3257 | 2.31E-03 | **2.92E-04** | 1.16E-01 | **1.66E-06** | 0 | 0 | 0 | 0 |
| Hexane | 0.7491 | 5.32E-03 | **6.71E-04** | 2.66E-01 | **3.83E-06** | 0 | 0 | 0 | 0 |

# San Joaquin Valley Unified Air Pollution Control District

## MEMORANDUM

**DATE:** June 25, 2002

**TO:** Errol Villegas, SAQE—Permit Services

**FROM:** Esteban Gutierrez, AQS—Technical Services

**SUBJECT:** AAQA and RMR Modeling request for Duke energy Avenal LLC.

As per your request, Technical Service performed modeling for criteria pollutants CO, NOx, SOx and $PM_{10}$; as well as a RMR for, two turbines, two IC engines, nineteen (19) cooling towers and a boiler for a power plant. The engineer supplied the maximum fuel rate as well as process rates for all of the units described above. ISCST3 model was used to determine dispersion value for cancer risk exposure.

The results from the RMR modeling runs and Criteria Pollutant Modeling are as follows:

**RMR Modeling Results**

| REFINED HRA SUMMARY | | | |
|---|---|---|---|
| **Device** | **(2) Turbines** | **Boiler** | **(3) 4 cell tower** |
| **Fuel** | **NG** | **NG** | |
| **Prioritization Score** | 0.8242 | .0107 | N/A |
| **Cancer Risk** | N/A | N/A | N/A |
| **Acute Hazard Index** | N/A | N/A | N/A |
| **Chronic Hazard Index** | N/A | N/A | N/A |
| **TBACT Required?** | No | No | No |

| REFINED HRA SUMMARY | | | |
|---|---|---|---|
| **Device** | **7 cell tower** | **300 Hp ICE** | **660 HP ICE** |
| **Fuel** | | **Diesel** | **Diesel** |
| **Prioritization Score** | N/A | N/A | N/A |
| **Cancer Risk** | N/A | 2.01E-6 | 1.00E-6 |
| **Acute Hazard Index** | N/A | N/A | N/A |
| **Chronic Hazard Index** | N/A | N/A | N/A |
| **Maximum operating Hrs** | | 200 | 38 |
| **TBACT Required?** | No | Yes | No |

## Criteria Pollutant Modeling Results*

Values are in ug/m$^3$

| | 1 Hour | 3 Hours | 8 Hours. | 24 Hours | Annual |
|---|---|---|---|---|---|
| CO | Pass | X | Pass | X | X |
| $NO_x$ | Pass*** | X | X | X | Pass |
| $SO_x$ | Pass | Pass | X | Pass | Pass |
| $PM_{10}$ | X | X | X | Pass** | Pass** |

*Results were taken from the attached PSD spreadsheet.
**The criteria pollutants noted by a double asterisk (**) are below EPA's level of significance as found in 40 CFR Part 51.165 (b)(2). Operating time for 24 hour risk was adjusted for PM10 levels.
*** Passing score was obtained from running OLM (Ozone Limiting Method.)

| (2) NG Turbines Stack Parameters | | | |
|---|---|---|---|
| **Source Type** | Point | **Process Rate (T1) MMbtu/yr** | 16,958,390 |
| **Stack Height (m)** | 44.2 | **Process Rate (T2) MMbtu/yr** | 20,582,010 |
| **Stack Diam. (m)** | 5.49 | **Hours of operation yr (T1)** | 8400 |
| **Gas Exit Velocity (m/sec) T1** | 20.4 | **Hours of operation yr (T2)** | 8760 |
| **Stack Gas Temp (°K)** | 356 | **Receptor Distance (m)** | 1609 |
| **Location Type** | Rural | | |

| 7 Cell Cooling Tower Stack Parameters | | | |
|---|---|---|---|
| **Source Type** | Point | **Location Type** | Rural |
| **Stack Height (m)** | 13.7 | **Process Rate Gal/Yr** | 57,153,744,000 |
| **Stack Diam. (m)** | 9.64 | **Receptor Distance (m)** | 1609 |
| **Gas Exit Velocity (m/sec)** | 8.10 | **Hours of operation** | 8760 |
| **Stack Gas Temp (°K)** | 293 | | |

| (3) 4 Cell Cooling Towers Stack Parameters | | | |
|---|---|---|---|
| **Source Type** | Point | **Location Type** | Rural |
| **Stack Height (m)** | 16.08 | **Process Rate Gal/Yr** | 5,308,560,000 |
| **Stack Diam. (m)** | 3.57 | **Receptor Distance (m)** | 1609 |
| **Gas Exit Velocity (m/sec)** | 11.46 | **Hours of operation** | 8760 |
| **Stack Gas Temp (°K)** | 293 | | |

| Boiler Stack Parameters | | | |
|---|---|---|---|
| **Source Type** | Point | **Location Type** | Rural |
| **Stack Height (m)** | 11.28 | **Process Rate MMbtu/yr** | 93,500 |
| **Stack Diam. (m)** | 0.812 | **Receptor Distance (m)** | 1609 |
| **Gas Exit Velocity (m/sec)** | 12.2 | **Hours of operation** | 2500 |
| **Stack Gas Temp (°K)** | 476 | | |

| Diesel Engine (300 Hp) | | | |
|---|---|---|---|
| **Source Type** | Point | **Closest Receptor (m)** | 1609 |
| **Stack Height (m)** | 3.04 | **Location Type** | RURAL |
| **Stack Diam. (m)** | 0.13 | **Max Operating (hr/yr)** | **100** |
| **Gas Exit Velocity (m/sec)** | 67.1 | **Fuel Type** | Diesel |
| **Stack Gas Temp (°K)** | 716 | **PM10 g/bhp-hr** | 0.09 |

| Diesel Engine (660 Hp) | | | |
|---|---|---|---|
| Source Type | Point | Closest Receptor (m) | 1609 |
| Stack Height (m) | 3.04 | Location Type | RURAL |
| Stack Diam. (m) | 0.23 | Max Operating (hr/yr) | 38 |
| Gas Exit Velocity (m/sec) | 45.0 | Fuel Type | Diesel |
| Stack Gas Temp (°K) | 799 | PM10 g/bhp-hr | 0.4 |

**Conclusion:**

The Criteria modeling runs indicate that the emissions from the proposed equipment will not have an adverse impact on the State and National AAQS. Therefore, no further modeling will be required to demonstrate that the AAQS or EPA's level of significance would be exceeded.

The carcinogenic risk for the 300 hp engine is 2.01E-06, which is below the maximum allowable risk of 10 in a million for diesel IC engines emitting $\leq$ 0.149g $PM_{10}$/bhp/hr. The risk for the 660 hp engine is 1.00E-06 which is the allowable risk of one in a million for engines emitting > 0.149g $PM_{10}$/bhp/hr. Therefore, **the project is approved for permitting, and TBACT is required for the 300 hp engine.** In order to assure compliance with the assumptions made for the risk management review the following conditions listed on the PTO are required:

1. Only CARB certified fuel containing not more than 0.05% sulfur by weight is to be used in these engines.

2. $PM_{10}$ emission rate shall not exceed **0.09 g/HP-hr (note method) for the 300 hp engine** (C-3953-8-0).

3. $PM_{10}$ emission rate shall not exceed **0.40 g/HP-hr (note method) for the 660 hp engine** (C-3953-9-0).

4. The exhaust stacks shall not be fitted with a rain caps, or any other similar devices, that impedes vertical exhaust flow.

5. The 300 hp engine (C-3953-8-0) shall only be operated for maintenance, testing, required regulatory purposes, and during emergency situations. Operation of the engine for maintenance and testing purposes shall not exceed **100 hours per year**.

6. The 660 hp engine (C-3953-9-0) shall only be operated for maintenance, testing, required regulatory purposes, and during emergency situations. Operation of the engine for maintenance and testing purposes shall not exceed **38 hours per year**.

7. The 660 hp engine (C-3953-9-0) shall not operate more than **7 hours in any rolling 24 hr period during maintenance, testing, and required regulatory purposes.**

# ATTACHMENT H

## *$SO_X$ for $PM_{10}$ Interpollutant Offset Analysis*

# $SO_X$ for $PM_{10}$ Interpollutant Offset Analysis
# Avenal Power Center, LLC

| | | | |
|---|---|---|---|
| Facility Name: | Avenal Power Center, LLC | Date: | June 30, 2010 |
| Mailing Address: | 500 Dallas Street. Level 31<br>Houston, TX 77002 | Engineer: | Derek Fukuda |
| | | Lead Engineer: | Joven Refuerzo |
| Contact Person: | Jim Rexroad | | |
| Telephone: | (713) 275-6147 | | |
| Application #: | C-3953-10-1, -11-1, -12-1, -13-1, and -14-1 | | |
| Project #: | C-1100751 | | |
| Location: | NE¼ Section 19, Township 21 South, Range 18 East – Mount Diablo Base Meridian on Assessor's Parcel Number 36-170-032 | | |
| Complete: | March 18, 2010 | | |

## I. Proposal

Avenal Power Center, LLC is seeking approval from the San Joaquin Valley Air Pollution Control District (the "District") for the installation of a "merchant" electrical power generation facility (Avenal Energy Project). The Avenal Energy Project will be a combined-cycle power generation facility consisting of two natural gas-fired combustion turbine generators (CTGs) each with a heat recovery steam generator (HRSG) and a 562.3 MMBtu/hr duct burner. Also proposed are a 300 MW steam turbine, a 37.4 MMBtu/hr auxiliary boiler, a 288 hp diesel-fired emergency IC engine powering a water pump, a 860 hp natural gas-fired emergency IC engine powering a 550 kW generator and associated facilities. The plant will have a nominal rating of 600 MW.

In addition, Avenal Power Center, LLC has proposed to limit the annual facility wide $NO_X$ emissions to 198,840 lb/year, and the annual facility wide CO emissions to 197,928 lb/year.

Facility C-3953 will become a major source for $NO_X$, VOC, and $PM_{10}$. There will be an increase in emissions for all pollutants and offsets are required for $NO_X$, VOC, and $PM_{10}$ emissions.

## II. Applicable Rules

**Rule 2201** New and Modified Stationary Source Review Rule (9/21/06) (Section 3.30 and 4.13.3.2)

## III. Process Description

**Combined-Cycle Combustion Turbine Generators**
Each natural gas-fired General Electric Frame 7 Model PG7241FA combined-cycle combustion turbine generator (CTG) will be equipped with Dry Low $NO_X$ combustors, a selective catalytic reduction (SCR) system with ammonia injection, an oxidation catalyst, a duct burner, and a heat recovery steam generator (HRSG). Each CTG will drive an electrical generator to produce approximately 180 MW of electricity. The plant will be a "combined-cycle plant," since the gas turbine and a steam turbine both turn electrical generators and produce power.

Each CTG will turn an electrical generator, but will also produce power by directing exhaust heat through its HRSG, which supplies steam to the steam turbine nominally rated at 300 MW, which turns another electrical generator.

Since two HRSGs will feed a single steam turbine generator, this design is referred to as a "two-on-one" configuration.

The CTGs will utilize Dry Low $NO_X$ (DLN) combustors, SCR with ammonia injection, and an oxidation catalyst to achieve the following emission rates:

$NO_X$: 2.0 ppmvd @ 15% $O_2$
VOC: 2.0 ppmvd @ 15% $O_2$
CO: 2.0 ppmvd @ 15% $O_2$
$SO_X$: 0.00282 lb/MMBtu (Hourly and Daily Limits; based on 1.0 gr S/100 dscf)
0.001 lb/MMBtu (Annual average; based on 0.36 gr S/100 dscf))
$PM_{10}$: 0.0107 lb/MMBtu

Continuous emissions monitoring systems (CEMs) will sample, analyze, and record $NO_X$, CO, and $O_2$ concentrations in the exhaust gas for each CTG.

Heat Recovery Steam Generators (HRSGs)
The HRSGs provide for the transfer of heat from the CTG exhaust gases to condensate and feedwater to produce stream. Each HRSG will be approximately 90 feet high and will have an exhaust stack approximately 145 feet tall by 19 feet in diameter. The size and shape of the HRSGs are specific to their intended purpose of high efficiency recycling of waste heat from the CTG.

The HRSGs will be multi-pressure, natural-circulation boilers equipped with transition ducts and duct burners. Pressure components of each HRSG include a low pressure (LP) economizer, LP evaporator, LP deaerator/drum, LP superheater, intermediate pressure (IP) economizer, IP evaporator, IP drum, IP superheaters, high pressure (HP) economizer, HP evaporator, HP drum, and HP superheaters and reheaters.

Superheated HP steam is produced in the HRSG and flows to the steam turbine throttle inlet. The exhausted cold reheat steam from the steam turbine is mixed with IP steam

from the HRSG and reintroduced into the HRSG through the reheaters. The hot reheat steam flows back from the HRSG into the STG. The LP superheated steam from the HRSG is admitted to the LP condenser. The condensate is pumped from the condenser back to the HRSG by condensate pumps. The condensate is preheated by an HRSG feedwater heater. Boiler feedwater pumps send the feedwater through economizers and into the boiler drums of the HRSG, where steam is produced, thereby completing the steam cycle.

Each HRSG is equipped with a SCR system that uses aqueous ammonia in conjunction with a catalyst bed to reduce $NO_X$ in the CTG exhaust gases. The catalyst bed is contained in a catalyst chamber located within each HRSG. Ammonia is injected upstream of the catalyst bed. The subsequent catalytic reaction converts $NO_X$ to nitrogen and water, resulting in a reduced concentration of $NO_X$ in the exhaust gases exiting the stack.

**Duct Burners**
Duct burners are installed in the HRSG transition duct between the HP superheater and reheat coils. Through the combustion of natural gas, the duct burners heat the CTG exhaust gases to generate additional steam at times when peak power is needed. The duct burners are also used as needed to control the temperature of steam produced by the HRSGs. The duct burners will have a maximum heat input rating of 562 MMBtu/hr on a higher heating value (HHV) basis per HRSG, and are expected to operate no more than 800 hours per year.

**Steam Turbine Generator**
The steam turbine system consists of a 300 MW nominally rated reheat steam turbine generator (STG), governor system, steam admission system, gland steam system, lubricating oil system, including oil coolers and filters and generator coolers. Steam from the HP superheater, reheater and IP superheater sections of the HRSG enters the corresponding sections of the STG as described previously. The steam expands through the turbine blading to drive the steam turbine and its generator. Upon exiting the turbine, the steam enters the deaerating condenser, where it is condensed to water.

**Auxiliary Boiler**
One 37.4 MMBtu/hr Cleaver Brooks Model CBL700-900-200#ST natural gas-fired boiler equipped with an Cleaver Brooks Model ProFire Ultra Low $NO_X$ burner, capable of providing up to 25,000 pounds per hour (lb/hr) of saturated steam. The boiler will be used to provide steam as needed for auxiliary purposes.

**Diesel-Fired Emergency IC Engine Powering a Fire Pump**
Emergency firewater will be provided by three pumps (a jockey pump, a main fire pump, and a back-up fire pump); two powered by electric motors and the other powered by a diesel-fired internal combustion engine. If the jockey pump is unable to maintain a set operating pressure in the piping network, the electric motor-driven fire pump will start automatically. If the electric motor-driven fire pump is unable to maintain a set operating pressure, the diesel engine-driven fire pump will start automatically. The

diesel-fired engine will be rated at 288 horsepower. The engine will be limited to no greater than 50 hours per year of non-emergency operation in accordance with the applicant's proposal.

**Natural Gas-Fired Emergency IC Engine Powering an Electrical Generator**
One 860 hp Caterpillar Model G3512LE natural gas-fired IC engine generator set will provide power to the essential service AC system in the event of grid failure or loss of outside power to the plant. This engine will be limited to no greater than 50 hours per year of non-emergency operation in accordance with the applicant's proposal.

## IV. Equipment Listing:

C-3953-10-1: 180 MW NOMINALLY RATED COMBINED-CYCLE POWER GENERATING SYSTEM #1 CONSISTING OF A GENERAL ELECTRIC FRAME 7 MODEL PG7241FA NATURAL GAS-FIRED COMBUSTION TURBINE GENERATOR WITH DRY LOW $NO_X$ COMBUSTOR, A SELECTIVE CATALYTIC REDUCTION (SCR) SYSTEM, AN OXIDATION CATALYST, HEAT RECOVERY STEAM GENERATOR #1 (HRSG) WITH A 562 MMBTU/HR DUCT BURNER AND A 300 MW NOMINALLY RATED STEAM TURBINE SHARED WITH C-3953-11

C-3953-11-1: 180 MW NOMINALLY RATED COMBINED-CYCLE POWER GENERATING SYSTEM #2 CONSISTING OF A GENERAL ELECTRIC FRAME 7 MODEL PG7241FA NATURAL GAS-FIRED COMBUSTION TURBINE GENERATOR WITH DRY LOW $NO_X$ COMBUSTOR, A SELECTIVE CATALYTIC REDUCTION (SCR) SYSTEM, AN OXIDATION CATALYST, HEAT RECOVERY STEAM GENERATOR #2 (HRSG) WITH A 562 MMBTU/HR DUCT BURNER AND A 300 MW NOMINALLY RATED STEAM TURBINE SHARED WITH C-3953-10

C-3953-12-1: 37.4 MMBTU/HR CLEAVER BROOKS MODEL CBL-700-900-200#ST NATURAL GAS-FIRED BOILER WITH A CLEAVER BROOKS MODEL PROFIRE, OR DISTRICT APPROVED EQUIVALENT, ULTRA LOW NOX BURNER

C-3953-13-1: 288 BHP CLARKE MODEL JW6H-UF40 DIESEL-FIRED EMERGENCY IC ENGINE POWERING A FIRE PUMP

C-3953-14-1: 860 BHP CATERPILLAR MODEL 3456 NATURAL GAS-FIRED EMERGENCY IC ENGINE POWERING WITH NON-SELECTIVE CATALYTIC REDUCTION (NSCR) POWERING A 500 KW ELECTRICAL GENERATOR

## V. Interpollutant Offset Ratio Proposal $SO_X$ for $PM_{10}$

Rule 2201, New and Modified Stationary Source Review, specifically allows the use of $PM_{10}$ precursor ERCs to offset $PM_{10}$ increases:

> *4.13.3 Interpollutant offsets may be approved by the APCO on a case-by-case basis, provided that the applicant demonstrates to the satisfaction of the APCO, that the emission increases from the new or modified source will not cause or contribute to a violation of an Ambient Air Quality Standard. In such cases, the APCO shall, based on an air quality analysis, impose offset ratios equal to or greater than the requirements of this rule.*
>
> *4.13.3.2 Interpollutant offsets between PM10 and PM10 precursors may be allowed.*

Based on this language, an applicant must demonstrate an appropriate interpollutant offset ratio, based on an air quality analysis (that is, based on the science of the precursor-to-$PM_{10}$ relationship given the atmospheric chemistry and the meteorology of the locale).

The $SO_X$ for $PM_{10}$ interpollutant ratio of 1.000:1 is based on District analysis (see Appendix A). The originating location of reduction of the proposed ERC certificates are greater than 15 miles from the proposed project. Therefore, a distance offset ratio of 1.5 applies. Combining the interpollutant and distance offset ratio, an overall $SO_X$ for PM10 offset ratio of 1.000 x 1.5 = 1.5:1 is valid for project C-1100751.

## IV. Project Offset Calculations

### i. C-3953-10-1 and C-3953-11-1 (Turbines)

#### *a. Maximum Hourly PE*

The maximum hourly potential to emit for $NO_X$, CO, and VOC from each CTG will occur when the unit is operating under start-up mode. The maximum hourly PE for both turbines operating together is when both are starting up and firing their duct burners.

The combined startup NOx emissions from the two turbines will be limited to 240 lbs/hr [maximum startup emission rate (160 lbs/hr) + average startup emission rate (80 lbs/hr)]. Similarly, the combined startup CO emissions from the two turbines will be limited to 1,902 lbs/hr, [maximum startup emission rate (1,000 lbs/hr) + average startup emission rate (902 lbs/hr)].

The maximum hourly emissions are summarized in the table below:

| Maximum Hourly Potential to Emit | | | | | |
|---|---|---|---|---|---|
| | Maximum Startup/Shutdown Emissions (lb/hr) | Turbine w/ Duct Burner Emissions Rate | Turbine #1 Emissions (lb/hr) | Turbine #2 Emissions (lb/hr) | Maximum Hourly Emissions for Both Turbines |
| $NO_X$ | 160 | 17.20 | 13.55 | 13.55 | 240.00 |
| CO | 1,000 | 10.60 | 8.35 | 8.35 | 1,902.00 |
| VOC | 16 | 5.89 | 3.34 | 3.34 | 32.00 |
| $PM_{10}$ | N/A[1] | 11.78 | 8.91 | 8.91 | 23.56 |
| $SO_X$ | N/A[7] | 6.65 | 5.23 | 5.23 | 13.30 |
| $NH_3$ | N/A | 32.13 | 25.31 | 25.31 | 64.26 |

### *b. Maximum Daily PE*

Maximum daily emissions for $NO_X$, CO, and VOC occurs when each CTG undergoes six (6) hours operating in startup or shutdown mode, and eighteen (18) hours operating with duct burner firing at full load. The startup and shutdown emissions for $PM_{10}$, $SO_X$, and NH3 are will be lower or equivalent to the emissions rate when the unit is fired at 100% load; therefore the maximum daily emissions for $PM_{10}$, $SO_X$, and NH3 occurs when each CTG is operated for twenty four (24) hours with duct burner firing at full load. The results are summarized in the table below:

| Maximum Daily Potential to Emit (w/ Startup and Shutdown) | | | | |
|---|---|---|---|---|
| | Average Startup/Shutdown Emissions Rate | Emissions Rate @ 100% Load with duct burner (101° F) | Emissions Rate @ 100% Load without duct burner (32° F) | DEL (per CTG) |
| $NO_X$ | 80 lb/hr (avg) | 17.20 lb/hr | 13.03 lb/hr | 789.6 lb/day |
| CO | 900 lb/hr (avg) | 10.60 lb/hr | 8.35 lb/hr | 5,590.8 lb/day |
| VOC | 16 lb/hr (avg) | 5.89 lb/hr | 3.34 lb/hr | 202.0 lb/day |
| $PM_{10}$ | N/A[8] | 11.78 lb/hr | 8.91 lb/hr | 282.7 lb/day |
| $SO_X$ | N/A[8] | 6.65 lb/hr | 5.23 lb/hr | 159.6 lb/day |
| $NH_3$ | N/A | 32.13 lb/hr | 25.31 lb/hr | 771.1 lb/day |

### *c. Maximum Annual PE*

The facility has indicated that the turbines will be operated in one of three different scenarios: weekend and weekday hot start scenario, weekend shutdown and weekday hot start scenario, and baseload scenario. The $SO_X$ emission factors used to calculate the annual potential emissions will be based

[1] $PM_{10}$ and $SO_X$ emissions during startups and shutdowns are lower than maximum hourly emissions.

on the applicant proposed average natural gas sulfur limit 0.36 gr/100 dscf.

$SO_X$ EF = (0.36 ~~gr S~~/100 ~~dscf~~) x (1 ~~lb S~~/7000 ~~gr~~) x (64 lb $SO_X$/32 ~~lb S~~) x (1 ~~scf~~/1013 ~~Btu~~) x ($10^6$ ~~Btu~~/MMBtu)
**= 0.001 lb-$SO_X$/MMBtu**

CTG w/o Duct Burner Firing:
$SO_X$ Emission Rate (lb/hr) = (1,856.3 MMBtu/hr) x (0.001 lb-$SO_X$/MMBtu)
**= 1.86 lb-$SO_X$/hr**

CTG w/ Duct Burner Firing:
$SO_X$ Emission Rate (lb/hr) = (2,356.5 MMBtu/hr) x (0.001 lb-$SO_X$/MMBtu)
**= 2.36 lb-$SO_X$/hr**

Potential annual emissions for each pollutant will be calculated for each of the three scenarios in the tables below:

**Scenario 1) Weekend and Weekday Hot Start:**

547.5 (1.5 hr/hot start x 365 hot start/yr) hours operating in startup and shutdown mode, 800 hours operating while firing at full load with the duct burner, and 6,683 hours operating while firing at full load without the duct burner. Since startup and shutdown emission rates for $PM_{10}$, $SO_X$, and NH3 are less than the emission rate when the CTG is fired at 100% load w/o the duct burner, the startup and shutdown emission rates will be assumed to be equivalent to the CTG fired at 100% load w/o the duct burner. Since the CTGs will be fired throughout the year, the emission factors for the unit when fired at the average ambient temperature (63° F) will be used to calculate the potential annual emissions.

| **Annual Potential to Emit Scenario 1) Weekend and Weekday Hot Start*** | | | | |
|---|---|---|---|---|
| | Average Startup/Shutdown Emissions Rate | Emissions Rate @ 100% Load with duct burner (63° F) | Emissions Rate @ 100% Load without duct burner (63° F) | Annual PE (per CTG)) |
| $NO_X$ | 80 lb/hr (avg) | 16.34 lb/hr | 13.03 lb/hr | **143,951 lb/year** |
| CO | 900 lb/hr (avg) | 10.60 lb/hr | 8.35 lb/hr | 557,033 lb/year |
| VOC | 16 lb/hr (avg) | 5.68 lb/hr | 3.17 lb/hr | **34,489 lb/year** |
| $PM_{10}$ | N/A[8] | 11.27 lb/hr | 9.00 lb/hr | 74,091 lb/year |
| $SO_X$ | N/A[8] | 2.36 lb/hr | 1.86 lb/hr | 15,337 lb/year |
| $NH_3$ | N/A | 32.13 lb/hr | 25.31 lb/hr | 208,708 lb/year |

* Emission factors were taken from Table 6.2-1.1 in the ATC application submittal.

**Scenario 2) Weekend Shutdown and Weekday Hot Start:**

624 ((1.5 hr/hot start x 208 hot start/yr) + (6.0 hr/cold start x 52 cold starts/year)) hours operating in startup and shutdown mode, 800 hours operating while firing at full load with the duct burner, and 3,800 hours operating while firing at full load without the duct burner. Since startup and shutdown emission rates for $PM_{10}$, $SO_X$, and NH3 are less than the emission rate when the CTG is fired at 100% load w/o the duct burner, the startup and shutdown emission rates will be assumed to be equivalent to the CTG fired at 100% load w/o the duct burner. Since the CTGs will be fired throughout the year, the emission factors for the unit when fired at the average ambient temperature (63° F) will be used to calculate the potential annual emissions.

| Annual Potential to Emit<br>Scenario 2) Weekend Shutdown and Weekday Hot Start* | | | | |
|---|---|---|---|---|
| | Average Startup/Shutdown Emissions Rate | Emissions Rate @ 100% Load with duct burner (63° F) | Emissions Rate @ 100% Load without duct burner (63° F) | Annual PE (per CTG) |
| $NO_X$ | 80 lb/hr (avg) | 16.34 lb/hr | 13.03 lb/hr | 112,506 lb/year |
| CO | 900 lb/hr (avg) | 10.60 lb/hr | 8.35 lb/hr | 601,810 lb/year |
| VOC | 16 lb/hr (avg) | 5.68 lb/hr | 3.17 lb/hr | 26,574 lb/year |
| $PM_{10}$ | N/A[8] | 11.27 lb/hr | 9.00 lb/hr | 48,832 lb/year |
| $SO_X$ | N/A[8] | 2.36 lb/hr | 1.86 lb/hr | 10,117 lb/year |
| $NH_3$ | N/A | 32.13 lb/hr | 25.31 lb/hr | 137,675 lb/year |

* Emission factors were taken from Table 6.2-1.1 in the ATC application submittal.

**Scenario 3) Baseload:**

800 hours operating while firing at full load with the duct burner, and 7,960 hours operating while firing at full load without the duct burner. Since the CTGs will be fired throughout the year, the emission factors for the unit when fired at the average ambient temperature (63° F) will be used to calculate the potential annual emissions.

| Annual Potential to Emit Baseload Scenario* | | | | |
|---|---|---|---|---|
| | Average Startup/Shutdown Emissions Rate | Emissions Rate @ 100% Load with duct burner (63° F) | Emissions Rate @ 100% Load without duct burner (63° F) | Annual PE (per CTG) |
| $NO_X$ | 80 lb/hr (avg) | 16.34 lb/hr | 13.03 lb/hr | 116,791 lb/year |
| CO | 900 lb/hr (avg) | 10.60 lb/hr | 8.35 lb/hr | 74,946 lb/year |
| VOC | 16 lb/hr (avg) | 5.68 lb/hr | 3.17 lb/hr | 29,777 lb/year |
| $PM_{10}$ | N/A[8] | 11.27 lb/hr | 9.00 lb/hr | **80,656 lb/year** |
| $SO_X$ | N/A[8] | 2.36 lb/hr | 1.86 lb/hr | **16,694 lb/year** |
| $NH_3$ | N/A | 32.13 lb/hr | 25.31 lb/hr | **219,972 lb/year** |

* Emission factors were taken from Table 6.2-1.1 in the ATC application submittal.

**Maximum Annual Potential to Emit:**

The highest annual potential emissions, for each pollutant, from the three different scenarios will be taken to determine the maximum annual potential to emit for the CTG. The results are summarized in the table below:

| Maximum Annual Potential to Emit | | |
|---|---|---|
| | Annual PE (per CTG) | Scenario |
| $NO_X$ | 143,951 lb/year | Scenario 1 |
| CO | 197,928 lb/year | Facility Wide Limit |
| VOC | 34,489 lb/year | Scenario 2 |
| $PM_{10}$ | 80,656 lb/year | Scenario 3 |
| $SO_X$ | 16,694 lb/year | Scenario 3 |
| $NH_3$ | 219,972 lb/year | Scenario 3 |

**ii. C-3953-12-0 (Boiler)**

The $PM_{10}$ potential to emit for the boiler is calculated as follows, and summarized in the table below.

$PE_{PM10}$ = (0.005 lb/MMBtu) * (37.4 MMBtu/hr)
= **0.19 lb $PM_{10}$/hr**

= (0.005 lb/MMBtu) * (37.4 MMBtu/hr) * (12 hr/day)
= **2.2 lb $PM_{10}$/day**

= (0.005 lb/MMBtu) * (37.4 MMBtu/hr) * (1,248 hr/year)
= **233 lb $PM_{10}$/year**

= (233 lb/year) * (4 qtr/year)
= **58 lb $PM_{10}$/qtr**

| Post Project Potential to Emit (PE2) (C-3953-12-0) | | | | |
|---|---|---|---|---|
| | Hourly Emissions (lb/hr) | Daily Emissions (lb/day) | Quarterly Emissions (lb/qtr) | Annual Emissions (lb/year) |
| $PM_{10}$ | 0.19 | 2.2 | 58 | 233 |

### iii. C-3953-13-0 (Diesel IC engine powering fire water pump)

The $PM_{10}$ emissions for the emergency fire pump engine is calculated as follows, and summarized in the table below:

$PE_{PM10}$ = (0.059 g/hp·hr) * (288 hp) ÷ (453.6 g/lb)
= **0.04 lb $PM_{10}$/hr**

= (0.059 g/hp·hr) * (288 hp) ÷ (453.6 g/lb) * (24 hr/day)
= **0.9 lb $PM_{10}$/day**

= (0.059 g/hp·hr) * (288 hp) ÷ (453.6 g/lb) * (12.5 hr/qtr)
= **0.5 lb $PM_{10}$/qtr**

= (0.059 g/hp·hr) * (288 hp) ÷ (453.6 g/lb) * (50 hr/year)
= **1.9 lb $PM_{10}$/year**

| Post Project Potential to Emit (PE2) (C-3953-13-0) | | | | |
|---|---|---|---|---|
| | Hourly Emissions (lb/hr) | Daily Emissions (lb/day) | Quarterly Emissions (lb/qtr) | Annual Emissions (lb/year) |
| $PM_{10}$ | 0.04 | 0.9 | 0.5 | 2 |

### iv. C-3953-14-0 (Natural gas IC engine powering electrical generator)

The $PM_{10}$ emissions for the emergency IC engine is calculated as follows, and summarized in the table below:

$PE_{PM10}$ = (0.034 g/hp·hr) * (860 hp) ÷ (453.6 g/lb)
= **0.06 lb $PM_{10}$/hr**

= (0.034 g/hp·hr) * (860 hp) ÷ (453.6 g/lb) * (24 hr/day)
= **1.5 lb $PM_{10}$/day**

= (0.034 g/hp·hr) * (860 hp) ÷ (453.6 g/lb) * (12.5 hr/qtr)
= **1 lb $PM_{10}$/qtr**

= (0.034 g/hp·hr) * (860 hp) ÷ (453.6 g/lb) * (50 hr/year)
= **3 lb $PM_{10}$/year**

| **Post Project Potential to Emit (PE2) (C-3953-14-0)** | | | | |
|---|---|---|---|---|
| | Hourly Emissions (lb/hr) | Daily Emissions (lb/day) | Quarterly Emissions (lb/qtr) | Annual Emissions (lb/year) |
| $PM_{10}$ | 0.06 | 1.5 | 1 | 3 |

**Post-Project Stationary Source Potential to Emit (SSPE2)**

Pursuant to Section 4.10 of District Rule 2201, the Post Project Stationary Source Potential to Emit (SSPE2) is the Potential to Emit (PE) from all units with valid Authorities to Construct (ATC) or Permits to Operate (PTO) at the Stationary Source and the quantity of emission reduction credits (ERC) which have been banked since September 19, 1991 for Actual Emissions Reductions that have occurred at the source, and which have not been used on-site.

| **Post-project Stationary Source Potential to Emit [SSPE2] (lb/year)** | | | | | | |
|---|---|---|---|---|---|---|
| Permit Unit | $NO_X$ * | CO ** | VOC | $PM_{10}$ | $SO_X$ | $NH_3$ |
| C-3953-10-1 | 198,840 | 197,928 | 34,489 | 80,656 | 16,694 | 219,972 |
| C-3953-11-1 | | | 34,489 | 80,656 | 16,694 | 219,972 |
| C-3953-12-1 | | | 201 | 233 | 132 | 0 |
| C-3953-13-1 | | | 12 | 2 | 0 | 0 |
| C-3953-14-1 | | | 31 | 3 | 1 | 0 |
| Post-project SSPE (SSPE2) | **198,840** | **197,928** | **69,222** | **161,550** | **33,521** | **439,944** |

* The facility has proposed to limit the $NO_X$ emission from this facility to 198,840 lb/year.
** The facility has proposed to limit the CO emission from this facility to 197,928 lb/year.

**Total Emissions to be Offset**

Pursuant to District Rule 2201, Section 4.6, emission offsets shall not be required for emergency equipment that is used exclusively as emergency standby equipment for electric power generation or any other emergency equipment as approved by the APCO that does not operate more than 200 hours per year for

non-emergency purposes and is not used pursuant to voluntary arrangements with a power supplier to curtail power. Therefore the emission from the diesel-fired fire water pump and the natural gas-fired emergency standby generator are not required to be offset.

| Emission to be Offset (lb/year) | | | | | | |
|---|---|---|---|---|---|---|
| Permit Unit | $NO_X$ * | CO ** | VOC | $PM_{10}$ | $SO_X$ | $NH_3$ |
| C-3953-10-1 | 198,840 | 197,928 | 34,489 | 80,656 | 16,694 | 219,972 |
| C-3953-11-1 | | | 34,489 | 80,656 | 16,694 | 219,972 |
| C-3953-12-1 | | | 201 | 233 | 132 | 0 |
| Post-project SSPE (SSPE2) | **198,840** | **197,928** | **69,179** | **161,545** | **33,520** | **439,944** |

* The facility has proposed to limit the $NO_X$ emission from this facility to 198,840 lb/year.
** The facility has proposed to limit the CO emission from this facility to 197,928 lb/year.

**Offset Calculations:**

$PM_{10}$:

SSPE2 ($PM_{10}$) = 161,545 lb/year
Offset threshold ($PM_{10}$) = 29,200 lb/year
ICCE = 0 lb/year

Offsets Required (lb/year) = [(161,545 – 29,200 + 0) x DOR]
= 132,345 lb/year x DOR

Calculating the appropriate quarterly emissions to be offset is as follows (in lb/qtr):

| 1st Quarter | 2nd Quarter | 3rd Quarter | 4th Quarter |
|---|---|---|---|
| 33,087 | 33,086 | 33,086 | 33,086 |

The applicant is proposing to use ERC Certificates C-894-4, N-721-4, N-723-4, N-762-5, S-2788-5, S-2789-5, S-2790-5, and 2791-5 which have an original site of reduction greater than 15 miles from the location of this project. Therefore, a distance offset ratio of 1.5:1 is applicable and the amount of $PM_{10}$ ERCs that need to be withdrawn is:

Offsets Required (lb/year) = 132,345 lb/year x 1.5
= 198,518 lb/year
= 99.26 ton/yr

Calculating the appropriate quarterly emissions to be offset is as follows (in lb/qtr):

| 1st Quarter | 2nd Quarter | 3rd Quarter | 4th Quarter |
|---|---|---|---|
| 49,630 | 49,629 | 49,629 | 49,630 |

The applicant has stated that the facility plans to use ERC certificates C-894-4, N-721-4, N-723-4, N-762-5, S-2788-5, S-2789-5, S-2790-5, and 2791-5 to offset the increases in $PM_{10}$ emissions associated with this project. The applicant has purchased the following quarterly amounts of the above certificates:

| | 1st Quarter | 2nd Quarter | 3rd Quarter | 4th Quarter |
|---|---|---|---|---|
| ERC #C-896-4 | 80 | 80 | 80 | 80 |
| ERC #N-721-4 | 0 | 0 | 3,215 | 0 |
| ERC #N-723-4 | 0 | 0 | 985 | 0 |
| ERC #S-2791-5 | 92,179 | 23,666 | 69,157 | 96,288 |
| ERC #S-2790-5 | 12,862 | 491 | 0 | 8,499 |
| ERC #S-2789-5 | 6 | 14 | 12 | 8 |
| ERC #S-2788-5 | 5 | 7 | 3 | 6 |
| ERC #N-762-5 | 21,000 | 21,000 | 21,000 | 21,000 |

Project $PM_{10}$ offset requirements

The applicant states either $PM_{10}$ ERC certificates C-894-4, N-721-4, N-723-4, N-762-5, S-2788-5, S-2789-5, S-2790-5, and 2791-5 will be utilized to supply the $PM_{10}$ offset requirements.

| | 1st Quarter | 2nd Quarter | 3rd Quarter | 4th Quarter |
|---|---|---|---|---|
| $PM_{10}$ Emissions to be offset: (at a 1.5:1 ratio): | 49,630 | 49,629 | 49,629 | 49,630 |
| Available ERCs from certificates C-896-4, N-721-4, and N-723-4: | 80 | 80 | 4,280 | 80 |
| ERCs applied from certificates C-896-4, N-721-4, and N-723-4 fully withdrawn as certificates C-896-4, N-721-4, and N-723-4: | -80 | -80 | -4,280 | -80 |
| Remaining ERCs from certificate C-896-4, N-721-4, and N-723-4: | 0 | 0 | 0 | 0 |
| Remaining $PM_{10}$ emissions to be offset (at a 1.5:1 ratio): | 49,550 | 49,549 | 45,349 | 49,550 |

Per Rule 2201 Section 4.13.3.2, interpollutant offsets between $PM_{10}$ and $PM_{10}$ precursors (i.e. $SO_X$) may be allowed. The applicant is proposing to use interpollutant offsets $SO_X$ for $PM_{10}$ at an interpollutant ratio of 1.0:1 (see Appendix A). This interpollutant ratio has been evaluated by the District's modeler, James Sweet, Air Quality Project Planner. Per Rule 2201 Section 4.13.7, Actual Emission Reductions (i.e. ERCs) that occurred from October through March (i.e. 1st and 4th Quarter), inclusive, may be used to offset increases in PM during any period of the year. Since the $SO_X$ ERCs are being used to offset $PM_{10}$ emissions, the above applies to the $SO_X$ ERCs.

In addition, the overall offset ratio is equal to the multiplication of the distance and interpollutant ratios (1.5 x 1.000 = 1.5).

| | 1st Quarter | 2nd Quarter | 3rd Quarter | 4th Quarter |
|---|---|---|---|---|
| Remaining $PM_{10}$ Emissions to be offset: (at a 1.5:1 ratio): | 49,550 | 49,549 | 45,349 | 49,550 |
| Remaining $PM_{10}$ emissions to be offset with $SO_X$ ERCs (at a 1.5:1 distance ratio and a 1.000:1 interpollutant $SO_X$:$PM_{10}$ ratio): | 49,550 | 49,549 | 45,349 | 49,550 |
| Remaining ERCs from certificates N-762-5, S-2788-5, S-2789-5, and S-2790-5: | 33,873 | 21,512 | 21,015 | 29,513 |
| Remaining ERCs from certificates N-762-5, S-2788-5, S-2789-5, and S-2790-5: | 0 | 0 | 0 | 0 |
| Remaining $PM_{10}$ emissions to be offset (at a 1.5:1 ratio and a 1.000:1 interpollutant $SO_X$:$PM_{10}$ ratio): | 15,677 | 28,037 | 24,334 | 20,037 |

| | 1st Quarter | 2nd Quarter | 3rd Quarter | 4th Quarter |
|---|---|---|---|---|
| Remaining PM10 Emissions to be offset: (at a 1.5:1 distance ratio and a 1.000:1 interpollutant $SO_X$:$PM_{10}$ ratio): | 15,677 | 28,037 | 24,334 | 20,037 |
| Remaining ERCs from certificate S-2791-5: | 92,179 | 23,666 | 69,157 | 96,288 |
| 1st qtr. ERCs applied to 2nd qtr. ERCs: | -4,371 | 4,371 | 0 | 0 |
| Adjusted Remaining ERCs from certificate S-2791-5: | 87,808 | 28,037 | 69,157 | 96,288 |
| Remaining PM10 emissions to be offset (at a 1.5:1 ratio and a 1.000:1 interpollutant $SO_X$:$PM_{10}$ ratio): | 15,677 | 28,037 | 24,334 | 20,037 |
| ERCs applied from certificate S-2791-5 partially withdrawn: | 15,677 | 28,037 | 24,334 | 20,037 |
| Remaining ERCs from certificate S-2791-5: | 72,131 | 0 | 44,823 | 76,251 |

As seen above, the facility has sufficient credits to fully offset the quarterly $SO_X$ and $PM_{10}$ emissions increases associated with this project.

## V. Conclusion

Approve use of an overall $SO_X$ for $PM_{10}$ interpollutant offset ratio of 1.5:1 (1.000 x 1.5).

## VI. Recommendation

Compliance with all applicable rules and regulations is expected. Issue Authorities to Construct C-3953-10-1, -11-1, -12-1, -13-1, and -14-1 with a $SO_X$ for $PM_{10}$ interpollutant offset ratio of 1.000:1.

## Appendix

A: District Review and Approval

# Appendix A

District Review and Approval

# Interpollutant Offset Ratio Explanation

The Air District's Rule 2201, "New and Modified Source Review", requires facilities to supply "emissions offsets" when a permittee requests new or modified permits that allow emissions of air contaminants above certain annual emission offset thresholds. In addition, Rule 2201 allows interpollutant trading of offsets amongst criteria pollutants and their precursors upon the appropriate scientific demonstration of an adequate trading ratio, herein referred to as the interpollutant ratio. A technical analysis is required to determine the interpollutant offset ratio that is justified by evaluation of atmospheric chemistry. This evaluation has been conducted using the most recent modeling analysis available for the San Joaquin Valley. The results of the analysis are designed to be protective of health for the entire Valley for the entire year, by applying the most stringent interpollutant ratio throughout the Valley.

It is appropriate for District particulate offset requirements to be achieved by either a reduction of directly emitted particulate or by reduction of the gases, called particulate precursors, which become particulates from chemical and physical processes in the atmosphere. The District interpollutant offset relationship quantifies precursor gas reductions sufficient to serve as a substitute for a required direct particulate emissions reduction. Emission control measures that reduce gas precursor emissions at the facility may be used to provide the offset reductions. Alternatively, emission credits for precursor reductions may be used in accordance with District regulations.

The amount of particulate formed by the gaseous emissions must be evaluated to determine how much credit should be given for the gaseous reductions. Gases combine and merge with other material adding molecular weight when forming into particles. Some of the gases do not become particulate matter and remain a gas. Both the extent of conversion into particles and resulting weight of the particles are considered to establish mass equivalency between direct particulate emissions and particulate formed from gas precursors. The Interpollutant offset ratio is expressed as a per-ton equivalency.

The District interpollutant analysis uses the most recent and comprehensive modeling of San Joaquin Valley particulate formation from sulfur oxides (SOx) and nitrogen oxides (NOx). Modeling compares industrial directly emitted particulate to particulate matter from precursor emissions. The interpollutant modeling procedure, assumptions and uncertainties are documented in an extensive analysis file. Additional documentation of the modeling procedure for the San Joaquin Valley is contained in the 2008 PM2.5 Plan and its appendices. The 2008 PM2.5 Plan provides evaluation of the atmospheric relationships for direct particulate emissions and precursor gases when they are highest during the fourth quarter of the year. The southern portion of the Valley is evaluated by both receptor modeling and regional modeling of chemical relationships for precursor particulate formation. Regional modeling was conducted for the entire Valley through 2014. The two modeling approaches are combined to determine interpollutant offset ratios applicable to, and protective of, the entire Valley (SOx for PM 1:1 and NOx for PM 2.629:1).

# DEVELOPMENT OF THE INTERPOLLUTANT RATIO

## For the proposed substitution of reductions of sulfur oxides (SOx) or nitrogen oxides (NOx) for directly emitted particulate matter

## March 2009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# Introduction

**Goal of Interpollutant Evaluation: Establish the atmospheric exchange relationship for substitution of alternative pollutant or precursor reductions for required reductions of directly emitted particulate**

Evaluation to establish the atmospheric relationship of different pollutants is required as a prerequisite for establishing procedures for allowing a required reduction to be met by substitution of a reduction of a different pollutant or pollutant precursor. Proposed new facility construction or facility modifications may result in increased emissions of a pollutant. The District establishes requirements for reductions of the pollutant to "offset" the proposed increase. A facility may propose a reduction of an alternative pollutant or pollutant precursor where reductions of that material have already been achieved at the facility beyond the amount required by District regulations or where emission reductions credits for reductions achieved by other facilities are economically available; however, for such a substitution to be allowed the District must establish equivalency standards for the substitution. The equivalency relationship used for offset requirements is referred to in this discussion as the interpollutant ratio. The interpollutant ratio is a mathematical formula expressing the amount of alternative pollutant or precursor reduction required to be substituted for the required regulatory reduction. This discussion is limited to the atmospheric relationships and does not address other policy or regulatory requirements for offsets such as are contained in District Rule 2201.

The following description is provided to explain key elements of the analysis conducted to develop the atmospheric relationship between the commonly requested substitutions. Emission reductions of sulfur oxide emissions or nitrogen oxide emissions are proposed by many facilities as a substitution for reduction of directly emitted particulates. Elemental and organic carbon emissions are the predominant case and dominant contribution to directly emitted particulate mass from industrial facilities, although other types of directly emitted particulates do occur. Therefore this atmospheric analysis examines directly emitted carbon particulates from industrial sources in comparison to the formation of particles from gaseous emissions of sulfur oxides and nitrogen oxides.

# Analyses included in Interpollutant evaluation

## *Factors Considered*

The foundation for this analysis is provided by the atmospheric modeling conducted for the 2008 PM2.5 Plan. Modeling conducted for this State Implementation Plan was conducted by the District and the California Air Resources Board using a variety of modeling approaches. Each separate model has technical limitations and uncertainties. To reduce the uncertainty of findings, a combined evaluation of results of all of the modeling methods is used to establish "weight of evidence" support for technical analysis and conclusions. The modeling methods are supported by a modeling protocol which was sent to ARB and EPA Region IX for review and was included in the appendices to the Plan.

The analysis file prepared for the interpollutant ratio evaluation includes emissions inventories, regional model daily output files, chemical mass balance modeling and speciated rollback modeling as produced for the 2008 PM2.5 Plan. This well examined and documented modeling information was used as a starting point for additional evaluation to determine interrelationships between directly emitted pollutants and particulates from precursors.

The interpollutant ratio analysis is limited to evaluation of directly emitted PM2.5 from industrial sources and formation of PM2.5 from precursor gases. While both directly emitted particulates and particulate from precursor gases also occur in the PM10 size range, there is much more uncertainty associated with deposition rates and particle formation rates for the larger size ranges. Additionally, because PM2.5 is a subset of PM10; all reductions of PM2.5 are fully creditable as reductions towards PM10 requirements. This analysis concentrates on the quarter of the year when both directly emitted carbon from industrial sources and secondary particulates are measured at the highest levels. Assessing atmospheric ratios at low concentrations is subject to much greater uncertainty and has limited value toward assessment of actions to comply with the air quality standards.

## *Elements from 2008 PM 2.5 Plan*

- Regional modeling daily output for eleven locations
- Chemical Mass Balance (CMB) modeling for four locations – source analysis, speciation profile selection, event meteorology evaluation
- Receptor speciated rollback modeling with adjustment for nitrate nonlinearity for four locations, evaluation of spatial extent of contributing sources
- Emission inventories and projections to future years as developed for the 2008 PM 2.5 Plan

- Modeling protocols for receptor modeling, regional modeling, and Positive matrix Factorization (PMF) analysis and evaluation of technical issues applicable to particulate formation in the San Joaquin Valley
- Model performance analysis as documented in appendices to the 2008 PM 2.5 Plan

### *Extension by additional analysis*

Additional evaluation was conducted to evaluate the receptor modeling relationship between direct PM from industrial sources and sulfate and nitrate particulate formed from SOx and NOx precursor gases. Area of influence adjustments were evaluated to ensure appropriate consideration of contributing source area for different types of pollutants for both directly emitted and secondary particulate. This evaluation was possible only for the southern four Valley counties and was conducted for both 2000 and 2009.

The regional model output was evaluated for the fourth quarter to evaluate general atmospheric chemistry in 2005 and 2014 to determine the correlation between northern and southern areas of the Valley. This evaluation determined that the atmospheric chemistry observed and modeled in the north was within the range of values observed and modeled in the southern SJV. This establishes that a ratio protective of the southern Valley will also be protective in the north.

The District determined from the additional analyses of both receptor and regional modeling that the most stringent ratio determined for the southern portion of the Valley would also be protective of the northern portion of the Valley. Due to the regional nature of these pollutants, actions taken in other counties must be assumed to have at least some influence on other counties; therefore to achieve attainment at the earliest practical date it is appropriate to require all counties to establish a consistent interpollutant ratio for the entire District.

### *Strengths*

The interpollutant ratio analysis uses established and heavily reviewed modeling and outputs as foundation data. Analysis of model performance has already been completed for the models and for the emissions inventories used for this analysis. The modeling was performed in accordance with protocols developed by the District and ARB and in accordance with modeling guidelines established by EPA. The combination of modeling approaches provides an analysis for the current year and provides projection to 2014. Weight of evidence comparison of various modeling approaches establishes the reliability of the foundation modeling, with all modeling approaches showing strong agreement in predicted results. Additional analysis performed to develop the interpollutant ratio uses both regional and receptor evaluations which were the primary models used for the 2008 PM 2.5 Plan.

### *Limitations*

Both industrial direct emissions and secondary formed particulate may be both PM2.5 and PM10. The majority of secondary particulates formed from precursor gases are in the PM2.5 range as are most combustion emissions from industrial stacks, however both secondary and stack emissions do contain particles larger than PM2.5. Regional modeling is more reliable for the smaller fraction due to travel distances and deposition rates. Large particles have much higher deposition and are much more difficult to replicate with a regional model. This leads to a strong technical preference for evaluating both emission types in terms of PM2.5 because the integration of receptor analysis and regional modeling for coarse particle size range up to PM10 has a much greater associated uncertainty.

# Analyses contained in Receptor modeling

## *Factors Considered*

This modeling approach uses speciated linear modeling based on chemical mass balance evaluation of contributing sources with San Joaquin Valley specific identification of contributing source profiles, adjustments from regional modeling for the nonlinearity of nitrate formation, adjustments for area of influence impacts of contributing sources developed from back trajectory analysis of high concentration particulate episodes and projections of future emission inventories as developed for the 2008 PM2.5 Plan.

## *Analyses in receptor modeling that use input from regional modeling*

The receptor modeling analysis uses a modified projection of nitrate particulate formation from nitrogen oxides based upon results of regional modeling. The atmospheric chemistry associated with nitrate particulate formation has been determined to be nonlinear; while the default procedures for speciated rollback modeling assume a linear relationship. This adjustment has been demonstrated as effective in producing reliable atmospheric projections for the prior PM10 Plans.

## *Extension by additional analysis*

Additional evaluations were added to results of the receptor modeling performed for the 2008 PM2.5 Plan. Calculations determine the observed micrograms per ton of emission for each contributing source category that can be resolved by chemical mass balance modeling methods. These ten categories allow differentiation of industrial direct emissions of organic and elemental carbon from other sources that emit elemental and organic carbon. The interpollutant calculation is developed as an addition to the receptor analysis by calculating the ratio of emissions per ton of directly emitted industrial PM2.5 to the per ton ratio of secondary particulate formed from NOx and SOx emissions. Summary tables and issue and documentation discussion was added to the analysis.

## *Strengths*

Receptor modeling provides the ability to separately project the effect of different key sources contributing to carbon and organic carbon. This is critical for establishing the atmospheric relationship between industrial emissions and the observed concentrations due to industrial emissions. Regional modeling methods at this time do not support differentiation of vegetative and motor vehicle carbon contribution from the emissions form industrial sources. The area of influence of contributing sources was also considered as a factor with the methods developed by the District to incorporate the gridded footprint of contributing sources into the receptor analysis. While regional

models use gridded emissions, current regional modeling methods do not reveal the resulting area of influence of contributing sources.

### *Limitations*

Receptor modeling uses linear projections for future years and cannot account for equilibrium limitations that would occur if a key reaction became limited by reduced availability of a critical precursor due to emission reductions. The regional model was used to investigate this concern and did not project any unexpected changes due to precursor limitations.

# Analyses contained in Regional modeling

## *Factors Considered*

The analysis file includes the daily modeling output representing modeled values for the base year 2005 and predicted values for 2014 for each of the eleven Valley sites that have monitoring data for evaluation of the models performance in predicting observed conditions. These sites are located in seven of the eight Valley counties. Madera County does not have monitoring site data for this comparison.

Modeling data for all quarters of the year was provided. Due to the higher values that occur due to stagnation events in the fourth quarter, both industrial carbon concentrations and secondary particulates forming from gases are highest in the fourth quarter. Evaluating the interpollutant ratio for other quarters would be less reliable and of less significance to assisting in the reduction of high particulate concentrations. Modeling for lower values has higher uncertainty. Modeling atmospheric ratios when the air quality standard is being met are axiomatically not of value to determining offset requirements intended to assist in achieving compliance with the air quality standard. However, for consistency of analysis between sites, days when the standard was being met during the fourth quarter were not excluded from the interpollutant ratio analysis. Bakersfield fourth quarter modeled data included only eight days that were at or below the standard. Fresno and Visalia sites averaged twelve days; northern sites 24 days and the County of Kings 38 days.

Modeling output provided data for both 2005 and 2014. While there is substantial emissions change projected for this period, the regional modeling evaluation does not project much change in the atmospheric ratios of directly emitted pollutants and secondary pollutants from precursor gases. This indicates that the equilibrium processes are not expected to encounter dramatic change due to limitation of reactions by scarcity of one of the reactants. This further justifies using the receptor evaluation determining the interpollutant ratio for 2009 through the year 2014 without further adjustment. If observed air quality data demonstrates a radical shift in chemistry or components during the next few years, such a change could indicate that a limiting reaction has been reached that was not projected by the model and such radical changes might require reassessment of the conclusion that the ratio should remain unchanged through 2014.

## *Extension by additional analysis*

Regional modeling results prepared for the 2008 PM2.5 Plan were analyzed to extract fourth quarter data for all sites. The atmospheric chemistry for all counties was analyzed for consistency and variation. This analysis provided a determination that the secondary formation chemistry and component sources contributing to concentrations observed in the north fell within the range of values similarly determined for the southern four counties. Based upon examination of the components and chemistry, the

northern counties would be expected to have an interpollutant ratio value less than the ratio determined for Kern County but greater than the one for Tulare County. This establishes that the interpollutant ratio determined by receptor analysis of the southern four counties provides a value that is also sufficiently protective for the north.

### *Strengths*

Regional models provide equilibrium based evaluations of particulate formed from precursor gases and provide a regional assessment that covers the entire Valley. The projection of particulate formed in future years is more reliable than linear methods used for receptor modeling projections.

### *Limitations*

The regional model does not provide an ability to focus on industrial organic carbon emissions separate from other carbon sources such as motor vehicles, residential wood smoke, cooking and vegetative burning. Regional modeling does not provide an assessment method for determination of sources contributing at each site or the area of influence of contributing emissions. Receptor analysis provides a more focused tool for this aspect of the evaluation.

# Results and Documentation

## SJVAPCD Interpollutant Ratio Results

**SOx for PM ratio: 1.000 ton of SOx per ton of PM**

**NOx for PM ratio: 2.629 tons of NOx per ton of PM**

**These ratios do not include adjustments for other regulatory requirements specified in provisions of District Rule 2201.**

The results of the modeling analysis developed an atmospheric interpollutant ratio for NOx to PM of 2.629 tons of NOx per ton of PM. This result was the most stringent ratio from the assessment industrial carbon emissions to secondary particulates at Kern County; with Fresno, Tulare and Kings counties having a lower ratio. The assessment of chemistry from the regional model required comparison of total carbon to secondary particulates and is therefore not directly useful to establish a ratio. However, the regional model does provide an ability to compare the general atmospheric similarity and compare changes in chemistry due to Plan reductions. Evaluation revealed that the atmospheric chemistry of San Joaquin, Stanislaus and Merced counties falls within the range of urban characteristics evaluated for the southern four counties; therefore the ratio established should be sufficiently protective of the northern four counties. Additionally, comparison of future year chemistry showed minimal change in pollutant ratio due to the projected changes in the emission inventory from implementation of the Plan. The SOx ratio as modeled indicates a value of less than one to one due to the increase in mass for conversion of SOx to a particulate by combination with other atmospheric compounds; however, the District has set guidelines that require at least one ton of an alternative pollutant for each required ton of reduction in accordance with District Rule 2201 Section 4.13.3. Therefore the SOx interpollutant ratio is established as 1.000 ton of SOx per ton of PM. These ratios do not include adjustments for other regulatory considerations, such as other provisions of District Rule 2201.

A guide to the key technical topics and the reference material relevant to that topic is found on the next page. References from the 2008 PM2.5 Plan may be obtained by requesting a copy of that document and its appendices or by downloading the document from http://www.valleyair.org/Air_Quality_Plans/AQ_Final_Adopted_PM25_2008.htm. References in Italics are spreadsheets included in the interpollutant analysis file "09 Interpollutant Ratio Final 032909.xls" which includes 36 worksheets of receptor modeling information from the 2008 PM2.5 Plan, 11 modified and additional spreadsheets for this analysis and two spreadsheets of regional model daily output. This file is generally formatted for printing with the exception of the two spreadsheets containing the regional model output "*Model-Daily Annual*" and "*Model-Daily Q4*" which are over 300 pages of raw unformatted model output files. The remainder of the file is formatted to print at approximately 100 pages. This file will be made available on request but is not currently posted for download.

# Interpollutant Ratio Issues & Documentation

| | TOPIC | Reference |
|---|---|---|
| 1 | **Reason for using PM2.5 for establishing the substitution relationship between direct emitted carbon PM and secondary nitrate and sulfate PM:** consistency of relationship between secondary particulates and industrial direct carbon combustion emissions. | 2008 PM2.5 Plan, Sections 3.3.2 through 3.4.2 |
| 2 | **Reason for using 4th Quarter analysis:** Highest PM2.5 for all sites. | *DV Qtrs* |
| 3 | **Reason for using analysis of southern SJV sites to apply to regional interpollutant ratio:** Northern site chemistry ratios are within the range of southern SJV ratios. Peak ratio will be protective for all SJV counties. | *Q4 Model Pivot, Model-site chem, Model-Daily Q4* |
| 4 | **Reason for using combined results of receptor and regional model:** Receptor model provides breakdown of different carbon sources to isolate connection between industrial emissions and secondary PM. | 2008 PM2.5 Plan, Appendix F |
| | Regional model provides atmospheric information concerning the northern SJV not available from receptor analysis. | 2008 PM2.5 Plan, Appendix G |
| 5 | **Most significant contributions of receptor evaluation:** Separation of industrial emissions from other source types. Area of influence evaluation for contributing sources. | 2008 PM2.5 Plan, Appendix F |
| 6 | **Most significant contributions of regional model:** Scientific equilibrium methods for atmospheric chemistry projections for 2014. Receptor technique is limited to linear methods. | 2008 PM2.5 Plan, Appendix G |
| 7 | **Common area of influence adjustments used for all receptor evaluations:** Geologic & Construction, Tire and Brake Wear, Vegetative Burning - contribution extends from more than just the urban area (L2) | Modeling evaluation by J. W. Sweet February 2009 Reflected in *IPR* County *2000-2009* worksheets |
| | Mobile exhaust (primary), Organic Carbon (Industrial) primary, Unassigned - contribution extends from more than larger area, subregional (L3) | |
| | Secondary particulates from carbon sources are dominated by the local area with some contribution from the surrounding area (average of L1 and L2) | |
| | Marine emissions not found present in CMB modeling for this analysis. | |
| 8 | **Variations to reflect secondary area of influence specific to location:** Fresno: Evaluation shows extremely strong urban signature (L1) for secondary sources<br>Kern: Evaluation shows a strong urban signature mixed with emissions from the surrounding industrial areas (average L1 and L2) for both carbon and secondary sources<br>Kings and Tulare: Prior evaluation has show a shared metropolitan contribution area (L2) | Modeling evaluation by J. W. Sweet February 2009 Reflected in *IPR* County *2000-2009* worksheets |
| 9 | **Reasons for using 2009 Interpollutant Ratio Projection:** 2009 Interpollutant ratio is consistent with current emissions inventories | 2008 PM2.5 Plan |
| | Regional modeling does not show a significant change in chemical relationships through 2014. | *Q4 Model Pivot* |
| 10 | **Reason for using SOx Interpollutant Ratio at 1.000:** A minimum offset ratio is established as 1.000 to 1.000 consistent with prior District policy and procedure for interpollutant offsets. | District Rule 2201 Section 4.13.3 |

# ATTACHMENT I

***Additional Supplemental Information***

Table 3.2-2. UNCONTROLLED EMISSION FACTORS FOR 4-STROKE LEAN-BURN ENGINES[a]
(SCC 2-02-002-54)

| Pollutant | Emission Factor (lb/MMBtu)[b] (fuel input) | Emission Factor Rating |
|---|---|---|
| Criteria Pollutants and Greenhouse Gases | | |
| $NO_x$[c] 90 - 105% Load | 4.08 E+00 | B |
| $NO_x$[c] <90% Load | 8.47 E-01 | B |
| CO[c] 90 - 105% Load | 3.17 E-01 | C |
| CO[c] <90% Load | 5.57 E-01 | B |
| $CO_2$[d] | 1.10 E+02 | A |
| $SO_2$[e] | 5.88 E-04 | A |
| TOC[f] | 1.47 E+00 | A |
| Methane[g] | 1.25 E+00 | C |
| VOC[h] | 1.18 E-01 | C |
| PM10 (filterable)[i] | 7.71 E-05 | D |
| PM2.5 (filterable)[i] | 7.71 E-05 | D |
| PM Condensable[j] | 9.91 E-03 | D |
| Trace Organic Compounds | | |
| 1,1,2,2-Tetrachloroethane[k] | <4.00 E-05 | E |
| 1,1,2-Trichloroethane[k] | <3.18 E-05 | E |
| 1,1-Dichloroethane | <2.36 E-05 | E |
| 1,2,3-Trimethylbenzene | 2.30 E-05 | D |
| 1,2,4-Trimethylbenzene | 1.43 E-05 | C |
| 1,2-Dichloroethane | <2.36 E-05 | E |
| 1,2-Dichloropropane | <2.69 E-05 | E |
| 1,3,5-Trimethylbenzene | 3.38 E-05 | D |
| 1,3-Butadiene[k] | 2.67E-04 | D |
| 1,3-Dichloropropene[k] | <2.64 E-05 | E |
| 2-Methylnaphthalene[k] | 3.32 E-05 | C |
| 2,2,4-Trimethylpentane[k] | 2.50 E-04 | C |
| Acenaphthene[k] | 1.25 E-06 | C |

Table 3.2-3. UNCONTROLLED EMISSION FACTORS FOR 4-STROKE RICH-BURN ENGINES[a]
(SCC 2-02-002-53)

| Pollutant | Emission Factor (lb/MMBtu)[b] (fuel input) | Emission Factor Rating |
|---|---|---|
| Criteria Pollutants and Greenhouse Gases | | |
| $NO_x$[c] 90 - 105% Load | 2.21 E+00 | A |
| $NO_x$[c] <90% Load | 2.27 E+00 | C |
| CO[c] 90 - 105% Load | 3.72 E+00 | A |
| CO[c] <90% Load | 3.51 E+00 | C |
| $CO_2$[d] | 1.10 E+02 | A |
| $SO_2$[e] | 5.88 E-04 | A |
| TOC[f] | 3.58 E-01 | C |
| Methane[g] | 2.30 E-01 | C |
| VOC[h] | 2.96 E-02 | C |
| PM10 (filterable)[i,j] | 9.50 E-03 | E |
| PM2.5 (filterable)[j] | 9.50 E-03 | E |
| PM Condensable[k] | 9.91 E-03 | E |
| Trace Organic Compounds | | |
| 1,1,2,2-Tetrachloroethane[l] | 2.53 E-05 | C |
| 1,1,2-Trichloroethane[l] | <1.53 E-05 | E |
| 1,1-Dichloroethane | <1.13 E-05 | E |
| 1,2-Dichloroethane | <1.13 E-05 | E |
| 1,2-Dichloropropane | <1.30 E-05 | E |
| 1,3-Butadiene[l] | 6.63 E-04 | D |
| 1,3-Dichloropropene[l] | <1.27 E-05 | E |
| Acetaldehyde[l,m] | 2.79 E-03 | C |
| Acrolein[l,m] | 2.63 E-03 | C |
| Benzene[l] | 1.58 E-03 | B |
| Butyr/isobutyraldehyde | 4.86 E-05 | D |
| Carbon Tetrachloride[l] | <1.77 E-05 | E |

btu=>ppm

| | SELECTION # |
|---|---|
| COAL (ANTHRACITE) | 0 |
| COAL (BITUMINOUS) | 1 |
| COAL (LIGNITE) | 2 |
| OIL (CRUDE, RESIDUAL, OR DISTILLATE) | 3 |
| GAS (NATURAL) | 4 |
| GAS (PROPANE) | 5 |
| GAS (BUTANE) | 6 |
| WOOD | 7 |
| WOOD BARK | 8 |
| MUNICIPAL SOLID WASTE | 9 |

| STANDARD O2 CORRECTION FOR EXTERNAL COMBUSTION IS 3% | | |
|---|---|---|
| Type of fuel (use table above) | 4 | GAS |
| O2 correction (i.e., 3%) | 15 | % |
| Enter LB/MMBTU emission factor | | |
| NOx | 0.847 | LB/MMBTU |
| CO | 0.130 | LB/MMBTU |
| VOC (as methane) | 0.000 | LB/MMBTU |

| CALCULATED EQUIVALENT CONCENTRATIONS | | |
|---|---|---|
| NOx | 229.94 | ppmv |
| CO | 57.98 | ppmv |
| VOC (as methane) | 0.00 | ppmv |

| pV = R*T | | |
|---|---|---|
| pressure (p) | 1 | atm |
| universal gas constant (R*) | 0.7302 | atm-scf/lbmole-oR |
| temperature (oF) | 60 | oF |
| calculated | | |
| molar specific volume (V) | 379.5 | scf/lbmole |
| Molecular weights | | |
| NOx | 46 | lb/lb-mole |
| CO | 28 | lb/lb-mole |
| VOC (as methane) | 16 | lb/lb-mole |

| F FACTORS FROM EPA METHOD 19 @ 68 F | | |
|---|---|---|
| COAL (ANTHRACITE) | 10100 DSCF/MMBTU | COAL |
| COAL (BITUMINOUS) | 9780 DSCF/MMBTU | COAL |
| COAL (LIGNITE) | 9860 DSCF/MMBTU | COAL |
| OIL (CRUDE, RESIDUAL, OR DISTILLATE) | 9160 DSCF/MMBTU | OIL |
| GAS (NATURAL) | 8710 DSCF/MMBTU | GAS |
| GAS (PROPANE) | 8710 DSCF/MMBTU | GAS |
| GAS (BUTANE) | 8710 DSCF/MMBTU | GAS |
| WOOD | 9240 DSCF/MMBTU | WOOD |
| WOOD BARK | 9600 DSCF/MMBTU | WOOD BARK |
| MUNICIPAL SOLID WASTE | 9570 DSCF/MMBTU | SOLID WASTE |
| F FACTOR USED IN CALCULATIONS | 8710 DSCF/MMBTU | GAS |

## Parts Per Million-Volume -> Grams/Brake Horsepower-Hour

### ppmv -> g/bhp-hr

**Variables:**

| | | |
|---|---|---|
| Engine Size: | 860 | hp |
| $NO_x$: | 230 | ppmv |
| CO: | 0 | ppmv |
| VOC: | 0 | ppmv (as $CH_4$) |
| $O_2$ level: | 15 | % |
| Engine Efficiency: | 35 | % (Assumed) |
| F-factor: | 8578 | dscf/MMBtu |
| Fuel Type | 1 | |

| | |
|---|---|
| OIL (CRUDE, RESIDUAL, OR DISTILLATE) | 0 |
| GAS (NATURAL) | 1 |
| GAS (PROPANE) | 2 |
| GAS (BUTANE) | 3 |

**Given:**

| | | |
|---|---|---|
| Conversion #1: | 379.5 | dscf/lb-mol |
| Conversion #2: | 393.24 | bhp-hr/MMBtu |
| Conversion #3: | 453.59 | g/lb |
| MW(NOx): | 46 | as $NO_2$ |
| MW(co): | 28 | |
| MW(voc): | 16 | as $CH_4$ |
| $O_2$ Correction: | 15 | |
| Pressure (p) | 1 | atm |
| Temp (°F) | 60 | °F |

**Formula:**

$$\frac{ppmv}{1} \times \frac{F\text{-factor}}{1} \times \frac{MW_{pollutant}}{1} \times \frac{20.9}{(20.9 - O_2\%)} \times \frac{1}{\text{Conversion \#1}} \times \frac{1}{\text{Conversion \#2}} \times \frac{\text{Conversion \#3}}{1} \times \frac{1}{\text{Engine Eff.}} =$$

**for NO:**

$$\Rightarrow \frac{230 \text{ parts}}{10^6 \text{ parts}} \times \frac{8578 \text{ dscf}}{\text{MMBtu}} \times \frac{46 \text{ lb}}{1 \text{ lb-mol}} \times \frac{20.9}{20.9 - 15} \times \frac{1 \text{ lb-mol}}{379.5 \text{ dscf}} \times \frac{\text{MMBtu}}{393.24 \text{ bhp-hr}} \times \frac{453.59 \text{ g}}{\text{lb}} \times \frac{1}{35\%} =$$

$= 2750 \text{ g/bhp-hr} \quad 2365 \text{ g/hr} \quad 5.21465 \text{ lbs/hr} \quad 125 \text{ lbs/day}$

**for CO:**

$$\Rightarrow \frac{0 \text{ parts}}{10^6 \text{ parts}} \times \frac{8578 \text{ dscf}}{\text{MMBtu}} \times \frac{28 \text{ lb}}{1 \text{ lb-mol}} \times \frac{20.9}{20.9 - 15} \times \frac{1 \text{ lb-mol}}{379.5 \text{ dscf}} \times \frac{\text{MMBtu}}{393.24 \text{ bhp-hr}} \times \frac{453.59 \text{ g}}{\text{lb}} \times \frac{1}{35\%} =$$

$= 0.000 \text{ g/bhp-hr} \quad 0 \text{ g/hr} \quad 0 \text{ lbs/hr} \quad 0 \text{ lbs/day}$

**for VOC:**

$$\Rightarrow \frac{0 \text{ parts}}{10^6 \text{ parts}} \times \frac{8578 \text{ dscf}}{\text{MMBtu}} \times \frac{16 \text{ lb}}{1 \text{ lb-mol}} \times \frac{20.9}{20.9 - 15} \times \frac{1 \text{ lb-mol}}{379.5 \text{ dscf}} \times \frac{\text{MMBtu}}{393.24 \text{ bhp-hr}} \times \frac{453.59 \text{ g}}{\text{lb}} \times \frac{1}{35\%} =$$

$= 0.000 \text{ g/bhp-hr} \quad 0 \text{ g/hr} \quad 0 \text{ lbs/hr} \quad 0 \text{ lbs/day}$

btu=>ppm

| | SELECTION # |
|---|---|
| COAL (ANTHRACITE) | 0 |
| COAL (BITUMINOUS) | 1 |
| COAL (LIGNITE) | 2 |
| OIL (CRUDE, RESIDUAL, OR DISTILLATE) | 3 |
| GAS (NATURAL) | 4 |
| GAS (PROPANE) | 5 |
| GAS (BUTANE) | 6 |
| WOOD | 7 |
| WOOD BARK | 8 |
| MUNICIPAL SOLID WASTE | 9 |

| STANDARD O2 CORRECTION FOR EXTERNAL COMBUSTION IS 3% | |
|---|---|
| Type of fuel (use table above) | 4 GAS |
| O2 correction (i.e., 3%) | 15 % |
| Enter LB/MMBTU emission factor | |
| NOx | 2.270 LB/MMBTU |
| CO | 0.130 LB/MMBTU |
| VOC (as methane) | 0.000 LB/MMBTU |

| CALCULATED EQUIVALENT CONCENTRATIONS | |
|---|---|
| NOx | 616.25 ppmv |
| CO | 57.98 ppmv |
| VOC (as methane) | 0.00 ppmv |

| pV = R*T | | |
|---|---|---|
| pressure (p) | 1 | atm |
| universal gas constant (R*) | 0.7302 | atm-scf/lbmole-oR |
| temperature (oF) | 60 | oF |
| calculated | | |
| molar specific volume (V) | 379.5 | scf/lbmole |
| Molecular weights | | |
| NOx | 46 | lb/lb-mole |
| CO | 28 | lb/lb-mole |
| VOC (as methane) | 16 | lb/lb-mole |

| F FACTORS FROM EPA METHOD 19 @ 68 F | | |
|---|---|---|
| COAL (ANTHRACITE) | 10100 DSCF/MMBTU | COAL |
| COAL (BITUMINOUS) | 9780 DSCF/MMBTU | COAL |
| COAL (LIGNITE) | 9860 DSCF/MMBTU | COAL |
| OIL (CRUDE, RESIDUAL, OR DISTILLATE) | 9160 DSCF/MMBTU | OIL |
| GAS (NATURAL) | 8710 DSCF/MMBTU | GAS |
| GAS (PROPANE) | 8710 DSCF/MMBTU | GAS |
| GAS (BUTANE) | 8710 DSCF/MMBTU | GAS |
| WOOD | 9240 DSCF/MMBTU | WOOD |
| WOOD BARK | 9600 DSCF/MMBTU | WOOD BARK |
| MUNICIPAL SOLID WASTE | 9570 DSCF/MMBTU | SOLID WASTE |
| F FACTOR USED IN CALCULATIONS | 8710 DSCF/MMBTU | GAS |

## Parts Per Million Volume -> Grams/Brake Horsepower - Hour

### ppmv -> g/bhp-hr

**Variables:**

| | | |
|---|---|---|
| Engine Size: | 860 | hp |
| $NO_x$: | 616 | ppmv |
| CO: | 0 | ppmv |
| VOC: | 0 | ppmv (as $CH_4$) |
| $O_2$ level: | 15 | % |
| Engine Efficiency: | 35 | % (Assumed) |
| F-factor: | 8578 | dscf/MMBtu |
| Fuel Type | 1 | |

| | |
|---|---|
| OIL (CRUDE, RESIDUAL, OR DISTILLATE) | 0 |
| GAS (NATURAL) | 1 |
| GAS (PROPANE) | 2 |
| GAS (BUTANE) | 3 |

**Given:**

| | | |
|---|---|---|
| Conversion #1: | 379.5 | dscf/lb-mol |
| Conversion #2: | 393.24 | bhp-hr/MMBtu |
| Conversion #3: | 453.59 | g/lb |
| MW(NOx): | 46 | as $NO_2$ |
| MW(co): | 28 | |
| MW(voc): | 16 | as $CH_4$ |
| $O_2$ Correction: | 20.9 | |
| Pressure (p) | 1 | atm |
| Temp (°F) | 60 | °F |

**Formula:**

$$\frac{ppmv \times F\text{-factor} \times MW_{pollutant} \times 20.9 \times 1 \times 1 \times Conversion\ \#3 \times 1}{10^6 \times 1 \times 1 \times (20.9 - O_2\%) \times Conversion\ \#1 \times Conversion\ \#2 \times 1 \times Engine\ Eff.} =$$

**for $NO_x$:**

$$\frac{616\ \text{parts} \times 8578\ \text{dscf} \times 46\ \text{lb} \times 20.9 \times 1\ \text{lb-mol} \times \text{MMBtu} \times 453.59\ \text{g} \times 1}{10^6\ \text{parts} \times \text{MMBtu} \times 1\ \text{lb-mol} \times (20.9 - 15) \times 379.5\ \text{dscf} \times 393.24\ \text{bhp-hr} \times \text{lb} \times 35\%} =$$

| | | | | | |
|---|---|---|---|---|---|
| 7.365 g/bhp-hr | 6334 g/hr | 13.9662 lbs/hr | 335 | lbs/day | |

**for CO:**

$$\frac{0\ \text{parts} \times 8578\ \text{dscf} \times 28\ \text{lb} \times 20.9 \times \text{lb} \times \text{MMBtu} \times 453.59\ \text{g} \times 1}{10^6\ \text{parts} \times \text{MMBtu} \times 1\ \text{lb-mol} \times (20.9 - 15) \times 379.5\ \text{dscf} \times 393.24\ \text{bhp-hr} \times \text{lb} \times 35\%} =$$

| | | | | | |
|---|---|---|---|---|---|
| 0.000 g/bhp-hr | 0 g/hr | 0 lbs/hr | 0 | lbs/day | |

**for VOC:**

$$\frac{0\ \text{parts} \times 8578\ \text{dscf} \times 16\ \text{lb} \times 20.9 \times \text{lb} \times \text{MMBtu} \times 453.59\ \text{g} \times 1}{10^6\ \text{parts} \times \text{MMBtu} \times 1\ \text{lb-mol} \times (20.9 - 15) \times 379.5\ \text{dscf} \times 393.24\ \text{bhp-hr} \times \text{lb} \times 35\%} =$$

| | | | | | |
|---|---|---|---|---|---|
| 0.000 g/bhp-hr | 0 g/hr | 0 lbs/hr | 0 | lbs/day | |

Avenal Power Center, LLC
500 Dallas Street, Level 31
Houston, TX 77002

RECEIVED
JUL 0 3 2008
Permits Srvc
S.IVAPCD

COPY

July 1, 2008

RE: Certification of Avenal Energy, owned by Avenal Power Center, LLC

I, Stuart Zisman, on behalf of Avenal Power Center, LLC, hereby certify under penalty of perjury as follows:

1. I am authorized to make this certification on behalf of Avenal Power Center, LLC.
2. This certification is made pursuant to Section 4.15.2 of Rule 2201 of the Rules and Regulations of the San Joaquin Valley Unified Air Pollution Control District.
3. To the best of the undersigned's knowledge, relative to Section 4.15.2 of District Rule 2201, Avenal Power Center, LLC. does not currently own, operate or control any Major Stationary Source or federal major modification in the State of California other than the proposed Avenal Energy Project.

Each of the statements herein is made in good faith. Accordingly, it is Avenal Power Center, LLC's understanding in submitting this certification that the SJVUAPCD shall take no action against Avenal Power Center, LLC or any of its employees based on any statement made in this certification.

Stuart Zisman
Vice President
Avenal Power Center, LLC

7/1/08
Dated

Joseph Forbes
Senior Lawyer

# ATTACHMENT J

## *EPA Comments and District Responses*

## EPA Comments / District Response

The comments (from Gerardo Rios) regarding the Preliminary Determination of Compliance for Avenal Power Center LLC (District facility C-3953) is encapsulated below followed by the District's response.

**EPA Comments – Letters Dated September 13, 2010**

**EPA Comment #1:**

Applicable federal requirements include thresholds for defining a major source of criteria pollutant emissions. For those sources where emission estimates and/or emission limits are relatively close to the federal thresholds, EPA encourages the following: (a) refinement of emissions and compliance demonstration methods that would ensure the thresholds would not be exceeded, and/or (b) a 5-10% buffer between the permitted emission limits and the federal threshold.

The proposed annual NOx emission and CO emission limits are within a margin of less than 5% of the federal annual threshold limit for defining a new major stationary source under the Federal Prevention of Significant Deterioration (PSD) permit program. The threshold is 100 tons per year (tpy) each. If the limits of these pollutants are relaxed, the facility may be subject to the applicable federal requirements, such as the Federal Prevention of Significant Deterioration (PSD) permitting program (See 40 CFR Part 52.21 (r)(4)).

**District's Response:**

*The permitted emissions from this facility are below PSD thresholds. The facility's $NO_X$ and CO emissions limits are included as permit conditions on the PDOC. The facility is also required to maintain records to demonstrate that they do not exceed these emission limits.*

*In addition, emissions from the turbine units are monitored with a CEMS system. The CEMS system continuously monitors the emissions from the turbine units and reports any exceedance of the permitted emissions rates to the District. These notifications are received on a daily basis. The emissions from the turbine units are also required to be compiled on a daily basis. The monitoring and reporting requirements in the PDOC are more than sufficient to assure compliance with the annual emissions limitations. No changes are being made to address this comment.*

**EPA Comment #2:**

In the "General Calculations" section (See PDOC Page 27, Section VII. C. 5), the District compares the annual emission estimates for regulated pollutants to the major source threshold to determine whether a pollutant is subject to major source requirements for $NO_X$, CO, VOC, $PM_{10}$, and $SO_X$ emissions. However,

$PM_{2.5}$, which also is a regulated pollutant, is not included. On May 8, 2008 EPA finalized regulations to implement the NSR program for $PM_{2.5}$. A source that emits or has the potential to emit 100 tpy or more PM2.5 in a nonattainment area is defined as a major stationary source. (Reference 40 CFR Part 51, Appendix S.) We recommend the District include in its evaluation the $PM_{2.5}$ emission estimates with a comparison to the federal nonattainment major source threshold of 100 tpy (or 200,000 pounds per year).

**District's Response:**

*The potential emissions of $PM_{10}$ from the facility are 161,552 lb-$PM_{10}$/year (Calculated in the PDOC). Using the conservative assumption that all $PM_{10}$ is $PM_{2.5}$, it is clear that the $PM_{2.5}$ emissions from this facility will not exceed the major source threshold of 100 tons/year. However, to avoid any confusion, the District will revise the PDOC to discuss the potential emissions of $PM_{2.5}$ from this operation.*

**EPA Comment #3:**

The proposed annual emissions (calculated on a twelve consecutive month rolling basis) from the facility are 198,840 pounds per year (lb/yr) $NO_X$ and 197,928 lb/year CO. (See PDOC Page 27, Section VII. C. 5) These annual emissions are equivalent to 99.4 tpy of $NO_X$ emissions and 98.9 tpy of CO emissions, both of which are relatively close to the federal PSD permit program applicability threshold of 100 tpy for each ofthese pollutants. A proposed permit condition requiring that annual emissions not exceed these levels has been added to all combustion related equipment. The condition reads as follows:

> *"Annual emissions from the facility, calculated on a twelve month rolling basis, shall not exceed any of the following limits: NOx (as N02) -198,840 lb/year; CO -197,928lb/year."*

In a review of the post-project potential to emit annual emission estimates in Sections VII.C.2.i through C.2.iv. (See PDOC Pages 16-26) for each piece of equipment, we noted that the combustion turbine operations contribute the majority of NOx and CO emissions.

Based on discussions with the District, we understand that in addition to the 12-month rolling facility NOx and CO emission limits that are equivalent to 99.4 tpy and 98.9, respectively, the District has made no other changes to the current FDOC permit conditions. These conditions include, but are not limited to, the following: continuous emissions monitoring of $NO_X$ and CO; compilation of emissions on a daily, monthly, 12 consecutive month rolling average, and annual basis; quarterly reporting of excess emissions; and acid rain (40 CFR Part 75) compliance requirements.

At this time, it appears the proposed requirements provide practically and federally enforceable conditions based on our understanding of the proposed revision. However, given that the $NO_X$ permit limit is within less than 1% of the PSD permit threshold and the CO limit is within 1.1% of the PSD permit threshold, we suggest that the District consider requiring Avenal to report more frequently emissions as the actual emissions approach or exceed 90% of the 12-consecutive month rolling average permit limit to assure the 100 tpy threshold is not exceeded.

**District's Response:**

*Emissions from the turbine units are monitored with a CEMS system. The CEMS system continuously monitors the emissions from the turbine units and reports any exceedance of the permitted emissions rates to the District. These notifications are received on a daily basis. The emissions from the turbine units are also required to be compiled on a daily basis. The monitoring and reporting requirements in the PDOC are more than sufficient to assure compliance with the annual emissions limitations. No changes are being made to address this comment.*

**EPA Comment #4:**

The District concludes on pp. 53-54 of the PDOC that the proposed project will not cause a violation of an air quality standard for NOx, and refers to Appendix G. PDOC Appendix G contains some additional detail on the air quality impact analysis for the I-hour N02 NAAQS, effective April 12, 2010, and states that "the emissions from the proposed equipment will not cause or contribute significantly to a violation of the State and National AAQS." The following are our comments specific to PDOC Appendix G:

a. SIP-Approved Rule 2201 -The District's approved SIP, in District Rule 2201, Section 4.14.1, provides that modeling used for purposes of determining whether a new or modified stationary source's emissions will cause or make worse the violation of an Ambient Air Quality Standard shall be consistent with the requirements contained in the most recent edition of EPA's "Guideline on Air Quality Models." This EPA guideline is found in 40 CFR Part 51, Appendix w. EPA recently has had occasion to review and comment on the applicant's I-hour N02 NAAQS analysis for the project in the context of the applicant's pending PSD permit application before EPA.

   We recognize that certain aspects of the project for which Avenal seeks a minor source permit vary from the project for which it seeks a PSD permit, in particular, the proposed addition of a facility-wide NOx emissions limit of the equivalent of approximately 99.4 tons per year (tpy) to the minor source permit. However, given that the equipment emitting NOx from the

two projects has the same permitted hourly emission rates, many of the comments EPA made concerning consistency with 40 CFR Part 51, Appendix W in reviewing the applicant's I-hour N02 NAAQS analysis for PSD purposes may be relevant to the I-hour N02 NAAQS analysis for this minor source permit as well. We have attached for your consideration our comments dated June 15, 2010 and August 12, 2010 on the I-hour N02 NAAQS analysis that Avenal submitted to EPA for PSD purposes. We would be happy to discuss any issues or questions you may have concerning these comments.

b. EPA Guidance Memorandum -We also note that EPA recently issued guidance relating to modeling for the I-hour N02 NAAQS, with a cover memorandum entitled *Guidance Concerning Implementation of the 1-hour N02 NAAQS for the Prevention of Significant Deterioration Program,* dated June 29, 2010, that included two attached guidance documents, one of which was entitled *Applicability of Appendix W Modeling Guidance for the 1-hour N02 National Ambient Air Quality Standard,* dated June 28, 2010. We understand that the District is aware of this guidance, and we encourage the District to refer to this guidance for further detail on this subject.

c. Assumptions and Decision-making Process -The District's rationale in Appendix G for its conclusion that the project's emissions will not cause or contribute significantly to a violation of the I-hour N02 NAAQS is not clear from the documents provided. For example, the table addressing "Operational" scenarios on page 2 of Appendix G indicates that Tier 1 and Tier 2 impacts are each greater than the N02 NAAQS limit, while Tier III and Tier IV impacts are each below the N02 NAAQS limit. Furthermore, it is unclear how the modeling analysis meets the requirements of Appendix W (See Comment 4.a.) or whether the District intended to follow those requirements for the proposed permit revision. We recommend that the District provide a discussion of which Tier the District is relying upon to support its conclusion, the basis for selecting that Tier, and the modeling inputs, assumptions, etc. for that Tier.

**District's Response:**

a. *The District has reviewed your comments dated June 15, 2010 and August 12, 2010 on the 1-hour N02 NAAQS analysis that Avenal submitted to EPA for PSD purposes, and has no comments at this time. We did not use Avenal Power's analysis to make determinations of NAAQS impacts, but used our own guidance to perform the NO2 modeling (please see responses below).*
b. *The District has reviewed the documents stated above and developed a modeling guidance to address EPA's memos that were provided to the modelers at EPA Region 9. The District is currently waiting for EPA's*

*response to this guidance, and is, in fact, working with EPA, ARB, and CAPCOA on developing statewide policy on how to implement our guidance, or something similar. The Avenal Power project was analyzed under this guidance, and the project was approved under Tier III of that guidance.*

c. *The District uses a tiered approach when determining compliance with any NAAQS. This approach is similar to that required by OAQPS in their memos which require that each progressively more accurate tier be used (Tier I-Complete Conversion, Tier II-NO2 Ration and Tier III-OLM) until compliance is demonstrated. This project was approved under Tier III. We believe our guidance is consistence with EPA modeling practices and direction, and as we have stated above, we are patiently awaiting EPA's input on our guidance.*

**EPA Comment #5, Joint letter to District and Avenal Power Center, LLC:**

Avenal Power Center, LLC (Avenal) recently applied for a minor source New Source Review (NSR) permit from the San Joaquin Valley Pollution Control District (SJVAPCD or District) for the Avenal Energy Project. This permit seeks authority to construct the project with emissions limits below the major source thresholds triggering Clean Air Act (CAA) prevention of significant deterioration (PSD) preconstruction review. On July 28, 2010, SJVAPCD's public notice announcing its Preliminary Determination of Compliance for this minor source permit application was published in the Fresno Bee, triggering a public review and comment period for the proposed permit.

Concurrently, Avenal is seeking a PSD permit from EPA Region 9 for essentially the same project, but with greater emissions exceeding the major source threshold and thereby triggering PSD preconstruction review. The applicant's simultaneous application for both a minor source permit and a major souce PSD permit for the project raises a potential concern about circumvention of PSD preconstruction requirements.

EPA guidance on this subject states:

> Parts C and D of the Clean Air Act exhibit Congress's clear intent that new major sources of air pollution be subject to preconstruction review. The purposes for these programs cannot be served without this essential element. Therefore, attempts to expedite construction by securing minor source status through receipt of operational restrictions from which the source intends to free itself shortly after operation are to be treated as circumvention of the preconstruction review requirements... If a major source or major modification permit application is filed simultaneously with or at approximately the same time as the minor source construction permit, this is strong evidence of an intent to circumvent the requirements of preconstruction review.

*Guidance on Limiting Potential to Emit in New Source Permitting,* Terrell E. Hunt and John S. Seitz, dated June 13, 1989, at pp. 13-14.

We recommend that the applicant carefully review the guidance quoted above and other applicable EPA guidance on this topic prior to commencing construction of the project under the minor source permit, should that permit be finalized by the SJVAPCD.

**District's Response:**

*The District disagrees that if Avenal were to construct under a California Energy Commission license that incorporates this minor source Determination of Compliance (DOC), it would be circumvention of the PSD preconstruction review.*

*Circumvention might occur if a source obtained a minor source permit and soon thereafter sought a PSD permit due to a small increase in emissions, and not as a new source. In this case, Avenal has applied for a PSD permit as a new source. If they construct as a minor source and don't receive a PSD permit, they will have to continue to comply with the minor source limits. However, constructing as a minor source and then obtaining a PSD permit as a new major source and operating in accordance with that PSD permit cannot be viewed as circumvention. Therefore, the EPA process, not the District's minor source permitting process, will determine whether circumvention will occur, and circumvention will not occur if EPA requires a PSD permit if Avenal pursues a permit with emissions above the PSD triggers.*

# ATTACHMENT K

***Green Action Comments and District Responses***

## Greenaction Comments / District Response

The comments (from Bradley Angel) regarding the Preliminary Determination of Compliance for Avenal Power Center LLC (District facility C-3953) is encapsulated below followed by the District's response.

**Greenaction Comments – Letter Dated September 11, 2010**

**Greenaction Comment #1:**

The Air District failed to conduct a proper and thorough public notice and public participation process. The failure to conduct proper notice and participation processes to the mostly low-income, Latino and Spanish-speaking residents of the nearest communities (Avenal, Huron and Kettleman City) violated the Air District's own environmental justice policy. The Air District's claim that you met your agency's required notice and participation mandates is insufficient as your own environmental justice policy commits the agency to uphold environmental justice.

Failing to notify residents or their organizations, failing to hold a public hearing and failing to provide Spanish-speaking residents equal time to comment as English speakers is a violation of environmental justice and civil rights policies and laws.

We are surprised and disappointed that the Air District would only translate information into Spanish following concerns being raised by Greenaction, and after the comment period already began. On August 20, 2010, we received an email from Dave Warner of the Air District that stated:

> Bradley,
>
> The San Joaquin Valley Air Pollution Control District will prepare aSpanish translation of a summary of the District's preliminary decision to issue a Determination of Compliance on the Avenal Power Center. This document should be available late on Monday, and we will post it on our Spanish-language link on our District website, at http://www.valleyair.org/General_info/SpanishHmong_Resources.htm

As this email was sent one week into the revised comment period, and as Spanish-speakers had not yet had the opportunity to read information in Spanish, this shows that there has been an unequal opportunity to comment that is improper.

The Air District's notice was inadequate for all of the affected public. No resident or organization representing residents received notice. We only learned of the original comment period from US EPA after it already had begun.

The Air District published a "Notice" in the Fresno Bee, but not in any Kings County or Spanish-language paper.

Even after meeting with the Air District on August 30, 2010 to raise all these concerns, the Air District refused to hold a public hearing, provide proper notice or provide equal opportunities to the Spanish-speaking residents who comprise a major percentage of residents of Avenal, Kettleman City and Huron.

Due to the discriminatory and disproportionate impact on low-income, Latino and Spanish-speakers of the lack of notice and full public participation notice for a project that would emit pollutants into an already over-polluted area, the Air District has violated its own environmental justice policy as well as California Government Code section 11135 and Title VI of the US Civil Rights Act of 1964.

**District's Response:**

*The District complied with all applicable regulatory public noticing requirements with respect to the Avenal Power Center Preliminary Determination of Compliance (PDOC) and in fact took considerable actions that went far beyond statutory requirements. The District properly published notice of the proposed issuance of the PDOC in a newspaper of general circulation, in this case, the Fresno Bee whose distribution does cover the area in question. This notice was published according to our federally approved Rule 2201, which defines the timing and process of such notices. There is no additional direction on public noticing in the District's Environmental Justice Strategy document, contrary to the commenter's claims.*

*However, we went far beyond our required notification processes for this project, as follows:*

1. *We published this notice, as we do all public notices, on the District's website, valleyair.org. This is not required by any rule or regulation, but is part of our continuing effort to make information available and accessible.*

2. *Upon hearing on August 16 of the commenter's concern that he was not notified of the District proposal to issue a DOC, we promptly, on August 18, notified him that we would extend the public noticing period for him and his clients a full additional 30 days from the date that he heard about our proposal. This was not required, since the commenter had not requested that he be informed of our actions on this project, and therefore he was not on record as an interested party. However, in the interests of providing the maximum reasonable opportunity for comment, we offered this accommodation.*

3. *Upon receiving the commenter's subsequent August 19 request for bilingual information on the project, and a public hearing, on August 20 we sent the commenter the following email, from which he quoted an excerpt above. We are providing it in full, below, as it explains our response in some additional detail that was missing from the commenter's excerpt:*

> *Bradley,*
>
> *The San Joaquin Valley Air Pollution Control District will prepare aSpanish translation of a summary of the District's preliminary decision to issue a Determination of Compliance on the Avenal Power Center. This document should be available late on Monday, and we will post it on our Spanish-language link on our District website, at http://www.valleyair.org/General_info/SpanishHmong_Resources.htm*
>
> *We would welcome your assistance in distributing it to your Spanish-speaking clients and associates. We will also be pleased to accept comments in Spanish as we have translation capabilities here at the District. As you are aware, we have already extended the public comment period to September 13, 2010, and we believe the above steps will provide you and your Spanish speaking associates ample opportunity to provide comment on our proposal.*
>
> *I just want to make sure you understand the status of this project atthis time as it pertains to the District. The District is taking public comment on a Preliminary Determination of Compliance, which is a recommendation to the California Energy Commission (CEC) that the project will comply with District regulations. We are not aware of any requirement that we hold a meeting for the purpose of receiving verbal comments.*
>
> *We are not going to hold a public hearing on this project at this time. Ours is not a final permitting decision and there is no hearing process associated with it - the CEC has the sole power plant licensing authority in the state of California for power plants over 50 megawatts. They conduct any necessary public hearings associated with such a license. Our action is a certification to the CEC that, if granted, CEC's license would meet our air quality requirements. CEC is able to accept or reject our proposed conditions of approval, or can make air quality permitting decisions contrary to our determination of compliance. In addition, the CEC makes all determinations regarding power plant siting.*

*Finally, contrary to your contention below, the District is not required to hold a public hearing, by rule or by policy We believe the process described above will assure an efficient, fair, and productive public comment process.*

*Dave Warner*
*Director of Permit Services*
*San Joaquin Valley APCD*

*In summary, we confirmed that we would prepare a Spanish-language summary of the project and make it available to the commenter for his outreach efforts. We also confirmed our commitment to address any comments we received in Spanish, and we explained the limitations of our role in the permitting process to provide clarity to any potential commenters. None of this was required by our rules and regulations, but was intended to provide additional opportunity for community members to participate in the process.*

4. *We then worked through the weekend to create a summary of the project, translate it to Spanish, and post it on the website the very next working day, Monday, August 23.*

5. *Next, on August 24 we agreed to meet with the commenter and any of his clients and community members on August 30. The commenter and other activist organization representatives attended the meeting, but, disappointingly, no independent community members. Again, this meeting was not required by any rule or regulation.*

6. *Finally, we granted another request from another employee of GreenAction that she be provided with an <u>additional</u> day to persuade community members of Avenal and Kettleman City to submit comments, extending the comment period to September 14, for a total public comment period of 53 days instead of the required 30 days. This provided GreenAction the opportunity to persuade community members to submit the comments summarized in the next comment section. And again, there was certainly no rule or regulation that required this accommodation.*

*In summary, contrary to the assertions of the commenter, the District not only met all legal requirements but went far beyond them in providing the public opportunities to comment on the Avenal Power Center Project.*

**<u>Greenaction Comment #2:</u>**

The claim by the company and the Air District that there would be substantially less emissions than were stated in the initial permit application dramatically conflicts with earlier information and needs extensive scrutiny including a full public environmental review. If there really would be dramatically lower emissions than first claimed, we wonder why the company did not state this

initially, raising questions as to whether the lower, newer estimate is based solely on a desire to avoid a PSD permit requirement and protracted appeals and legal battles.

**District's Response:**

*While no response is necessary, it should be noted that the proposal for lower annual emissions was only possible after rigorous analysis by Avenal Power of actual emissions data from other recently constructed similar power plants. In addition, it seems remarkable that there should be a complaint about a company committing to lower emissions from a facility, regardless of the purpose or intent of the proposal.*

**Greenaction Comment #3:**

The Air District's claim that there would be "zero impact" from the proposed power plant's emissions flies in the face of reality. A huge fossil fuel power plant, no matter how much cleaner than others of its kind, still will have pollution impacts. This "zero impact" claim ignores the fact that this would be a fossil fuel power plant that would have emissions and use fuels that contribute to climate change, would emit a broad range of pollutants, and its emissions would act cumulatively in concert with the many other pollution sources in the area.

The proposed fossil fuel power plant would be close to Kettleman City, a small low-income community of color that is suffering a horrible health crisis involving a large number of birth defects and infant deaths. Even a minor increase in emissions near this community could have severe and unforeseen health impacts due to the current health vulnerability of residents. In addition, the entire San Joaquin Valley already suffers from high rates of asthma, and if built this power plant would emit asthma-triggering pollutants.

**District's Response:**

*The District has searched the PDOC and has not been able to locate the phrase "zero impact".*

*However, the District has performed a Health Risk Assessment (HRA) as well as an Ambient Air Quality Analysis (AAQA) for this facility. The HRA was performed using the AERMOD model and Hot Spots Analysis and Reporting Program (HARP), and demonstrated that the acute and chronic hazard indices were less than 1.0 and the cancer risk was less than one in a million. Pursuant to the District's risk management policy, Policy APR 1905, TBACT is not required for any proposed emissions unit with a cancer risk less than one in one million, and chronic or acute hazard index less than 1.*

*The AAQA demonstrated that the proposed equipment will not cause a violation of an air quality standard for $NO_X$, CO, or $SO_X$. In addition, as shown in the PDOC, the calculated contribution of $PM_{10}$ will not exceed the EPA significance level. Therefore, this project will not cause or contribute significantly to a violation of the State or National AAQS.*

**Greenaction Comment #4:**

This proposed fossil fuel power plant is not needed. Many things have changed since the CPUC originally determined that the Avenal Power Center was needed. As California emerges from an economic recession, the energy landscape has changed. PG&E now has access to more electricity generation than it needs. Last summer, PG&E's territory operated with a 44% reserve margin during summer peak. This extraordinarily high margin is in part due to the CPUC's success at increasing energy efficiency and the demand decrease from the recession. These factors, along with delayed facility retirements and inflated population and energy export assumptions made by the CEC demonstrate that the 600 MWs that the Avenal Power Center would generate are no longer needed. Even PG&E has forecasted a decrease in need. In addition, several large solar projects are to be sited here, and other solar projects are already underway, providing truly clean and renewable energy instead of dirty fossil fuel energy.

Despite all this evidence, Avenal Power Center continues its push for this power plant. The pollution and health effects of this proposed facility are unacceptable when the new capacity is clearly not needed. Finally, allowing unneeded fossil fuel energy would also likely crowd out renewable projects.

**District's Response:**

*The District is not able to take the California energy landscape into account when determining if a new project will meet applicable air quality rules and regulations. This comment should be directed to the California Energy Commission.*

# ATTACHMENT L

***NRDC and CRPE Comments and District Responses***

**National Resources Defense Council (NRDC) and Center on Race, Poverty & The Environment (CRPE) Comments / District Response**

The comments (from Ingrid Brostrom and David Pettit) regarding the Preliminary Determination of Compliance for Avenal Power Center LLC (District facility C-3953) are encapsulated below followed by the District's responses.

**NRDC and CRPE Comments – Letter Dated September 13, 2010**

**NRDC and CRPE Comment #1:**

The proposed Avenal Energy project in Kings County will add hundreds of tons of air pollution per year to what is already one of the most degraded airsheds in the United States. NOx and VOCs are ozone (commonly known as "smog") precursors and fine particle (PM2.5) precursors. Both ozone and PM2.5 levels in the San Joaquin Valley constitute a public health crisis. The Environmental Working Group published the Air Resources Board's estimates that show 1,292 San Joaquin Valley residents die each year from long-term exposure to PM2.5. Ozone and PM pollution exacerbate respiratory conditions, including asthma, increase hospitalizations and emergency room visits, contribute to cardiac illnesses, and increase school and work absenteeism. The American Lung Association ranks the San Joaquin Valley counties of Kern, Tulare, and Fresno as the third, fourth, and sixth most ozone-polluted counties in the United States, respectively. For long term exposure to PM2.5, the American Lung Association ranks the San Joaquin Valley counties of Kern, Tulare, Kings, and Fresno as the first, fourth, seventh, and eighth most polluted counties. A document prepared jointly by the California Air Resources Board and the American Lung Association describes ozone as

> a powerful oxidant that can damage the respiratory tract, causing inflammation and irritation, and induces symptoms such as coughing, chest tightness, shortness of breath, and worsening of asthma symptoms. Ozone in sufficient doses increases the permeability of lung cells, rendering them more susceptible to toxins and microorganisms. The greatest risk is to those who are more active outdoors during smoggy periods, such as children, athletes, and outdoor workers. Exposure to levels of ozone above the current ambient air quality standard leads to lung inflammation and lung tissue damage, and a reduction in the amount of air inhaled into the lungs. Recent evidence has, for the first time, linked the onset of asthma to exposure of elevated ozone levels in exercising children (McConnell 2002). These levels of ozone also reduce crop and timber yields, damage native plants, and damage materials such as rubber, paints, fabric, and plastics.

The document also shows the significant health effects and costs of exposure to fine particulate matter and ozone in California. In late 2008, Jane V. Hall, Ph.D., and Victor Brajer, Ph.D., published a comprehensive analysis of the effects from not meeting the 1997 8-hour ozone standard and the 2008 PM2.5. The health

effects of not meeting these standards, and their concomitant economic values, inflict a conservative measurable cost of $5.7 billion *each year* –$1,600 per person – in the San Joaquin Valley.

**District's Response:**

*The District has demonstrated in the PDOC that the proposed facility is in compliance with all applicable $NO_X$ and VOC rules and regulations. It should be noted that these rules and regulations are among the strictest and most stringent in the nation and are designed to protect the health of the residents of the San Joaquin Valley.*

**NRDC and CRPE Comment #2:**

The June, 2009 EPA Statement of Basis And Ambient Air Quality Impact Report for a prevention of significant deterioration (PSD) permit states, at page 14, that emissions of CO and NOx from the Project are expected to be 1,205,400 pounds per year and 288,600 pounds per year, respectively. The July 13, 2010 Revised Preliminary Determination of Compliance for the Project states, at page 1, that emissions of CO will now be 197,928 pounds per year and NOx 198,840 pounds per year, both to be enforced as permit limitations. Conveniently, this would bring both the CO and NOx emissions under the 100-ton limit for major sources under Title V of the Clean Air Act. This change in emission numbers was accomplished with no changes to the setup or operation of the Project itself.

In addition, this sentence occurs relating to the new CO and NOx limits:

> If the annual [CO/NOx] emissions from these units exceed this value, they will be set equal to the proposed facility wide [CO/NOx] emission limit.

Revised PDOC at pages 9 (NOx) and 10 (CO). There are two ways to read this confusing sentence. One is that the sub-100 tons limits are meaningless and will be ignored if exceeded. The other is that APCD is attempting to engage in the type of "flexible permitting" that USEPA has disapproved in Texas. In either case, the federal Clean Air Act has been violated.

**District's Response:**

*The District agrees that the wording in the PDOC is slightly confusing. The intent of the statement was to explain that the potential annual emissions from each of the turbines was calculated based on a stated scenario that was provided by the applicant and that if the unit was not operated exactly in accordance with this scenario, there was the potential for higher $NO_X$ and CO emissions from the unit. However, the total emissions from the facility would not be allowed to exceed the proposed facility wide $NO_X$ and CO emissions limits.*

*The stated scenario is an estimate of what the projected annual emissions from the unit could be if it was operated according to that schedule. Since the operational schedule of the power plant is based on electrical demand, the facility cannot be held to a specific operational schedule. The main point to understand is that the annual emissions from the facility will not exceed the facility wide limit that is stated as a condition on the PDOC, and therefore the impact from the facility's emissions will not be greater than that evaluated by the District.*

***Attached Letter Addressed to U.S. EPA - Dated October 14, 2009***

**El Pueblo Para Aire y Agua Limpio/People for Clean Air and Water, GreenAction for Health & Environmental Justice, NRDC and CRPE Comments**

The following comments were sent to U.S. EPA on October 14, 2009 from Maricela Mares Alatorre, Bradley Angel, Ingrid Brostrom and David Pettit on behalf of El Pueblo Para Aire y Agua Limpio/People for Clean Air and Water, GreenAction for Health & Environmental Justice, the Center on Race, Poverty, & the Environment, and the Natural Resources Defense Council. These comments were not sent to the District therefore, the District did not previously respond to the comments. These comments refer to the DOC performed in District project C-1080386, which analyzed the prior, higher-emitting proposal. In addition, all comments received by the District for project C-1080386 were addressed in the FDOC for that project.

The revised PDOC being processed as District project C-1100751 will obviously have similarities to the PDOC processed in District project C-1080386. It is also obvious that changes to the PDOC were made and therefore, not all comments made in the October 14, 2009 letter are still applicable. However, because these comments have been referenced in other correspondence regarding the latter project, we are addressing them at this time.

The applicable comments (from Maricela Mares Alatorre, Bradley Angel, Ingrid Brostrom and David Pettit) regarding the Preliminary Determination of Compliance for Avenal Power Center LLC (District facility C-3953) are encapsulated below followed by the District's responses.

**El Pueblo Para Aire y Agua Limpio/People for Clean Air and Water, GreenAction for Health & Environmental Justice, NRDC and CRPE Comment #1:**

The proposed Avenal Energy project in Kings County will add hundreds of tons of air pollution per year to what is already one of the most degraded airsheds in the United States. NOx and VOCs are ozone (commonly known as "smog") precursors and fine particle (PM2.5) precursors. Both ozone and PM2.5 levels in the San Joaquin Valley constitute a public health crisis. The Environmental Working Group published the Air Resources Board's estimates that show 1,292 San Joaquin Valley residents die each year from long-term exposure to PM2.5. Ozone and PM pollution exacerbate respiratory conditions, including asthma, increase hospitalizations and emergency room visits, contribute to cardiac illnesses, and increase school and work absenteeism. The American Lung Association ranks the San Joaquin Valley counties of Kern, Tulare, and Fresno as the third, fourth, and sixth most ozone-polluted counties in the United States, respectively. For long term exposure to PM2.5, the American Lung Association ranks the San Joaquin Valley counties of Kern, Tulare, Kings, and Fresno as the first, fourth, seventh, and eighth most polluted counties. A document prepared

jointly by the California Air Resources Board and the American Lung Association describes ozone as

> a powerful oxidant that can damage the respiratory tract, causing inflammation and irritation, and induces symptoms such as coughing, chest tightness, shortness of breath, and worsening of asthma symptoms. Ozone in sufficient doses increases the permeability of lung cells, rendering them more susceptible to toxins and microorganisms. The greatest risk is to those who are more active outdoors during smoggy periods, such as children, athletes, and outdoor workers. Exposure to levels of ozone above the current ambient air quality standard leads to lung inflammation and lung tissue damage, and a reduction in the amount of air inhaled into the lungs. Recent evidence has, for the first time, linked the onset of asthma to exposure of elevated ozone levels in exercising children (McConnell 2002). These levels of ozone also reduce crop and timber yields, damage native plants, and damage materials such as rubber, paints, fabric, and plastics.

The document also shows the significant health effects and costs of exposure to fine particulate matter and ozone in California. In late 2008, Jane V. Hall, Ph.D., and Victor Brajer, Ph.D., published a comprehensive analysis of the effects from not meeting the 1997 8-hour ozone standard and the 2008 PM2.5. The health effects of not meeting these standards, and their concomitant economic values, inflict a conservative measurable cost of $5.7 billion *each year* –$1,600 per person – in the San Joaquin Valley.

**District's Response:**

*This is the same comment that was made in the NRDC and CRPE Letter Dated September 13, 2010 and addressed above. See above for District Response.*

**El Pueblo Para Aire y Agua Limpio/People for Clean Air and Water, GreenAction for Health & Environmental Justice, NRDC and CRPE Comment #2:**

The BACT determinations proposed by the Project and EPA are flawed in several respects. The BACT determinations do not comply with federal PSD program top-down BACT analysis requirements. The PSD permit is also flawed in that the applicant did not perform a BACT analysis for greenhouse gas emissions. Additionally, the proposed CO emission limitation for the combustion turbines is not BACT.

**District's Response:**

*The District does not have the authority to issue PSD permits. Any PSD related questions are inappropriate for discussion under the District public noticing comment period.*

*In addition, since the District is not the lead agency for CEQA, GHG will not be addressed by the District.*

*The revised project proposed to limit the annual CO emissions to under 200,000 lb/year. Therefore, BACT for CO is not triggered and any discussion of BACT for CO is unnecessary.*

**El Pueblo Para Aire y Agua Limpio/People for Clean Air and Water, GreenAction for Health & Environmental Justice, NRDC and CRPE Comment #3:**

The Project is expected to emit 80.7 tons/year of PM/PM10. *See* the June 16, 2009 EPA Statement of Basis and Ambient Air Quality Impact Report at p. 14. As we discuss below, we believe that the Project's plan to offset these PM emissions through SOx offsets is invalid under the Clean Air Act. Accordingly, ambient air quality will be impaired by the Project.

As you know, the San Joaquin Valley is in non-attainment for PM2.5. The Project proposes to meet 98% of its PM offset requirements from SOx offsets at a one-to-one ratio. *See* Final Staff Report, Air Quality Table 19. This is highly problematic for a number of reasons.

First, the one-to-one ratio ignores the very different health risks of SOx and PM. The U.S. EPA has found that particulate matter can cause or contribute to increased respiratory symptoms, such as irritation of the airways, coughing, or difficulty breathing, for example; decreased lung function; aggravated asthma; development of chronic bronchitis; irregular heartbeat; nonfatal heart attacks; and premature death in people with heart or lung disease.

Second, the Project applicants should not be allowed to use PM10 as a surrogate for PM2.5 emissions.

**District's Response:**

*The facility is not using $PM_{10}$ as a surrogate for $PM_{2.5}$. The facility has proposed to offset $PM_{10}$ emissions with $SO_X$ ERCs at the District evaluated interpollutant offset ratios. District Rule 2201, Section 4.13.3 allows for the use of interpollutant offsets at ratios based on air quality analysis. The $SO_X$ for $PM_{10}$ offset ratio used in this project is based on the best available science for determining how much $PM_{10}$ $SO_X$ can create. In addition, the facility is not a Major Source for $PM_{2.5}$ emissions; therefore $PM_{2.5}$ requirements will not be addressed in this project.*

**Attached Letter Addressed to U.S. EPA - Dated October 15, 2009**

**EarthJustice Comments**

The following comments were sent to U.S. EPA on October 15, 2009 from Paul Cort of EarthJustice. These comments were not sent to the District therefore, the District did not respond to the comments. These comments refer to the DOC performed in District project C-1080386. In addition, all comments received by the District for project C-1080386 were addressed in the FDOC for that project.

The revised PDOC being processed as District project C-1100751 will obviously have similarities to the PDOC processed in District project C-1080386. It is also obvious that changes to the PDOC were made and therefore, not all comments made in the October 14, 2009 letter are still applicable. However, because these comments have been referenced in other correspondence regarding the latter project, we are addressing them at this time.

The applicable comments from Paul Cort regarding the Preliminary Determination of Compliance for Avenal Power Center LLC (District facility C-3953) are encapsulated below followed by the District's response.

**EarthJustice Comment #1:**

Commenter's find it stunning that the proposed permit does not even mention CO2 emissions or controls. EPA is well aware that the Environmental Appeals Board ("EAB") has returned multiple PSD permits for failing to consider whether CO2 is a pollutant "subject to regulation" under the Clean Air Act. *See In re Deseret Power Elec. Coop.*, PSD Appeal No. 07 - 03 (EAB Nov. 13, 2008); *In re Northern Mich. University Ripley Heating Plant*, PSD Appeal No. 08 - 02 (EAB Feb. 18, 2009). In light of these decisions, EPA Region 9 also withdrew portions of the PSD Permit issued to Desert Rock Energy Company in order to reconsider the issue of whether CO2 is a pollutant subject to regulation. Yet EPA proposes a PSD permit for another power plant that will emit over 1.7 million tons of CO2 each year without any discussion of these contentious issues whatsoever. EPA must revise the proposed permit to explain EPA's position on BACT for CO2 so that the public can comment on the control levels selected or EPA's rationale for refusing to impose such controls.

**District's Response:**

*This is the same comment that was made in the NRDC and CRPE Letter dated September 13, 2010 and addressed above. See above for District Response.*

**EarthJustice Comment #2:**

The BACT determinations proposed by the Project and EPA are flawed in several respects. The BACT determinations do not comply with federal PSD

program top-down BACT analysis requirements. The PSD permit is also flawed in that the applicant did not perform a BACT analysis for greenhouse gas emissions. Additionally, the proposed CO emission limitation for the combustion turbines is not BACT.

**District's Response:**

*The District does not have the authority to issue PSD permits. Any PSD related questions are inappropriate for discussion under the District public noticing comment period.*

*In addition, since the District is not the lead agency for CEQA, GHG will not be addressed by the District.*

*The revised project proposed to limit the annual CO emissions to under 200,000 lb/year. Therefore, BACT for CO is not triggered and any discussion of BACT for CO is unnecessary.*

**EarthJustice Comment #3:**

The Proposed Permit Fails to Demonstrate that the Avenal Project Will Not Cause or Contribute to Violations of National Ambient Air Quality Standards for Ozone and Fine Particulate Matter.

**District's Response:**

*The facility is not a Major Source for $PM_{2.5}$; therefore $PM_{2.5}$ (fine particulate matter) requirements will not be addressed in this project.*

*There is no EPA approved model capable of accounting for the photochemical complexities of regional ozone formation to determine the impacts of ozone from a single site due to NOx and VOC emissions. In addition, the facility in this project does not directly emit ozone. Therefore, an analysis of nearby ozone emissions impacts was not performed in this project. Finally, we believe that our very strict standards for NOx and VOC from new sources, among the most stringent in the nation, are sufficient safeguard to prevent any single source from contributing significantly to a violation of the ozone NAAQS.*

# ATTACHMENT M

***Rob Simpson Comments and District Responses***

## Public Comments / District Response

The comments (from Rob Simpson) regarding the Preliminary Determination of Compliance for Avenal Power Center LLC (District facility C-3953) is encapsulated below followed by the District's response.

**Rob Simpson Comments – Emailed Letters Received November 17, 2010**

**Simpson Comment #1 - Public Notice:**

The notice was not given to me in sufficient enough time to prepare adequate comments. The newspaper notice does not provide enough information about the project to the public and was not published in Spanish.

**District's Response:**

*On the contrary, although Mr. Simpson was not on record as being interested in receiving information regarding this specific project, we are always quite interested in providing interested parties an opportunity to provide input, and so we provided a full 30-day period for Mr. Simpson to comment, the same amount of time provided all interested parties on all permitting projects. As for the second comment, please refer to our response to GreenAction's comment #1.*

**Simpson Comment #2:**

The revised PDOC seems to have one purpose, evasion of the Clean Air Act requirements for the Prevention of Significant Deterioration (PSD). The only change in the revised permit is a limitation on annual NOx and CO emissions but the way the permit is worded this limitation is not federally enforceable. Page 9 of the PDOC states that,

> "*The facility has proposed to limit the annual facility wide NOx emissions to 198,840 lb/year. If the annual NOx emissions from these units exceed this value, they will be set equal to the proposed facility wide NOx emission limit.*"

Page 10 of the PDOC states:

> *"The facility has proposed to limit the annual facility wide CO emissions to 197,928 lb/year. If the annual CO emissions from 'these units exceed this value, they will be set equal to the proposed facility wide CO emission limit."*

So essentially there is no change from the original permit and the Avenal Power Project still requires a PSD permit. Issuance of this permit would be a violation of the Clean Air Act and the district and the applicant would be subject to enforcement.

**District's Response:**

*See response to NRDC and CRPE comment #2.*

**Simpson Comment #3 - The District is the Lead Agency for this Project:**

The CEC appears to no longer be the lead agency for the project the district under CEQA, CEC or District rules. The District is now the lead agency since the purpose of the revision to the permit is merely to avoid PSD review and the CEC has no jurisdiction over PSD issues on this project. Thus the district is now the lead agency for review of this project and must conduct a complete EIR prior to issuance of an Authority to Construct for this project.

**District's Response:**

*The District is not the lead agency for this project. Pursuant to California Public Resources Code Section 25500, the CEC "shall have the exclusive power to certify all sites (for power plants over 50 MW) and related facilities in the state". The California Public Resources Code further states that "the issuance of a certificate by the commission shall be in lieu of any permit, certificate, or similar document required by any state, local or regional agency".*

**Simpson Comment #4 - Is an FDOC an ATC?:**

- Does the FDOC process comport with the Districts Federal permitting requirements?
- Is it the federal New Source Review (NSR) permit?
- Has the prior FDOC expired for this facility?
- Has the Applicant commenced construction or use of the prior FDOC?

**District's Response:**

*The FDOC complies with Federal non-attainment pollutant permitting requirements, as implemented with the District's EPA-approved non-attainment NSR rule. This rule requires the District to issue a Determination of Compliance, rather than an Authority to Construct because, as noted above, the CEC has the sole licensing authority for large power plants in California. Our NSR rule does not incorporate federal attainment NSR (PSD) requirements. EPA retains the sole authority to issue PSD permits in the San Joaquin Valley.. The prior FDOC is tied to the CEC's license that has been issued, therefore it has not expired. However, the facility has not commenced construction or use of the prior FDOC. The FDOC under which construction is commenced (and only after CEC has approved any related licensing action) will determine the conditions under which the facility must operate.*

**Simpson Comment #5:**

- I contend that the Warren Alquist Act hijacks air districts authority under the Clean Air Act in conflict with Federal law, does the District agree?.
- Does the District agree with the Brief submitted by the South Coast Air District (Exhibit 3) in the Humboldt Superior Court proceeding regarding a power plant permit that I appealed?

**District's Response:**

*The District does not agree with either the "hijack" comment or the South Coast AQMD's brief on the subject. State law provides the CEC with sole permitting authority, but does not allow them to issue a license that violates the District's regulations. The DOC process provides the District ample opportunity to provide the appropriate guidance to the CEC prior to their licensing process. This process does not violate federal permitting requirements in any way. The federal EPA has approved the DOC process as embodied in the language of the District's NSR rule and that approval explicitly acknowledges that the process complies with federal permitting requirements.*

**Simpson Comment #6:**

The District indicated in emails that it did not intend to issue an Authority to Construct for this project. Please provide some indication of how the permit would be enforceable without an Authority to Construct and who could enforce the State and Federal aspects of the permit. The PDOC has extensive references to an ATC.

**District's Response:**

*Thank you for pointing out that we referred to the DOC as the ATC several times in our evaluation. We apologize for that error. The District has removed all references to the issuance of ATC's in the FDOC evaluation.*

*Pursuant to District Rule 2201, Section 5.8.9, the APCO shall issue a Permit to Operate to any applicant receiving a certificate from the California Energy Commission pursuant to this rule provided that the construction or modification is in compliance with all conditions of the certificate and of the Determination of Compliance, and provided that the Permit to Operate includes the conditions prescribed in Section 5.7. The District will then perform inspections of the facility to determine if it meets all requirements on their PTO.*

**Simpson Comment #7 - The BACT Analysis for the Permit is Defective:**

The district's top down BACT analysis for NOx is defective because it fails to:

- Identify any alternative technologies or work practices which are technologically feasible for reducing NOx emissions, and
- To quantify the collateral impacts from the selection of SCR as the proposed alternative, and
- Identify combustion technologies that are effective is reducing $NO_X$ emissions. (i.e. steam injection, dry low $NO_X$ combustors, and catalytic combustors), and
- Analyze post-combustion controls including selective noncatalytic combustion and EM, and
- Evaluate the risk of an accident from the transport of $NH_3$, and
- Evaluate $NH_3$ as a precursor to PM2.5.

**District's Response:**

*The District did not re-evaluate BACT for this proposal as the daily emissions were not revised. The existing Top-Down BACT Analysis did not consider any $NO_X$ emissions control other than the use of SCR to lower the $NO_X$ emissions to 2.0 ppmvd @ 15% $O_2$, as no more efficient technology has been identified. Pursuant to the District BACT Policy, no analysis is necessary for a project in which the most effective control alternative listed in the BACT Guideline is selected. BACT Guideline 3.4.2 identifies BACT for $NO_X$ as the use of SCR or equal to meet an emission concentration limit of 2.0 ppmvd @ 15% $O_2$ as the most stringent technologically feasible $NO_X$ requirement. Since the applicant proposed the most effective BACT control alternative, no evaluation of other control technologies were performed.*

*In addition, BACT only covers operational emissions; therefore the risk from accidents during the transport of $NH_3$ is not evaluated and can not be evaluated under the District's NSR rule.*

*The evaluation of $NH_3$ as a precursor to $PM_{2.5}$ was not performed since the facility is not a Major Source for $PM_{2.5}$ emissions. However, it should be noted that the Valley's atmosphere does contain ammonia, largely from the Valley's considerable agricultural operations, and relatively small amounts caused by SCR systems are insignificant and are quite worth the significant NOx emissions reductions generated by the SCR. In addition, the District did analyze the health risk impacts of the NH3 emissions that are resulting from the requirement that SCR be installed, and there is no significant risk. Also see the response to comment #17, below.*

**Simpson Comment #8 - $NO_X$ Emissions During Startup and Shut Down:**

Emissions are greater during startups, shutdowns and combustor tuning periods than they are during steady-state operation, the BACT limits established for steady-state operations are not technically feasible during these periods. As these limits are not "achievable" during these operating modes, they are not "Best Available Control Technology" as defined in the Federal Regulations. Therefore, alternate BACT limits must be specified for these modes of operation. The discussion of Best Available Control Technologies does not include information on minimizing startup emissions or startup durations. The U.S. Environmental Protection Agency (U.S. EPA) requires that BACT apply not only during normal steady-state operations but also during transient operating periods such as startups. The District should consider conducting, as part of the BACT analysis, a review of combustion turbine and combined cycle system operational controls or design features that can shorten start up and shutdown events and optimize emission control systems.

**District's Response:**

*As noted above, the District did not re-evaluate BACT for this proposal as the daily emissions were not revised.*

**Simpson Comment #9 - BACT VOC Emission Limit:**

The district has selected a VOC emission limit of 1.4 ppmvd @ 15% 02 when the unit is fired without the duct burner and 2.0 ppmvd @ 15% 02 when it is fired with the duct burners. The BAAQMD has recently established a BACT VOC emission limit for large gas turbines for VOC's. BACT is the use of good combustion practice and abatement with an oxidation catalyst to achieve a permit limit for each gas turbine of 0.616 lb per hour or 0.00127 lb/MMBtu, which is equivalent to 1 ppm POC, 1-hr average. Since VOC emissions contribute to ozone formation and the district is in severe non attainment for the 8-hour ozone standard the district should adhere to the lower VOC emission rate or provide a top down BACT evaluation which shows that this rate is not achievable or is not cost effective.

**District's Response:**

*As noted above, the District did not re-evaluate BACT for this proposal as the daily emissions were not revised. The District Top-Down BACT Analysis did not consider any VOC emissions control other than limiting the VOC emissions to 2.0 ppmvd @ 15% $O_2$ when the duct burner is fired, and 1.5 ppmvd @ 15% $O_2$ when the duct burner is not fired.*

*The applicant proposed VOC emissions of 1.4 ppmvd @ 15% $O_2$ when the unit is fired without the duct burner and 2.0 ppmvd @ 15% $O_2$ when it is fired with the duct*

*burner. The BACT analysis that established the Technologically Feasible BACT option of 1.5 ppmvd @ 15% $O_2$ did not take into account emissions from a duct burner. Therefore the applicants proposed 1.4 ppmvd VOC @ 15% $O_2$ emission factor will be determine to meet the highest ranking control option listed in the BACT. Since the applicant proposed the most effective BACT control alternative, no evaluation of other control technologies were performed.*

**Simpson Comment #10 - BACT $PM_{2.5}$ / $PM_{10}$ Emission Limit:**

The permit proposes to allow the project to emit as much as 11.78 pounds per hour of PM-10 with the project utilizing duct firing. According to BAAQMD the projects listed in the table below all have lower PM emission limits than those proposed for this project. BACT for PM 2.5 for large combined cycle turbines with duct firing is 9 pounds per hour. The district needs to impose this limit in the FDOC.

**District's Response:**

As noted above, the District did not re-evaluate BACT for this proposal as the daily emissions were not revised. *District BACT Policy, Section IX.D, states that a cost effective analysis is not necessary for a project in which the most effective control alternative is selected. BACT Guideline 3.4.2 identifies BACT for $PM_{10}$ as the use of an air inlet filter, lube oil vent coalescer and natural gas fuel. Since the applicant proposed the most effective BACT control alternative, no evaluation of other control technologies were performed. In addition, it is likely that a PM10 limit of 11.78 lb/hr is substantially the same as a PM2.5 limit of 9.0 lbs/hr, as PM2.5 is a fraction of PM10.*

**Simpson Comment #11 - Air Quality Impact Analysis:**

Section 4.14.2 of this Rule requires that an air quality impact analysis (AQIA) be conducted for the purpose of determining whether 'the operation of the proposed equipment will cause or make worse a violation of an air quality standard. For NOx the impact analysis conducted by the district in Attachment G page 2 demonstrates that the project does violate the new NO2 standard for all tiers when using District approved 3 yr Ave. of the 98$^{th}$ percentile of the annual distribution of the daily 1 hour max ppb /ug/m3 for the Visalia site which is 115.72 ug/m3. So the project does in fact violate the new federal NO2 standard and thus cannot be permitted.

**District's Response:**

*The impact analysis in Attachment G clearly states that the project passes the AAQA at Tier III for both the commissioning periods and normal operational periods. The District used the 3 year average daily distribution of daily 1 hour*

*max ppb /ug/m3 for the Hanford site. The District used the numbers from the Hanford site because it is closer to the facility's location than the Visalia site.*

**Simpson Comment #12:**

The PDOC uses the PM-10 surrogate approach to analyze the particulate matter impacts from the project. On October 20, 2010, the USEPA issued a final rule providing modeling thresholds for evaluating impacts of PM2.5 emissions under the Prevention of Significant Deterioration (PSD) program and the Non attainment NSR program. The rule establishes Class I and Class II Increment Thresholds and Significant Impact Levels (SILs), and a Significant Monitoring Concentration (SMC) threshold. The project according to the analysis presented on page 54 exceeds both the significant impact levels for the annual PM 2.5 standard and the 24 PM 2.5 hour standard. The FDOC needs to address the compliance of the project with the new rules.

**District's Response:**

*The project does not trigger PSD permitting and the facility is not a Major Source for $PM_{2.5}$ emissions. Therefore, the District is not required to perform modeling to evaluate impacts of $PM_{2.5}$.*

**Simpson Comment #13 - Federal 1 hour NO2 Standard:**

The permit does not present an adequate and complete analysis for the new Federal 1 hour NO2 standard. The district failed to include information on any nearby sources which are required to be modeled with Avenal's emissions. A full impact analysis should be presented in the permit for the public to comment on using the EPA's Guideline on Air Quality Models (40 CFR Part 51 Appendix W).

**District's Response:**

*This project does not trigger a PSD permit and therefore it is not required to follow the guideline on air quality models in 40 CFR Part 51 Appendix W. If it did trigger PSD permitting, the federal EPA would be obligated to perform such modeling, if appropriate.*

**Simpson Comment #14:**

The revised permit should provide the input data that was used to determine compliance with the new NO2 standard. Emission factors and NO2 inventories should be presented for the public to review not just the information that is presented on page 2 Attachment G. The analysis on page 2 Attachment G demonstrates that the project does violate the new NO2 standard for all tiers when using District approved 3 yr Ave. of the 98$^{th}$ percentile of the annual

distribution of the daily 1 hour max ppb / ug/m3 for the Visalia site which is 115.72 ug/m3.

**District's Response:**

*The impact analysis in Attachment G clearly states that the project passes the AAQA at Tier III for both the commissioning periods and normal operational periods. The District used the 3 year average daily distribution of daily 1 hour max ppb /ug/m3 for the Hanford site. The District used the numbers from the Hanford site because it is closer to the facility's location than the Visalia site.*

**Simpson Comment #15:**

Modeling for the NO2 standard should indicate whether worst case emissions which would be the start up and shut down emissions for the project were utilized in the modeling for compliance with the standard.

**District's Response:**

*The District performed modeling during the commissioning period and the standard operational period to determine compliance with the NO2 standard. The modeling performed by the District for these periods demonstrated compliance with the NO2 standards.*

**Simpson Comment #16 - The Proposed Interpollutant Trade Values Violates EPA Guidance and $PM_{2.5}$ NSR Regulations:**

Based on an EPA assessment, the preferred trading ratios for SO2 to PM2.5 was set at 40:1.

**District's Response:**

*The facility did not propose to offset $PM_{2.5}$ emissions with SO2 credits. Furthermore, this facility is not a Major Source for $PM_{2.5}$; therefore the District did not evaluate $PM_{2.5}$ emissions. This comment is not applicable to this project.*

**Simpson Comment #17 - Ammonia Emissions:**

Other power plant turbines have achieved a 2 ppm $NO_X$ limit with a 5 ppm $NH_3$ slip limit.

The district must consider the transport of the ammonia emissions to regions that may not be ammonia rich outside of the San Joaquin Valley. The district is not an isolated island.

**District's Response:**

*Ammonia is an integral part of the NOx emissions control system when using SCR. The District has no regulatory basis for restricting ammonia slip to 5 ppmv. Ammonia is not a criteria air contaminant or a "precursor" as defined in District Rule 2201. The District's BACT Clearinghouse does not specify an ammonia slip rate for combustion turbines using SCR. While ammonia emissions may be restricted as part of a health risk evaluation that determines an unacceptable health risk from the ammonia to exposed populations, this is not the case with Avenal Power Center. The risk due to all toxic air contaminant emissions, including 10 ppmv ammonia, was found to be not significant.*

*A high ammonia slip from the turbine will not lead to increased $PM_{10}$ formation in the atmosphere. The air basin currently has an excess of ammonia emissions; therefore lowering ammonia emissions will not reduce PM formation. This is demonstrated in the Districts $PM_{2.5}$ plan which does not not rely on ammonia reductions to reduce $PM_{2.5}$, but rather relies largely on $NO_X$ reductions.*

*Generally, increased ammonia injection rates, and therefore increased ammonia slip rates, are required to maintain NOx BACT performance levels (2.0 ppmv) as the catalyst ages. Allowances for operation at the end of the economic life of a control technology and for periods of non-steady state operation (including startup and shutdown which can result in ammonia slip higher than 5 ppmv) are part of a BACT determination.*

**Simpson Comment #18 - Emission Reduction Credits:**

ERC's used on the prior PDOC are unavailable for use on the new PDOC.

**District's Response:**

*The ERC listed in the previous FDOC and the ones listed in the new PDOC will only be used for one of the projects. Once they are withdrawn for either project, they will no longer be available to be withdrawn for the remaining project. In addition, the applicant has provided sufficient ERC's of offset the emissions increase in either one of the projects.*

**Simpson Comment #19:**

The PDOC indicates that the closest population center is the residential district of Avenal approximately 6 miles to the southwest. Are there people residing or working closer than that to the project? Could there be sensitive receptors closer to the site?

**District's Response:**

*According to the application submitted by the facility, the nearest resident is 7,700 feet to the Northeast and the nearest business is 3,957 feet to the Northwest. However, our analysis of emissions and risk from those emissions is based on a theoretical long-term exposure at the point of maximum pollutant concentration. Therefore, our conclusion that there will be no significant risk from any emissions from this facility is not dependant on receptor location.*

**Simpson Comment #20:**

It appears that there are residential structures and extensive farm land around the site. Could emissions from the facility affect crops or wildlife?

**District's Response:**

*Such issues are addressed in the CEC's CEQA-equivalent process and are not a part of the District's analysis. However, it should be noted that the District's Health Risk Assessment (HRA) is a multipathway assessment of risk, and would include the affect on public health generated by pollutant deposition on plants and animals that are subsequently ingested by the public.*

**Simpson Comment #21:**

- Has the District conducted and Environmental Justice analysis of the projects effects? Could farm workers be an environmental justice community that suffers a greater impact due to hard physical labor in the vicinity of the project, lack of health care, poverty and additional stressors like chemicals used in farming?
- Can farming activities cause additional air quality impacts that could contribute to a negative cumulative effect?
- Will this facility induce growth?
- Could on site Solar pre-heaters reduce Air quality impacts?
- Can this facility cause an increase of greenhouse gas emissions?
- Are there potential negative localized effects of Greenhouse gases?
- How does this plan comport with AB32?
- How does this plan comport with EXECUTIVE ORDER S-3-05?
- Has the District studied the potential air quality effects of the use of imported LNG?
- The District should study the life cycle effects of fossil fuel extraction and delivery?
- Has the District studied the effects of the facility utilizing water from the California Aqueduct?
- Will the vaporization of this water lead to negative air quality effects by increasing PM or other pollutants in the Air?

- Will the use of this water cause negative air quality effects by the diversion of water that could be utilized for farming or other uses?
- Will the pumping of this water through the Aqueduct, from its source, cause Air quality emissions?
- Is it legal to use Potable water for this Power plant use?
- As water quality changes will these effects change?
- Are there methods of minimizing these potential effects? Dry cooling for instance?

**District's Response:**

*These questions should be directed to the CEQA lead agency for this project (CEC). Since the District is not the lead agency for this project, these comments will not be addressed at this time.*

**Simpson Comment #22:**

How much money does the District receive if this project is approved? Denied?

**District's Response:**

*Whether the project is approved or denied, the District receives application filing fees for all proposed equipment, and hourly engineering fees for the time spent evaluating the project. At this time, we would expect the total will be approximately $5,000. In addition, if the project is approved, the District will receive an annual permit fee to maintain the facility's permits, of approximately $26,000 per year. This latter amount would be the same whether the facility constructs under the conditions of this FDOC and a subsequent CEC approval, or under the existing FDOC which the CEC used in issuing the existing power plant license.*

**Comments Received from Rob Simpson in Exhibit 4:**

The document provided labeled Exhibit 4 is the same document that Mr. Simpson presented as testimony for the CEC Hearings under proceeding 08-AFC-01. This exhibit was discussed at the Pre-Hearing Conference on June 30, 2009. After a review of the document, the CEC Committee overseeing the project concluded that the only information that would be allowed as testimony would be the information included in Exhibit W. A discussion of this can be found in the Pre-Hearing Conference Transcript, available at: http://www.energy.ca.gov/sitingcases/avenal/documents/2009-06-30_TRANSCRIPT.PDF. The District agrees with CEC's conclusion and will respond to the comments presented in Exhibit W. All additional comments in Exhibit 4 are documents pertaining to projects unrelated to this project, and comments that are not applicable to this project.

**Simpson Comment #23:**

The applicant proposes to offset the projects PM 2.5 emissions on a pound for pound basis with SOx offsets. Proposed interpollutant trading ratios are required to be scientifically justified with a site specific air quality analysis, as required by Rule 2201, Section 4.13.3. The PDOC attempts to establish an interpollutant ratio based on modeling analyses performed in the Districts 2008 PM 2.5 plan.

The EPA has finalized its regulations to implement the New Source Review (NSR) program for fine particulate matter on July 15, 2008. Their recommended ratio of SOx offsets to PM 2.5 offsets is 40 tons of SOx for each ton of PM 2.5. The applicant is proposing a ratio that is 40 times less stringent than EPA has recommended.

In addition the CEC and the air district allow the project to emit 33,521 pounds of SO2 with no mitigation despite the alleged CEC policy to offset all PM2.5 precursors. If one pound of SO2 offsets 1 pound of PM 2.5 the CEC and the Air District are allowing 33,521 pounds of SO2 to remain unmitigated. The new EPA rules on PM 2.5 require a pound for pound offset ratio for PM 2.5 precursors. If the districts assumption that one pound of SOx offsets 1 pound of PM 2.5 as allowed in the interpollutant trade the district is allowing 33,521 pounds of SOx to remain unmitigated creating 33,521 pounds of PM 2.5 in violation of CEQA and EPA NSAR rules for PM 2.5.

**District's Response:**

*The facility did not propose to offset $PM_{2.5}$ emissions with SO2 credits. Furthermore, this facility is not a Major Source for $PM_{2.5}$; therefore the District did not evaluate $PM_{2.5}$ emissions. This comment is not applicable to this project.*

**Simpson Comment #24:**

The FDOC allows an ammonia slip of 10 ppm. The 5 ppm ammonia limit in combination with a 2 ppm NO limit has already been required for some CEC licensed facilities. In the alternative the District could perform a site specific analysis that demonstrates that no particulate matter will be formed locally or district wide due to the ammonia slip emissions and require mitigation if the analysis demonstrates that there is significant secondary particulate matter formation from the ammonia emissions from the LGS.

The district must also consider the transport of the ammonia emissions to regions that may not be ammonia rich outside of the San Joaquin Valley. The transportation and storage of ammonia presents a risk of an ammonia release in the event of a major accident.

**District's Response:**

*This comment was addressed in the District response to Rob Simpson Comment #17 above.*

**Comments Received from Rob Simpson in Exhibit 5:**

The document labeled Exhibit 5, submitted by Rob Simpson, discusses the California energy landscape. The District does not take the California energy landscape into account when determining if a new project will meet applicable air quality rules and regulations. This comment should be directed to the California Energy Commission (CEC).

*Attach. 15*

San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

HEALTHY AIR LIVING™

MAR 2 2 2016

N. Ross Buckenham
ABEC #3 LLC dba Lakeview Dairy Biogas
c/o California Bioenergy, LLC
2828 Routh St, Suite 500
Dallas, TX 75201-1438

**Re: Notice of Preliminary Decision - Authority to Construct**
**Facility Number: S-8637**
**Project Number: S-1143770**

Dear Mr. Buckenham:

Enclosed for your review and comment is the District's analysis of ABEC #3 LLC dba Lakeview Dairy Biogas's application for an Authority to Construct for installation of an anaerobic digester system and two 1,468 bhp digester gas-fired IC engines with selective catalytic reduction (SCR) systems for emissions control at Lakeview Farms dairy, at 17702 Bear Mountain Blvd, Bakersfield, CA.

The notice of preliminary decision for this project will be published approximately three days from the date of this letter. After addressing all comments made during the 30-day public notice period, the District intends to issue the Authority to Construct. Please submit your written comments on this project within the 30-day public comment period, as specified in the enclosed public notice.

Thank you for your cooperation in this matter. If you have any questions regarding this matter, please contact Mr. Ramon Norman of Permit Services at (559) 230-5909.

Sincerely,

Arnaud Marjollet
Director of Permit Services

AM:rn

Enclosures

cc: Tung Le, CARB (w/ enclosure) via email

**Seyed Sadredin**
Executive Director/Air Pollution Control Officer

**Northern Region**
4800 Enterprise Way
Modesto, CA 95356-8718
Tel: (209) 557-6400 FAX: (209) 557-6475

**Central Region (Main Office)**
1990 E. Gettysburg Avenue
Fresno, CA 93726-0244
Tel: (559) 230-6000 FAX: (559) 230-6061

**Southern Region**
34946 Flyover Court
Bakersfield, CA 93308-9725
Tel: 661-392-5500 FAX: 661-392-5585

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# San Joaquin Valley Air Pollution Control District

## Authority to Construct Application Review

Digester System and Two Digester Gas-Fired IC Engines with SCR

| | | | |
|---|---|---|---|
| Facility Name: | ABEC #3 LLC dba Lakeview Dairy Biogas | Date: | March 7, 2016 |
| Mailing Address: | ABEC #3 LLC<br>c/o California Bioenergy, LLC<br>2828 Routh Street, Suite 500<br>Dallas, TX 75201-1438 | Engineer:<br><br>Lead Engineer: | Ramon Norman<br><br>Jerry Sandhu |
| Contact Person: | N. Ross Buckenham - California Bioenergy/ ABEC #3 LLC | | |
| Telephone: | (214) 849-9886 | Cell Phone: | (214) 906-9359 |
| E-Mail: | rbuckenham@calbioenergy.com | | |
| Application #(s): | S-8637-1-0, -2-0, and -3-0 | | |
| Project #: | S-1143770 | | |
| Deemed Complete: | May 14, 2015 | | |

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## I. Proposal

ABEC #3 LLC dba Lakeview Dairy Biogas, a subsidiary of California Bioenergy, LLC, has requested Authority to Construct (ATC) permits to construct a covered lagoon anaerobic digester system (ATC S-8637-1-0) and to install two 1,468 bhp digester gas-fired IC engines (or approved engines of equal or lesser bhp) (ATCs S-8637-2-0 and -3-0) at Lakeview Farms dairy (Facility S-5254). Each engine will be equipped with a selective catalytic reduction (SCR) system for emissions control and will power an electrical generator that will produce up to 1,059 kW. The new digester will be constructed in an area of the existing dairy that is currently used for manure drying and storage. Lakeview Farms dairy will send manure from the dairy to the ABEC #3 LLC anaerobic digesters located on the dairy site. The digester system will produce renewable biogas that will be used to fuel the IC engine generator sets.

ABEC #3 LLC dba Lakeview Dairy Biogas and Lakeview Farms dairy, which are separate companies, are undertaking the project as a partnership. ABEC #3 LLC has provided information supporting that the dairy and the ABEC #3 LLC biogas facility will be separately owned and operated. The following is a summary of some of the information provided by the applicant. The proposed digester system at the dairy will be operated and maintained by ABEC #3 LLC. The responsibility of the dairy will be limited to providing the manure feedstock and disposing of the effluent, which the dairy already must do for compliance with water quality regulations. ABEC #3 LLC will not be involved at all in the dairy's primary activity, production of milk. The feedstock and lease agreements specify that ABEC #3 LLC will build, own, and operate the biogas facility and also allows ABEC #3 LLC to make plant and equipment improvements. The proposed digester gas-fired IC engine generator sets that will be constructed on land leased from the dairy site and will be owned, operated, and maintained by ABEC #3 LLC. ABEC #3 LLC will be solely responsible for ensuring that the digester system and digester gas-fired IC engines comply with all applicable air quality regulations. The generator sets will sell all the power generated to the grid and will not provide any power

directly to the dairy. Because the dairy and the proposed digester gas power plant at the site will be separately owned and operated and will have different two-digit Standard Industrial Classification (SIC) codes (Industry Group 24: Dairy Farms for the dairy vs. Industry Group 49: Electric, Gas, And Sanitary Services for the IC engine generator sets), pursuant to Section 3.39 of District Rule 2201, the proposed digester system and the digester gas-fired IC engines will not be part of the dairy agricultural stationary source. Therefore, the digester system and digester gas-fired IC engines will be permitted as a separate non-agricultural stationary source (Facility S-8637).

## II. Applicable Rules

| | |
|---|---|
| Rule 2201 | New and Modified Stationary Source Review Rule (4/21/11) |
| Rule 2410 | Prevention of Significant Deterioration (6/16/11) |
| Rule 2520 | Federally Mandated Operating Permits (6/21/01) |
| Rule 4101 | Visible Emissions (2/17/05) |
| Rule 4102 | Nuisance (12/17/92) |
| Rule 4201 | Particulate Matter Concentration (12/17/92) |
| Rule 4701 | Stationary Internal Combustion Engines – Phase 1 (8/21/03) |
| Rule 4702 | Stationary Internal Combustion Engines (11/14/13) |
| Rule 4801 | Sulfur Compounds (12/17/92) |

40 CFR Part 60, Subpart JJJJ Standards of Performance for Stationary Spark Ignition Internal Combustion Engines
40 CFR Part 63, Subpart ZZZZ National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines
CH&SC 41700 Health Risk Assessment
CH&SC 42301.6 School Notice
Public Resources Code 21000-21177: California Environmental Quality Act (CEQA)
California Code of Regulations, Title 14, Division 6, Chapter 3, Sections 15000-15387: CEQA Guidelines

## III. Project Location

The ABEC #3 LLC Stationary Source (Facility S-8637) is located on Lakeview Farms dairy at 17702 Bear Mountain Blvd, Bakersfield, CA (Mt. Diablo Meridian T 31S, R 26E, Sec 20 in Kern County). The proposed equipment is not located within 1,000 feet of the outer boundary of a K-12 school. Therefore, the public notification requirement of California Health and Safety Code 42301.6 is not applicable to this project.

## IV. Process Description

Anaerobic Digester System

An anaerobic digester is a sealed basin or tank that is designed to accelerate and control the decomposition of organic matter by microorganisms in the absence of oxygen. Anaerobic decomposition results in the conversion of organic compounds in the substrate into methane ($CH_4$), carbon dioxide ($CO_2$), and water rather than intermediate Volatile Organic Compounds (VOCs). The gas generated by this process is known as biogas, waste gas, or digester gas. In addition to methane and carbon dioxide, biogas may also contain small amounts of Nitrogen ($N_2$), Oxygen ($O_2$), Hydrogen Sulfide ($H_2S$), and Ammonia ($NH_3$). Biogas may also include

trace amounts of various VOCs that remain from incomplete digestion of the volatile solids in the incoming substrate. Because biogas is mostly composed of methane, the main component of natural gas, the gas produced in the digester can be cleaned to remove $H_2S$ and other impurities and used as fuel.

The proposed anaerobic digester system will be designed to process the manure generated by the cattle at Lakeview Farms dairy. The manure will be flushed from the cow housing areas at the dairy to a mechanical separation system prior to the digester system. This pre-digester mechanical separation system will remove fibrous solids from the manure. After the mechanical separation system, the liquid manure will flow to a sand settling lane that is designed to remove heavy solids by sedimentation. After the separation systems, the liquid manure will gravity flow into the proposed covered lagoon digesters. The liquid effluent from the covered lagoon digesters will be pumped to the existing large storage pond at the dairy from where it can be used to irrigate and fertilize adjacent cropland.

The proposed anaerobic digester system will process the liquid fraction from the dairy manure solid separation system. The anaerobic digester system will consist of an in-ground, covered lagoon anaerobic digester that will be divided into one or more cells. The final number of covered lagoon anaerobic digester cells and the final dimensions of each cell will be determined based on borings to locate subsurface sand and groundwater that are required to demonstrate compliance with the requirements of the Regional Water Quality Control Board. The preliminary information submitted by the applicant indicates that the first cell of the covered lagoon anaerobic digester will have the following approximate dimensions: 655 ft long by 262 ft wide at the top, with an average depth of 23 ft, and a side slope (run/rise) of 2.0 and that the second cell of the covered lagoon anaerobic digester will have the following approximate dimensions: 500 ft long by 200 ft wide at the top, with an average depth of 22.75 ft, and a side slope (run/rise) of 2.0. The covered lagoon digester will operate at ambient temperatures; however, the covered lagoon digester may utilize heat from the engines to warm the substrate to promote more efficient anaerobic digestion. An area located east of the existing lagoons at the dairy, which is currently used for drying and storage of solid manure, will be excavated to create the proposed covered lagoon anaerobic digester.

The applicant indicates that the lagoon cell(s) will be covered in accordance with Natural Resources Conservation Services (NRCS) Practice Standard Code 367 – Roofs and Covers. The bottom and the walls of the new lagoon cell(s) will be lined with high-density polyethylene (HDPE) membranes and a gas collection system will be installed. The new lagoon cells will be fitted with HDPE covers. The gas collection system will consist of perforated piping under the HDPE covers of the covered lagoons.

The covered lagoon digester will be equipped with an air injection system for removal of $H_2S$ from the digester gas. The continuous injection of controlled quantities of air under the digester covers increases the amount of oxygen in the space under the digester covers and in the surface layer of the digester liquid, which facilitates oxidation of sulfides in the digester gas and at the surface of the liquid to elemental sulfur and water. Injection of air also promotes biological removal of $H_2S$ from the digester gas by facilitating the establishment of sulfur oxidizing microorganisms, such as Thiobacillus species, which have the ability to grow under various environmental conditions and oxidize $H_2S$ to elemental sulfur. The digester gas will be captured by the covered lagoon gas collection system and will be piped to the gas conditioning

system for polishing to remove additional $H_2S$ and for removal of moisture. The gas will then be sent to the engines for use as fuel to generate electricity for sale to a utility and to produce heat for the digester system. When the gas cannot be used in the engines, the digester gas will collect under the lagoon covers. As the gas collects under the lagoon covers, the pressure in the digesters will rise. In rare emergency situations when the gas cannot be combusted in the engines for an extended period, the pressure will cause the relief valves to open and release the digester gas, composed primarily of methane and carbon dioxide, into the atmosphere. As the pressure decreases, the gas relief valves will automatically close and normal operation will proceed.

When operating at full capacity, the digester system is expected to produce an average of 360,000 $ft^3$ of biogas per day. The applicant has indicated that the biogas produced by the covered lagoon digester will be composed of approximately 60-70% methane and 30-40% carbon dioxide. Because the proposed digester system will be able to store the biogas for extended periods under the digester covers and the proposed engines at the ABEC #3 LLC Stationary Source (Facility S-8637) will have more than sufficient capacity to combust all of the gas generated, no flare is being proposed for the digester installation at this facility.

Covered Lagoon Anaerobic Digester Measurements

The measurements given below for the proposed covered lagoon anaerobic digester cells at the ABEC #3 LLC Stationary Source (Facility S-8637) are based on the preliminary information provided by the applicant. As discussed above, the final number of covered lagoon anaerobic digester cells and the final dimensions of each cell will be determined based compliance with the requirements of the Regional Water Quality Control Board.

- 1st Covered Lagoon Anaerobic Digester Cell
  - Top Dimensions: 655 ft long x 262 ft wide
  - Average Depth: 23 ft
  - Side Slope (run/rise): 2.0
  - Approximate Volume (not including 2 ft. freeboard): 2,705,808 $ft^3$ (~20,239,444 gal)
- 2nd Covered Lagoon Anaerobic Digester Cell
  - Top Dimensions: 500 ft long x 200 ft wide
  - Average Depth: 22.75 ft
  - Side Slope (run/rise): 2.0
  - Approximate Volume (not including 2 ft. freeboard): 1,613,210 $ft^3$ (~10,612,380 gal)

Digester Gas-Fired IC Engines

The applicant is proposing to install two 1,468 bhp GE Jenbacher model J 320 GS-C82 lean burn digester gas-fired IC engines (or equivalent engines of equal or lesser rating approved by the District, such as 1,412 bhp Caterpillar model A3516A+ IC engines or 1,431 bhp Dresser Rand Guascor model SFGLD 560 IC engines). Each engine will be equipped with an SCR system and will power an electrical generator that will produce up to 1,059 kWe. Digester gas, which consists mostly of methane, the main component of natural gas, will be combusted in the IC engines to produce power. After initial removal of $H_2S$ in the digester system, the digester gas will be piped to the gas conditioning system for polishing to remove $H_2S$ using an iron sponge and/or activated carbon $H_2S$ scrubber or an equivalent $H_2S$ removal system and for removal of moisture. The digester gas will then be piped to the IC engines for use as fuel. The engines will power electrical generators that will produce power to be sold to a utility. Excess heat from the engines will be used in the first covered lagoon anaerobic digester (West

Lagoon Digester) to promote more efficient production of digester gas. The engines will be permitted to operate up to 24 hr/day and 8,760 hr/year.

In addition to the use of digester gas as fuel, the engines will also be permitted to use natural gas as fuel for no more than 96,000 kW-hrs of operation during initial utility interconnect testing in the event that insufficient digester gas is available for the engines at the time that the required utility testing is scheduled. The engines will remain subject to the same emission limits during the limited period that allows the use of natural gas fuel for required utility testing.

## V. Equipment Listing

S-8637-1-0: ANAEROBIC DIGESTER SYSTEM CONSISTING OF COVERED LAGOON ANAEROBIC DIGESTER CELL(S) WITH PRESSURE/VACUUM VALVE(S) AND AN AIR INJECTION SYSTEM FOR CONTROL OF H2S

S-8637-2-0: 1,468 BHP GE JENBACHER MODEL J 320 GS-C82 (OR DISTRICT APPROVED EQUIVALENT) DIGESTER GAS-FIRED LEAN-BURN IC ENGINE WITH A SELECTIVE CATALYTIC REDUCTION (SCR) SYSTEM, AND AN IRON SPONGE AND/OR CARBON H2S REMOVAL SYSTEM (OR APPROVED EQUIVALENT H2S REMOVAL SYSTEM) POWERING AN ELECTRICAL GENERATOR

S-8637-3-0: 1,468 BHP GE JENBACHER MODEL J 320 GS-C82 (OR DISTRICT APPROVED EQUIVALENT) DIGESTER GAS-FIRED LEAN-BURN IC ENGINE WITH A SELECTIVE CATALYTIC REDUCTION (SCR) SYSTEM, AND AN IRON SPONGE AND/OR CARBON H2S REMOVAL SYSTEM (OR APPROVED EQUIVALENT H2S REMOVAL SYSTEM) POWERING AN ELECTRICAL GENERATOR

## VI. Emission Control Technology Evaluation

Digester System (S-8637-1-0)

The digester system will be equipped with a pressure-vacuum (PV) relief valves or an emergency venting system. The digester gas will be scrubbed to remove hydrogen sulfide ($H_2S$) and will be used to fuel engines to generate electricity. Combustion of the digester gas in the engines will convert any VOCs present in the gas into carbon dioxide and water. As stated above, because the digester system will be able to store the gas for extended periods and the engines will have more than enough capacity to combust all of the gas generated, no flare is being proposed for this digester project.

$H_2S$ Removal

As described above, the covered lagoon anaerobic digester will utilize an air injection system for removal of $H_2S$ from the digester gas. The continuous injection of controlled quantities of air under the lagoon covers increases the amount of oxygen in the space under the digester covers and the surface layer of the liquid in the covered lagoon digester, which facilitates oxidation of sulfides in the digester gas and in the liquid surface to elemental sulfur and water.

The sulfur dissolves in the liquid in the digester and can be removed from the digester system by deposition and filtration. Injection of air also promotes biological removal of $H_2S$ from the digester gas by facilitating the establishment of sulfur oxidizing microorganisms, such as Thiobacillus species, which have the ability to grow under various environmental conditions and oxidize $H_2S$ to elemental sulfur and sulfates that can be removed from the digester system. Use of air injection to remove $H_2S$ from digester gas has been shown to have higher effectiveness in covered lagoon digesters because the large areas under the lagoon covers facilitate contact with the digester gas and lagoon surface, which enables improved oxidation and biological reduction of sulfides. Successful installations of the air injection sulfur removal system have demonstrated significantly reduced operation costs when compared to other methods of sulfur removal.

For final polishing, the digester gas will be sent through an iron sponge $H_2S$ scrubber and/or an activated carbon $H_2S$ scrubber or an equivalent system to remove $H_2S$ from the gas prior to combustion in the proposed engines.

An iron sponge scrubber is comprised of vessel(s) containing iron sponge, which consists of a hydrated form of iron oxide infused onto wood shavings. The wood shavings serve only as a carrier for the iron oxide powder. Iron oxide infused into the wood surface will not wash off or migrate with the gas. As the gas passes through the iron sponge material, the $H_2S$ is removed by the following chemical reaction producing black iron sulfide and water:

$$H_2S + Fe(OH)_2 \rightarrow FeS + 2H_2O + heat$$

For the iron sponge to perform effectively, it must be maintained within a defined range of sufficient moisture content. This requirement is typically satisfied if the gas is saturated with water vapor, as is frequently the case with digester gas. If the iron sponge becomes dry, it can be re-wet and remain effective. The iron sponge reaction is not pressure sensitive.

Specially treated activated carbon can also be used to remove $H_2S$ from gas streams. $H_2S$ will be adsorbed as the gas flows through the activated carbon bed. Activated carbon has a large number of pores, which greatly increase the surface area for adsorption. Contaminants in the gas diffuse into these pores and are retained on the carbon surface due to both chemical and physical forces. Activated carbon used for the removal of $H_2S$ is usually treated with chemical bases to increase the holding capacity for $H_2S$.

The proposed scrubber will consist of enclosed vessels filled with iron sponge and/or treated activated carbon. The digester gas will flow through the scrubber and then to a dryer and chiller to remove moisture. For continuous operation, there will be a secondary unit that will be brought online at specified times or when monitoring indicates that the primary unit is nearing saturation. Valves can be arranged so either bed can operate while the other is serviced. The useful life of the iron sponge and activated carbon vessels will vary depending on the inlet concentration of $H_2S$, the flow rate, and the mass in the vessels. Before a scrubber is completely spent, it must be regenerated or replaced. Spent iron sponge or activated carbon vessels will be sent to a regeneration facility or to an appropriate disposal facility.

The proposed scrubber will be capable of reducing $H_2S$ concentrations in the digester gas to 40 ppmv or less. Reducing the $H_2S$ concentration in the gas will minimize $SO_X$ emissions from

combustion and will also reduce the maintenance requirements for the engines and will protect catalysts from masking, plugging, and poisoning.

Digester Gas-Fired IC Engines (S-8637-2-0 & -3-0)

The proposed engines will be equipped with:

- Turbocharger
- Aftercooler
- Air/Fuel Ratio or an $O_2$ Controller
- Lean Burn Technology
- Positive Crankcase Ventilation (PCV) or 90% efficient control device
- Selective Catalytic Reduction (SCR)

The turbocharger reduces $NO_X$ emissions from engines by increasing the efficiency and promoting more complete burning of the fuel.

The aftercooler functions in conjunction with the turbocharger to reduce the inlet air temperature. By reducing the inlet air temperature, the peak combustion temperature is lowered, which reduces the formation of thermal $NO_X$.

The fuel/air ratio controller (oxygen controller) is used to maintain the amount of oxygen in the exhaust stream to optimize engine operation and catalyst function.

Lean burn technology increases the volume of air in the combustion process and therefore increases the heat capacity of the mixture. This technology also incorporates improved swirl patterns to promote thorough air/fuel mixing. This in turn lowers the combustion temperature and reduces $NO_X$ formation.

The PCV system or 90% efficient control device reduces crankcase VOC and $PM_{10}$ emissions by at least 90% over an uncontrolled crankcase vent.

A Selective Catalytic Reduction (SCR) system operates as an external control device where flue gases and a reagent, in this case urea, pass through an appropriate catalyst. Urea, will be injected upstream of the catalyst where it is converted to ammonia. The ammonia is used to reduce $NO_X$, over the catalyst bed, to form elemental nitrogen, water vapor, and other by-products. The use of a catalyst typically reduces the $NO_X$ emissions by up to 90%.

## VII. General Calculations

### A. Assumptions

- ABEC #3 LLC dba Lakeview Dairy Biogas (Facility S-8637) and Lakeview Farms dairy (Facility S-5254) are separate stationary sources at the same site.
- Because of the high moisture content of separated manure solids, PM emissions from the handling of separated solids for the digester system are considered negligible.
- Because the manure for the digester system will be taken from the mechanical separation system at Lakeview Farms dairy and the digested solids and effluent from the digester system will be returned to Lakeview Farms dairy for use, all emissions from the manure

processed in the digester system will be allocated to the liquid manure handling system at Lakeview Farms dairy.

- The proposed digester system will reduce potential VOC emissions from manure generated by the cattle at Lakeview Farms dairy. Manure that is currently stored in uncovered lagoon(s) and pond(s) will instead be placed in covered ponds at the ABEC #3 LLC facility, thereby decreasing volatilization of compounds from the manure. In a digester, most VOCs present will be converted to methane (an exempt compound) and carbon dioxide further reducing the potential for VOC emissions. Because results of dairy digester analyses have indicated very low VOC content (less than 1% by weight), fugitive VOC emissions from the digester system are assumed to be negligible, consistent with District Policy SSP 2015. During operation, the digester gas will be directed to the engines where the gas will be combusted resulting in the oxidation of gaseous hydrocarbons into carbon dioxide and water. Therefore, VOC emissions from the digester system are considered negligible.
- Molar composition of typical digester gas is about 60% methane and 40% carbon dioxide with trace amounts of hydrogen sulfide, VOC, and other compounds.[1]
- Typical Higher Heating Value for Digester Gas: 600 Btu/scf (Per AP-42 (4/00) - notes to Tables Table 3.1-1, Table 3.1-2b, Table 3.1-7, and Table 3.1-8)
- Typical EPA F-factor for Digester Gas: 9,100 dscf/MMBtu (dry, adjusted to 60 °F), (Estimated based on previous digester gas fuel analyses for source tests)
- Average sulfur content of the scrubbed digester gas: 40 ppmv as $H_2S$ (required as BACT; approximately 2.4 grains/100 scf)
- bhp to Btu/hr conversion: 2,545 Btu/hp-hr
- Thermal efficiency of engines: commonly ≈ 33%
- Molar Specific Volume = 379.5 scf/lb-mol (at 60°F)
- Molecular weights:
  $NO_X$ (as $NO_2$) = 46 lb/lb-mol  CO = 28 lb/lb-mol  NH3 = 17 lb/lb-mol
  VOC (as $CH_4$) = 16 lb/lb-mol  $SO_X$ (as $SO_2$) = 64.06 lb/lb-mol
- Each of the engines will be permitted to operate 24 hours/day and 365 days per year.
- There will be no increase in permitted emissions for the limited use of natural gas for required initial utility testing in the event that sufficient digester gas is not available for the engines at the time that the required initial utility testing is scheduled.
- PM2.5 emissions from the digester gas-fired IC engines are assumed to be equal to PM10 emissions.

[1] U.S. EPA AgSTAR (http://www2.epa.gov/agstar), "Market Opportunities for Biogas Recovery Systems at U.S. Livestock Facilities" (November 2011, http://www2.epa.gov/agstar/agstar-market-opportunities-report); American Biogas Council – Frequent Questions (https://www.americanbiogascouncil.org/biogas_questions.asp); "Anaerobic Digestion Overview", David Schmidt, University of Minnesota Department of Biosystems and Agricultural Engineering (http://www.extension.umn.edu/agriculture/manure-management-and-air-quality/manure-treatment/docs/anaerobic-digestion-overview.pdf); and "Anaerobic Digestion of Animal Wastes: Factors to Consider", ATTRA - National Sustainable Agriculture Information Service (https://attra.ncat.org/attra-pub/summaries/summary.php?pub=307)

Assumptions for Commissioning Period

- The applicant has requested that the ATC permits include a commissioning period to allow testing, adjustment, tuning, and calibration of the engines without the SCR systems installed. The duration of the commissioning period shall consist of no more than 120 hours of operation of each engine without an SCR system installed.
- Engine emissions during the commissioning period will be calculated as uncontrolled based on information provided by the engine supplier.

## B. Emission Factors

Emission Factors during the Commissioning Period:

The commissioning period precedes normal operation of a power plant. Activities conducted during the commissioning period typically include: checking all mechanical, electrical, and control systems for the units and related equipment; confirming the performance measures specified for the equipment; test firing the units; and tuning of the units and the generators. The early stages of commissioning are conducted prior to the installation of the emission control equipment to prevent damage to this equipment. In accordance with EPA's guidance, the commissioning period is considered the final phase of the construction process rather than initial startup of the equipment.[2] Therefore, other than quantifying emissions for New and Modified Source Review (NSR), source-specific emission limitations from applicable rules and regulations are generally not effective until completion of the commissioning period. Because emission control devices are not in place and functioning during commissioning, higher emission limits are required during this time.

The emission factors for $NO_X$ (1.0 g/bhp-hr), CO (4.85 g/bhp-hr), and VOC (1.0 g/bhp-hr) for the commissioning period are the emission factors provided by the engine supplier for the engines without SCR systems or oxidation catalysts. The emission factors during the commissioning period for $SO_X$ (0.04 g/bhp-hr), $PM_{10}$ (0.07 g/bhp-hr), and ammonia slip (0.05 g/bhp-hr) after initial installation of the SCR system are assumed to be the same emissions factors as during normal operation. $SO_X$ emissions are based on the maximum sulfur content of the dairy digester gas (required as BACT; approximately 2.4 grains/100 scf). $PM_{10}$ emissions on a lb/MMBtu basis are assumed to be similar to natural gas-fueled IC engines. For more conservative $PM_{10}$ emission calculations, the PM emission factor for rich burn natural gas-fueled engines given in EPA's Compilation of Air Pollutant Emission Factors (AP-42) is used because it is higher than the value for lean burn natural gas-fueled engines listed in EPA AP-42. The ammonia emission factor is based on the ammonia slip limit of 10 ppmv $NH_3$.

[2] See US EPA Implementation Question and Answer Document for National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines and New Source Performance Standards for Stationary Compression Ignition and Spark Ignition Internal Combustion Engines, April 2, 2013, Question 39 (http://www.epa.gov/airtoxics/icengines/docs/20120717riceqaupdate.pdf)

| Commissioning Period Emission Factors for Digester Gas-Fired Engines | | |
|---|---|---|
| Pollutant | g/bhp·hr | Source |
| $NO_X$ | 1.0 | Engine Supplier's Information |
| $SO_X$ | 0.04 | 40 ppmvd in fuel gas; BACT Requirement/Mass Balance equation below |
| $PM_{10}$ | 0.07 | AP-42 (7/00) Table 3.2-3 (Conservative Value based on Rich-Burn Natural Gas Engines) |
| CO | 4.85 | Engine Supplier's Information |
| VOC | 1.0 | Engine Supplier's Information |
| $NH_3$ | 0.05 | 10 ppmvd @ 15% $O_2$ in exhaust; Required/Proposed – See equation below |

$SO_X$ – 40 ppmvd $H_2S$ in fuel gas

$$\frac{40\,ft^3\,H_2S}{10^6\,ft^3} \times \frac{32.06\,lb\,S}{lb\text{-}mol\,H_2S} \times \frac{lb\text{-}mole}{379.5\,ft^3} \times \frac{64.06\,lb\,SO_2}{32.06\,lb\,S} \times \frac{ft^3}{600\,Btu} \times \frac{10^6\,Btu}{MMBtu} = 0.0113\,\frac{lb\,SOx}{MMBtu}$$

$$0.0113\,\frac{lb\,SOx}{MMBtu} \times \frac{1\,MMBtu}{10^6\,Btu} \times \frac{Btu_{in}}{0.33Btu_{out}} \times \frac{2{,}545\,Btu}{hp\text{-}hr} \times \frac{453.59\,g}{lb} = 0.040\,\frac{g\,SOx}{bhp\text{-}hr}$$

$NH_3$ – 10 ppmvd @ 15% $O_2$ in exhaust

$$\frac{10\,ppmv\,NH_3}{10^6} \times \frac{17\,lb\,NH_3}{lb\text{-}mole} \times \frac{lb\text{-}mole}{379.5\,ft^3} \times \frac{9{,}100\,ft^3}{MMBtu} \times \frac{20.9\%\,O_2}{(20.9-15)\%\,O_2} = 0.0144\,\frac{lb\,NH_3}{MMBtu}$$

$$0.0144\,\frac{lb\,NH_3}{MMBtu} \times \frac{1\,MMBtu}{10^6\,Btu} \times \frac{Btu_{in}}{0.33Btu_{out}} \times \frac{2{,}545\,Btu}{hp\text{-}hr} \times \frac{453.59\,g}{lb} = 0.05\,\frac{g\,NH_3}{bhp\text{-}hr}$$

Emission Factors during Normal Operation after the Commissioning Period:

The emission factors for $NO_X$ (0.15 g/bhp-hr), CO (1.75 g/bhp-hr), and VOC (0.10 g/bhp-hr) for the proposed engines during normal operation were proposed by the applicant and are supported by information provided by the engine supplier. The emission factors for $NO_X$ and VOC were required as BACT. The emission factors for $SO_X$ (0.04 g/bhp-hr), $PM_{10}$ (0.07 g/bhp-hr), and ammonia slip (0.05 g/bhp-hr) during normal operation are same as the emission factors presented above for the commissioning period.

| Emission Factors for Digester Gas-Fired Engines (Normal Operation) | | | | |
|---|---|---|---|---|
| Pollutant | g/bhp·hr | lb/MMBtu | ppmvd (@ 15%$O_2$) | Source |
| $NO_X$ | 0.15 | 0.0429 | 11 ppmvd | BACT Requirement; Proposed by Applicant – See equation on Page 11 below |
| $SO_X$ | 0.04 | 0.0113 | 40 ppmvd in fuel gas | BACT Requirement/Mass Balance equation above |
| $PM_{10}$ | 0.07 | 0.01941 | -- | AP-42 (7/00) Table 3.2-3 (Conservative Value based on Rich-Burn Natural Gas Engines) |
| CO | 1.75 | 0.500 | 210 ppmvd | Proposed by Applicant – See equation on Page 11 below |
| VOC | 0.10 | 0.0286 | 21 ppmvd as $CH_4$ | BACT Requirement; Proposed by Applicant – See equation on Page 11 below |
| $NH_3$ | 0.05 | 0.0144 | 10 ppmvd | Required/Proposed – See equation above |

$NO_X$ – 0.15 g/bhp-hr

$$0.15\frac{g\,NOx}{bhp-hr}\times\frac{1\,lb}{453.59\,g}\times\frac{1\,hp-hr}{2{,}545\,Btu}\times\frac{0.33Btu_{out}}{1Btu_{in}}\times\frac{10^6\,Btu}{1\,MMBtu}=0.0429\frac{lb\,NOx}{MMBtu}$$

$$0.0429\frac{lb\,NOx}{MMBtu}\times\frac{(20.9-15)\%\,O_2}{20.9\%\,O_2}\times\frac{1\,MMBtu}{9{,}100\,ft^3}\times\frac{379.5\,ft^3}{lb-mole}\times\frac{lb-mole}{46\,lb\,NOx}\times\frac{10^6\,ppmv}{1}=11\ ppmvd\ NOx\ @\ 15\%\ O_2$$

CO – 1.75 g/bhp-hr

$$1.75\frac{g\,CO}{bhp-hr}\times\frac{1\,lb}{453.59\,g}\times\frac{1\,hp-hr}{2{,}545\,Btu}\times\frac{0.33Btu_{out}}{1Btu_{in}}\times\frac{10^6\,Btu}{1\,MMBtu}=0.500\frac{lb\,CO}{MMBtu}$$

$$0.500\frac{lb\,CO}{MMBtu}\times\frac{(20.9-15)\%\,O_2}{20.9\%\,O_2}\times\frac{1\,MMBtu}{9{,}100\,ft^3}\times\frac{379.5\,ft^3}{lb-mole}\times\frac{lb-mole}{28\,lb\,CO}\times\frac{10^6\,ppmv}{1}=210\,ppmvd\ CO\ @\ 15\%\ O_2$$

VOC – 0.10 g/bhp-hr

$$0.10\frac{g\,VOC}{bhp-hr}\times\frac{1\,lb}{453.59\,g}\times\frac{1\,hp-hr}{2{,}545\,Btu}\times\frac{0.33Btu_{out}}{1Btu_{in}}\times\frac{10^6\,Btu}{1\,MMBtu}=0.0286\frac{lb\,VOC}{MMBtu}$$

$$0.0286\frac{lb\,VOC}{MMBtu}\times\frac{(20.9-15)\%\,O_2}{20.9\%\,O_2}\times\frac{1\,MMBtu}{9{,}100\,ft^3}\times\frac{379.5\,ft^3}{lb-mole}\times\frac{lb-mole}{16\,lb\,VOC}\times\frac{10^6\,ppmv}{1}=21\,ppmvd\ VOC\ @\ 15\%\ O_2$$

## C. Calculations

### 1. Pre-Project Potential to Emit (PE1)

Since the digester system and the engines are new emissions units, PE1 = 0 for all affected pollutants.

### 2. Post Project Potential to Emit (PE2)

Digester System (S-8637-1-0)

As explained above, the digester system will be composed of sealed lagoons that will reduce VOC emissions from the manure and will have negligible fugitive emissions; therefore, VOC emissions from the manure will only be attributed to Lakeview Farms dairy for manure prior to entering the digester system and when returned to the dairy and emissions from the digester system are considered negligible.

Digester Gas-Fired Engines (S-8637-2-0 and -3-0)

Daily PE2 for Each Engine during the Commissioning Period:

Daily PE during the commissioning period for each of the proposed engines is calculated in the table below:

| Daily PE for Engines S-8637-2-0 &-3-0 During the Commissioning Periods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $NO_X$ | 1.0 | (g/hp·hr) x | 1,468 | (hp) x | 24 | (hr/day) ÷ 453.59 (g/lb) = | **77.7** | (lb/day) |
| $SO_X$ | 0.04 | (g/hp·hr) x | 1,468 | (hp) x | 24 | (hr/day) ÷ 453.59 (g/lb) = | **3.1** | (lb/day) |
| $PM_{10}$ | 0.07 | (g/hp·hr) .x | 1,468 | (hp) x | 24 | (hr/day) ÷ 453.59 (g/lb) = | **5.4** | (lb/day) |
| CO | 4.85 | (g/hp·hr) x | 1,468 | (hp) x | 24 | (hr/day) ÷ 453.59 (g/lb) = | **376.7** | (lb/day) |
| VOC | 1.0 | (g/hp·hr) x | 1,468 | (hp) x | 24 | (hr/day) ÷ 453.59 (g/lb) = | **77.7** | (lb/day) |
| $NH_3$ | 0.05 | (g/hp·hr) x | 1,468 | (hp) x | 24 | (hr/day) ÷ 453.59 (g/lb) = | **3.9** | (lb/day) |

Daily PE2 for Each Engine during Normal Operation after the Commissioning Period:

Daily PE for each of the proposed engines during normal operation after completion of the commissioning periods is calculated in the table below:

| Daily PE for Engines S-8637-2-0 &-3-0 After Commissioning | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $NO_X$ | 0.15 | (g/hp·hr) x | 1,468 | (hp) x | 24 | (hr/day) ÷ 453.59 (g/lb) = | **11.7** | (lb/day) |
| $SO_X$ | 0.04 | (g/hp·hr) x | 1,468 | (hp) x | 24 | (hr/day) ÷ 453.59 (g/lb) = | **3.1** | (lb/day) |
| $PM_{10}$ | 0.07 | (g/hp·hr) x | 1,468 | (hp) x | 24 | (hr/day) ÷ 453.59 (g/lb) = | **5.4** | (lb/day) |
| CO | 1.75 | (g/hp·hr) x | 1,468 | (hp) x | 24 | (hr/day) ÷ 453.59 (g/lb) = | **135.9** | (lb/day) |
| VOC | 0.10 | (g/hp·hr) x | 1,468 | (hp) x | 24 | (hr/day) ÷ 453.59 (g/lb) = | **7.8** | (lb/day) |
| $NH_3$ | 0.05 | (g/hp·hr) x | 1,468 | (hp) x | 24 | (hr/day) ÷ 453.59 (g/lb) = | **3.9** | (lb/day) |

Maximum Annual PE2 for Each Engine During the first Year Including the Commissioning Periods:

As discussed above, each of the proposed engines will be allowed to operate up to 120 hours for commissioning during the first year of operation. The maximum annual PE for each engine will calculated based on the maximum hours of operation during the commissioning period and the remaining hours during normal operation.

$NO_X$
1,468 bhp x (1.0 g-$NO_X$/bhp-hr x 120 hr + 0.15 g-$NO_X$/bhp-hr x 8,640 hr) ÷ 453.59 g/lb = **4,583 lb-$NO_X$**

$SO_X$
1,468 bhp x (0.04 g-$SO_X$/bhp-hr x 120 hr + 0.04 g-$SO_X$/bhp-hr x 8,640 hr) ÷ 453.59 g/lb = **1,134 lb-$SO_X$**

$PM_{10}$
1,468 bhp x (0.07 g-$PM_{10}$/bhp-hr x 120 hr + 0.07 g-$PM_{10}$/bhp-hr x 8,640 hr) ÷ 453.59 g/lb = **1,985 lb-$PM_{10}$**

CO
1,468 bhp x (4.85 g-CO/bhp-hr x 120 hr + 1.75 g-CO/bhp-hr x 8,640 hr) ÷ 453.59 g/lb = **50,818 lb-CO**

VOC
1,468 bhp x (1.0 g-VOC/bhp-hr x 120 hr + 0.10 g-VOC/bhp-hr x 8,640 hr) ÷ 453.59 g/lb
= **3,185 lb-VOC**

$NH_3$
1,468 bhp x (0.05 g-$NH_3$/bhp-hr x 120 hr + 0.05 g-$NH_3$/bhp-hr x 8,640 hr) ÷ 453.59 g/lb
= **1,418 lb-$NH_3$**

Maximum Total Combined Annual PE2 from Both Engines, Including Commissioning:

The maximum total combined annual PE2 for both the engines, including commissioning emissions, is calculated as follows:

$NO_X$: 4,583 lb-$NO_X$/yr-engine x 2 engines = **9,166 lb-$NO_X$/yr**
$SO_X$: 1,134 lb-$SO_X$/yr-engine x 2 engines = **2,268 lb-$SO_X$/yr**
$PM_{10}$: 1,985 lb-$PM_{10}$/yr-engine x 2 engines = **3,970 lb-$PM_{10}$/yr**
CO: 50,818 lb-CO/yr-engine x 2 engines = **101,636 lb-CO/yr**
VOC: 3,185 lb-VOC/yr-engine x 2 engines = **6,370 lb-VOC/yr**
$NH_3$: 1,418 lb-$NH_3$/yr-engine x 2 engines = **2,836 lb-$NH_3$/yr**

Annual PE2 for Each Engine in years with no Commissioning:

The annual PE2 for each of the engines after completion of the first year of operation when there will not be any commissioning emissions is calculated as follows:

| **Annual PE2 for Engines S-8637-2-0 &-3-0 with no Commissioning** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $NO_X$ | 0.15 | (g/hp·hr) x | 1,468 | (hp) x | 8,760 | (hr) ÷ 453.59 (g/lb) = | **4,253** | (lb/yr) |
| $SO_X$ | 0.04 | (g/hp·hr) x | 1,468 | (hp) x | 8,760 | (hr) ÷ 453.59 (g/lb) = | **1,134** | (lb/yr) |
| $PM_{10}$ | 0.07 | (g/hp·hr) x | 1,468 | (hp) x | 8,760 | (hr) ÷ 453.59 (g/lb) = | **1,985** | (lb/yr) |
| CO | 1.75 | (g/hp·hr) x | 1,468 | (hp) x | 8,760 | (hr) ÷ 453.59 (g/lb) = | **49,614** | (lb/yr) |
| VOC | 0.10 | (g/hp·hr) x | 1,468 | (hp) x | 8,760 | (hr) ÷ 453.59 (g/lb) = | **2,835** | (lb/yr) |
| $NH_3$ | 0.05 | (g/hp·hr) x | 1,468 | (hp) x | 8,760 | (hr) ÷ 453.59 (g/lb) = | **1,418** | (lb/yr) |

Max Total Combined Annual PE2 from Both Engines in years with no Commissioning:

The maximum total combined annual PE2 for both the engines in years with no commissioning is calculated as follows:

$NO_X$: 4,253 lb-$NO_X$/yr-engine x 2 engines = **8,506 lb-$NO_X$/yr**
$SO_X$: 1,134 lb-$SO_X$/yr-engine x 2 engines = **2,268 lb-$SO_X$/yr**
$PM_{10}$: 1,985 lb-$PM_{10}$/yr-engine x 2 engines = **3,970 lb-$PM_{10}$/yr**
CO: 49,614 lb-CO/yr-engine x 2 engines = **99,228 lb-CO/yr**
VOC: 2,835 lb-VOC/yr-engine x 2 engines = **5,670 lb-VOC/yr**
$NH_3$: 1,418 lb-$NH_3$/yr-engine x 2 engines = **2,836 lb-$NH_3$/yr**

**Maximum Daily and Annual PE2 from Calculations Above:**

The maximum daily and annual emissions for each pollutant calculated above, including commissioning emissions, are shown in the table below.

| Max. Post-Project Potential to Emit (PE2) for S-8637-2-0 &-3-0 | | | |
|---|---|---|---|
| | Max. Daily Emissions for each engine (lb/day) | Max. Annual Emissions for each engine (lb/year) | Max. Total Combined Annual Emissions for both engines (lb/year) |
| $NO_X$ | 77.7 | 4,583 | 9,166 |
| $SO_X$ | 3.1 | 1,134 | 2,268 |
| $PM_{10}$ | 5.4 | 1,985 | 3,970 |
| CO | 376.7 | 50,818 | 101,636 |
| VOC | 77.7 | 3,185 | 6,370 |
| $NH_3$ | 3.9 | 1,418 | 2,836 |

### 3. Pre-Project Stationary Source Potential to Emit (SSPE1)

Pursuant to District Rule 2201, the SSPE1 is the Potential to Emit (PE) from all units with valid Authorities to Construct (ATC) or Permits to Operate (PTO) at the Stationary Source and the quantity of Emission Reduction Credits (ERC) which have been banked since September 19, 1991 for Actual Emissions Reductions (AER) that have occurred at the source, and which have not been used on-site.

Since this is a new facility, there are no valid ATCs, PTOs, or ERCs at the Stationary Source; therefore, the SSPE1 is equal to zero for all pollutants.

### 4. Post Project Stationary Source Potential to Emit (SSPE2)

Pursuant to District Rule 2201, the SSPE2 is the PE from all units with valid ATCs or PTOs at the Stationary Source and the quantity of ERCs which have been banked since September 19, 1991 for AER that have occurred at the source, and which have not been used on-site.

| SSPE2 (lb/year) | | | | | | |
|---|---|---|---|---|---|---|
| Permit Unit | $NO_X$ | $SO_X$ | $PM_{10}$ | CO | VOC | $NH_3$ |
| ATC S-8637-1-0 (Digester System) | 0 | 0 | 0 | 0 | 0 | 0 |
| ATC S-8637-2-0 (1,468 bhp Digester Gas Engine)[3] | 4,583 | 1,134 | 1,985 | 50,818 | 3,185 | 1,418 |
| ATC S-8637-3-0 (1,468 bhp Digester Gas Engine)[3] | 4,583 | 1,134 | 1,985 | 50,818 | 3,185 | 1,418 |
| SSPE2 | 9,166 | 2,268 | 3,970 | 101,636 | 6,370 | 2,836 |

[3] The SSPE2 values listed in this table include the worst case annual emissions during the 120 hours of allowed commissioning time where the engines are allowed to operate uncontrolled for setup and tuning purposes. After the first year, the PE for $NO_X$, CO, and VOC emissions will go down as the engines will no longer be allowed to operate without controls in place for these pollutants.

## 5. Major Source Determination

**Rule 2201 Major Source Determination:**

Pursuant to District Rule 2201, a Major Source is a stationary source with a SSPE2 equal to or exceeding one or more of the following threshold values. For the purposes of determining major source status the following shall not be included:

- any ERCs associated with the stationary source
- Emissions from non-road IC engines (i.e. transportable IC engines at a particular site at the facility for less than 12 months)
- Fugitive emissions, except for the specific source categories specified in 40 CFR 51.165

| Rule 2201 Major Source Determination (lb/year) | | | | | | |
|---|---|---|---|---|---|---|
| | $NO_X$ | $SO_X$ | $PM_{10}$ | $PM_{2.5}$ | CO | VOC |
| SSPE1 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSPE2 | 9,166 | 2,268 | 3,970 | 3,970 | 101,636 | 6,370 |
| Major Source Threshold | 20,000 | 140,000 | 140,000 | 200,000* | 200,000 | 20,000 |
| Major Source? | No | No | No | No | No | No |

* The application for this project was deemed complete before 2/18/2016, which was when the District's PM2.5 Major Source Threshold was lowered to 140,000 lb/year

Note: PM2.5 assumed to be equal to PM10

**Rule 2410 Major Source Determination:**

The facility or the equipment evaluated under this project is not listed as one of the categories specified in 40 CFR 52.21 (b)(1)(iii). Therefore the PSD Major Source threshold is 250 tons per year (tpy) for any regulated NSR pollutant.

| PSD Major Source Determination (tons/year) | | | | | | |
|---|---|---|---|---|---|---|
| | NO2 | VOC | SO2 | CO | PM | PM10 |
| Estimated Facility PE before Project Increase | 0 | 0 | 0 | 0 | 0 | 0 |
| PSD Major Source Thresholds | 250 | 250 | 250 | 250 | 250 | 250 |
| PSD Major Source ? (Y/N) | N | N | N | N | N | N |

Because this is a new facility, the PE for all regulated NSR pollutants prior to the project is equal to zero.

As shown above, the facility is not an existing PSD major source for any regulated NSR pollutant expected to be emitted at this facility.

**6. Baseline Emissions (BE)**

The BE calculation (in lb/year) is performed pollutant-by-pollutant for each unit within the project to calculate the QNEC, and if applicable, to determine the amount of offsets required.

Pursuant to District Rule 2201, BE = PE1 for:

- Any unit located at a non-Major Source,
- Any Highly-Utilized Emissions Unit, located at a Major Source,
- Any Fully-Offset Emissions Unit, located at a Major Source, or
- Any Clean Emissions Unit, located at a Major Source.

otherwise,

BE = Historic Actual Emissions (HAE), calculated pursuant to District Rule 2201.

Since the proposed digester system and engines are new emissions units, BE = PE1 = 0 for all pollutants from each unit.

**7. SB 288 Major Modification**

SB 288 Major Modification is defined in 40 CFR Part 51.165 as "any physical change in or change in the method of operation of a major stationary source that would result in a significant net emissions increase of any pollutant subject to regulation under the Act."

Since this facility is not a major source for any of the pollutants addressed in this project, this project does not constitute an SB 288 major modification.

**8. Federal Major Modification**

District Rule 2201 states that a Federal Major Modification is the same as a "Major Modification" as defined in 40 CFR 51.165 and part D of Title I of the CAA.

Since this facility is not a Major Source for any pollutants, this project does not constitute a Federal Major Modification. Additionally, since the facility is not a major source for $PM_{10}$ (140,000 lb/year), it is not a major source for PM2.5 (200,000 lb/year since the application for the project was deemed complete before 2/18/2016).

**9. Rule 2410 – Prevention of Significant Deterioration (PSD) Applicability Determination**

Rule 2410 applies to any pollutant regulated under the Clean Air Act, except those for which the District has been classified nonattainment. The pollutants which must be addressed in the PSD applicability determination for sources located in the SJV and which are emitted in this project are: (See 52.21 (b) (23) definition of significant)

- NO2 (as a primary pollutant)
- SO2 (as a primary pollutant)
- CO
- PM
- PM10
- Hydrogen sulfide (H2S)[4]
- Total reduced sulfur (inlcuding H2S)[4]

## I. Project Emissions Increase - New Major Source Determination

The post-project potentials to emit from all new and modified units are compared to the PSD major source thresholds to determine if the project constitutes a new major source subject to PSD requirements.

The facility or the equipment evaluated under this project is not listed as one of the categories specified in 40 CFR 52.21 (b)(1)(i). The PSD Major Source threshold is 250 tons per year (tpy) for any regulated NSR pollutant.

| PSD Major Source Determination: Potential to Emit (tons/year) | | | | | | |
|---|---|---|---|---|---|---|
| | NO2 | VOC | SO2 | CO | PM | PM10 |
| Total PE from New and Modified Units | 4.6 | 3.2 | 1.1 | 50.8 | 2.0 | 2.0 |
| PSD Major Source threshold | 250 | 250 | 250 | 250 | 250 | 250 |
| New PSD Major Source? | N | N | N | N | N | N |

As shown in the table above, the potential to emit for the project, by itself, does not exceed any PSD major source threshold. Therefore Rule 2410 is not applicable and no further analysis is required.

## 10. Quarterly Net Emissions Change (QNEC)

The QNEC is calculated solely to establish emissions that are used to complete the District's PAS emissions profile screen. Detailed QNEC calculations are included in Appendix A.

[4] Because the facility is not included in the specific source categories listed in 40 CFR 51.165, for PSD purposes only non-fugitive emissions from the engine exhaust stacks must be addressed for this project. Although the sulfur (primarily $H_2S$) in the fuel will be converted almost entirely to $SO_X$ during combustion, the maximum possible amount of $H_2S$ and total reduced sulfur compounds from the engine stacks can be calculated by assuming that all sulfur in the fuel is emitted as $H_2S$. Based on the fuel sulfur limit of 40 ppmv as $H_2S$, the maximum possible $H_2S$ emission factor for the engines is calculated to be 0.02 g-$H_2S$/bhp (0.0056 lb-$H_2S$/MMBtu), resulting in a total combined maximum of < 0.06 tpy $H_2S$ from the exhaust stacks of both engines. This is well below the applicable PSD threshold of 250 tpy.

## VIII. Compliance

### Rule 2201 New and Modified Stationary Source Review Rule

#### A. Best Available Control Technology (BACT)

##### 1. BACT Applicability

BACT requirements are triggered on a pollutant-by-pollutant basis and on an emissions unit-by-emissions unit basis. Unless specifically exempted by Rule 2201, BACT shall be required for the following actions*:

a. Any new emissions unit with a potential to emit exceeding two pounds per day,
b. The relocation from one Stationary Source to another of an existing emissions unit with a potential to emit exceeding two pounds per day,
c. Modifications to an existing emissions unit with a valid Permit to Operate resulting in an AIPE exceeding two pounds per day, and/or
d. Any new or modified emissions unit, in a stationary source project, which results in an SB 288 Major Modification or a Federal Major Modification, as defined by the rule.

*Except for CO emissions from a new or modified emissions unit at a Stationary Source with an SSPE2 of less than 200,000 pounds per year of CO.

**a. New emissions units – PE > 2 lb/day**

As seen in Section VII.C.2 above, the applicant is proposing to install a new digester system with and two new digester gas-fired IC engines.

Digester System (S-8637-1-0)

As explained above, the digester system will consist of sealed lagoon(s) that will reduce VOC emissions from the manure at the dairy and emissions from the digester system are considered negligible. Therefore BACT for new units with PE > 2 lb/day purposes is not required for the digester system.

Digester Gas-Fired Engines (S-8637-2-0 and -3-0)

The proposed engines will each have a PE greater than 2.0 lb/day for $NO_X$, $SO_X$, $PM_{10}$, CO, VOC, and $NH_3$. Therefore, BACT is triggered for $NO_X$, $SO_X$, $PM_{10}$, and VOC. As part of the BACT requirements, $NH_3$ slip from the SCR systems will also be limited. The PE for CO from each unit also exceeds 2.0 lb/day; however, BACT is not triggered for CO since the SSPE2 for CO is not greater than 200,000 lbs/year, as demonstrated in Section VII.C.5 above.

**b. Relocation of emissions units – PE > 2 lb/day**

As discussed in Section I above, there are no emissions units being relocated from one stationary source to another; therefore BACT is not triggered for relocation of an emissions unit.

**c. Modification of emissions units – AIPE > 2 lb/day**

As discussed in Section I above, there are no modified emissions units associated with this project. Therefore, BACT is not triggered for modification of a unit.

**d. SB 288/Federal Major Modification**

As discussed in Sections VII.C.7 and VII.C.8 above, this project does not constitute an SB 288 or Federal Major Modification. Therefore BACT is not triggered for Major Modification purposes.

**2. BACT Guideline**

S-8637-2-0 & -3-0

BACT Guideline 3.3.15 applies to the proposed digester gas-fired IC engines. (See Appendix B)

**3. Top-Down BACT Analysis**

Pursuant to the Top-Down BACT Analysis (See Appendix B), BACT has been satisfied with the following:

$NO_X$: $NO_X$ emissions ≤ 0.15 g/bhp-hr
$SO_X$: Fuel sulfur content ≤ 40 ppmv (as $H_2S$)
$PM_{10}$: Fuel sulfur content ≤ 40 ppmv (as $H_2S$)
VOC: VOC emissions ≤ 0.10 g/bhp-hr
$NH_3$: $NH_3$ slip emissions ≤ 10 ppmv @ 15% $O_2$

**B. Offsets**

**1. Offset Applicability**

Offset requirements shall be triggered on a pollutant by pollutant basis and shall be required if the SSPE2 equals to or exceeds the offset threshold levels in Table 4-1 of Rule 2201.

The SSPE2 is compared to the offset thresholds in the following table.

| Offset Determination (lb/year) | | | | | |
|---|---|---|---|---|---|
| | $NO_X$ | $SO_X$ | $PM_{10}$ | CO | VOC |
| SSPE2 | 9,166 | 2,268 | 3,970 | 101,636 | 6,370 |
| Offset Thresholds | 20,000 | 54,750 | 29,200 | 200,000 | 20,000 |
| Offsets triggered? | No | No | No | No | No |

### 2. Quantity of Offsets Required

As seen above, the SSPE2 is not greater than the offset thresholds for all the pollutants; therefore offset calculations are not necessary and offsets will not be required for this project.

## C. Public Notification

### 1. Applicability

Public noticing is required for:
a. New Major Sources, Federal Major Modifications, and SB 288 Major Modifications,
b. Any new emissions unit with a Potential to Emit greater than 100 pounds during any one day for any one pollutant,
c. Any project which results in the offset thresholds being surpassed, and/or
d. Any project with an SSIPE of greater than 20,000 lb/year for any pollutant.
e. Any project which results in a Title V significant permit modification

#### a. New Major Sources, Federal Major Modifications, and SB 288 Major Modifications

New Major Sources are new facilities, which are also Major Sources. As shown in Section VII.C.5 above, the SSPE2 is not greater than the Major Source threshold for any pollutant. Therefore, public noticing is not required for this project for new Major Source purposes.

As demonstrated in Sections VII.C.7 and VII.C.8, this project does not constitute an SB 288 or Federal Major Modification; therefore, public noticing for SB 288 or Federal Major Modification purposes is not required.

#### b. PE > 100 lb/day

Applications which include a new emissions unit with a PE greater than 100 pounds during any one day for any pollutant will trigger public noticing requirements.

The PE2 for the proposed new IC engines is compared to the daily PE Public Notice thresholds in the following table:

Digester Gas-Fired IC Engines (S-8637-2-0 & -3-0)

| PE > 100 lb/day Public Notice Thresholds | | | |
|---|---|---|---|
| Pollutant | PE2 (lb/day) | Public Notice Threshold | Public Notice Triggered? |
| $NO_X$ | 77.7 | 100 lb/day | No |
| $SO_X$ | 3.1 | 100 lb/day | No |
| $PM_{10}$ | 5.4 | 100 lb/day | No |
| CO | 376.7 | 100 lb/day | **Yes** |
| VOC | 77.7 | 100 lb/day | No |
| $NH_3$ | 3.9 | 100 lb/day | No |

Therefore, public noticing for PE > 100 lb/day purposes is required.

**c. Offset Threshold**

The SSPE1 and SSPE2 are compared to the offset thresholds in the following table.

| Offset Thresholds | | | | |
|---|---|---|---|---|
| Pollutant | SSPE1 (lb/year) | SSPE2 (lb/year) | Offset Threshold | Public Notice Required? |
| $NO_X$ | 0 | 9,166 | 20,000 lb/year | No |
| $SO_X$ | 0 | 2,268 | 54,750 lb/year | No |
| $PM_{10}$ | 0 | 3,970 | 29,200 lb/year | No |
| CO | 0 | 101,636 | 200,000 lb/year | No |
| VOC | 0 | 6,370 | 20,000 lb/year | No |

As detailed above, there were no thresholds surpassed with this project; therefore public noticing is not required for surpassing an offset threshold.

**d. SSIPE > 20,000 lb/year**

Public notification is required for any permitting action that results in a SSIPE of more than 20,000 lb/year of any affected pollutant. According to District policy, the SSIPE = SSPE2 – SSPE1. The SSIPE is compared to the SSIPE Public Notice thresholds in the following table.

| SSIPE Public Notice Thresholds | | | | | |
|---|---|---|---|---|---|
| Pollutant | SSPE2 (lb/year) | SSPE1 (lb/year) | SSIPE (lb/year) | SSIPE Public Notice Threshold | Public Notice Required? |
| $NO_x$ | 9,166 | 0 | 9,166 | 20,000 lb/year | No |
| $SO_x$ | 2,268 | 0 | 2,268 | 20,000 lb/year | No |
| $PM_{10}$ | 3,970 | 0 | 3,970 | 20,000 lb/year | No |
| CO | 101,636 | 0 | 101,636 | 20,000 lb/year | **Yes** |
| VOC | 6,370 | 0 | 6,370 | 20,000 lb/year | No |
| $NH_3$ | 2,836 | 0 | 2,836 | 20,000 lb/year | No |

As demonstrated above, the SSIPE for CO was greater than 20,000 lb/year; therefore public noticing for SSIPE > 20,000 lbs is required.

**e. Title V Significant Permit Modification**

Since this facility does not have a Title V operating, this change is not a Title V Significant Modification, and therefore public noticing is not required.

**2. Public Notice Action**

As discussed above, public noticing is required for this project for CO emissions from an emissions unit in excess of 100 lb/day and for an SSIPE for CO that exceeds 20,000 lb/yr. Therefore, public notice documents will be submitted to the California Air Resources Board (ARB) and a public notice will be published in a local newspaper of general circulation prior to the issuance of the ATC for this equipment.

## D. Daily Emission Limits (DELs)

DELs and other enforceable conditions are required by Rule 2201 to restrict a unit's maximum daily emissions, to a level at or below the emissions associated with the maximum design capacity. The DEL must be contained in the latest ATC and contained in or enforced by the latest PTO and must be enforceable, in a practicable manner, on a daily basis. DELs are also required to enforce the applicability of BACT.

***Proposed Rule 2201 (DEL) Conditions for the Digester System (S-8637-1-0)***

As stated above, the digester system will reduce emissions from the manure produced by cattle at Lakeview Farms dairy. The following condition will be placed on the ATC permit to ensure that fugitive emissions from the digester system will be negligible:

- The VOC content of the digester gas produced by the digester system shall not exceed 10% by weight. [District Rule 2201]
- The air injection system shall be maintained and operated in accordance with the supplier's recommendations to minimize the concentration of hydrogen sulfide (H2S) in the digester gas. [District Rule 2201]

***Proposed Rule 2201 (DEL) Conditions for the Digester Gas-Fired Engines (S-8637-2-0 & -3-0)***

Proposed Rule 2201 (DEL) Conditions for Engines during Both Commissioning and Normal Operation:

- This engine shall only be fueled with digester gas except in the case that sufficient digester gas is unavailable for the engine at the time that the required one-time initial utility interconnect testing is scheduled. If sufficient digester gas is unavailable for the engine at the time that the required initial utility interconnect testing is scheduled, the engine will be permitted to use sufficient natural gas fuel to complete the required utility interconnect testing. [District Rule 2201]

- During times this engine is fueled with natural gas for required initial utility interconnect testing, the engine shall continue to comply with all emission standards and limitations contained in this permit. [District Rule 2201]
- The total amount of electrical energy produced by this engine while fueled on natural gas for required one-time initial utility interconnect testing shall not exceed 96,000 kW-hrs. The following records shall be maintained: 1) date(s) and time(s) that this engine is fueled with natural gas for utility testing, 2) the total amount of electrical energy (kW-hr) produced by this engine when fueled with natural gas for utility testing, and 3) the total number of hours that this engine is fueled with natural gas. [District Rule 2201]
- The sulfur content of the digester gas used as fuel in this engine shall not exceed 40 ppmv as H2S. The applicant may utilize an averaging period of up to 24 hours in length for demonstration of compliance with the fuel sulfur content limit. [District Rules 2201, 4102, 4702, and 4801]
- Ammonia (NH3) emissions from this engine shall not exceed 10 ppmvd @ 15% O2. [District Rule 2201]

Proposed Rule 2201 (DEL) Conditions during Commissioning Period:

For these digester gas-fired IC engines, the DELs for $NO_X$, $PM_{10}$, CO, and VOC are stated in the form of maximum emission factors (g/bhp-hr) and maximum number of hours allowed for commissioning activities.

- Commissioning period shall commence when all mechanical, electrical, and control systems are installed and individual system startup has been completed, or when the reciprocating engine is first fired, whichever occurs first. The commissioning period shall terminate when the engine has completed initial performance testing, completed initial engine tuning, and the engine is available for commercial operation. The total duration of the commissioning period for this engine shall not exceed 120 hours of operation. [District Rule 2201]
- The owner/operator shall minimize the emissions from the engine to the maximum extent possible during the commissioning period. [District Rule 2201]
- During the commissioning period emission rates from this IC engine shall not exceed any of the following limits: 1.0 g-NOx/bhp-hr, 0.07 g-PM10/bhp-hr, 4.85 g-CO/bhp-hr, 1.0 g-VOC/bhp-hr. [District Rule 2201]
- The total number of firing hours of this unit without abatement of emissions by the SCR system shall not exceed 120 hours during the commissioning period. Such operation of this unit without abatement shall be limited to discrete commissioning activities that can only be properly executed without the SCR system. Upon completion of these activities, the unused balance of the 120 firing hours without abatement shall expire. [District Rule 2201]

Proposed Rule 2201 (DEL) Conditions during Normal Operation:

For the proposed digester gas-fired IC engines, the DELs for $NO_X$, $PM_{10}$, CO, and VOC during normal operation are stated in the form of emission factors (g/hp-hr & ppmv), the

maximum engine horsepower rating (1,468 bhp), and the maximum operational time of 24 hours per day.

- Coincident with the end of the commissioning period, emissions from this IC engine shall not exceed any of the following limits: 0.15 g-NOx/bhp-hr (for periodic alternate monitoring, equivalent to 11 ppmvd NOx @ 15% O2), NOx referenced as NO2; 0.07 g-PM10/bhp-hr; 1.75 g-CO/bhp-hr (for periodic alternate monitoring, equivalent to 210 ppmvd CO @ 15% O2); 0.10 g-VOC/bhp-hr (for periodic alternate monitoring, equivalent to 21 ppmvd VOC @ 15% O2), VOC referenced as CH4. [District Rules 2201 and 4702]

## E. Compliance Assurance

### 1. Source Testing

The proposed 1,468 bhp digester gas-fired engines are subject to District Rule 4702 - Internal Combustion Engines. Section 6.3.2.1 of District Rule 4702 requires source testing of $NO_X$, CO, and VOC emissions at least once every 24 months for a non-agricultural spark-ignited IC engine. The periodic source testing required by District Rule 4702 will ensure compliance with the applicable New Source Review (NSR) requirements $NO_X$, CO, and VOC. Therefore, source testing for $NO_X$, CO, and VOC will be required within 90 days of initial start-up and at least once 24 months thereafter. Since the control equipment will include an SCR system, periodic testing of ammonia slip will also be required. In addition, Section 5.10.1 of District Rule 4702 requires an annual analysis of the sulfur content of engine fuel. The $PM_{10}$ emissions from the engine are not expected to change much over time as long as the quality of the gas used to fuel the engines remains consistent. The facility will be required to periodically monitor the sulfur content of the digester gas fuel, which should ensure that the quality of the digester gas fuel is consistent. Therefore, initial $PM_{10}$ source testing will be required to demonstrate compliance with the $PM_{10}$ emission limit, but ongoing $PM_{10}$ source testing will not be required.

The proposed engines are also subject to 40 CFR 60, Subpart JJJJ – Standards of Performance for Stationary Spark Ignition Internal Combustion Engines. However, the District has not been delegated the authority to implement 40 CFR 60, Subpart JJJJ for non-Major Sources; therefore, no testing requirements from this subpart will be included in the ATC permits. However, the applicant will be responsible for compliance with the applicable requirements of this regulation.

The following conditions will be placed on the engine permits to ensure compliance:

- Source testing to measure NOx, CO, VOC, PM10, and ammonia (NH3) emissions from this unit shall be conducted within 90 days of initial start-up. [District Rules 1081, 2201, and 4702]
- Source testing to measure NOx, CO, VOC, and ammonia (NH3) emissions from this unit shall be conducted at least once every 24 months. [District Rules 1081, 2201, and 4702]

- {3791} Emissions source testing shall be conducted with the engine operating either at conditions representative of normal operations or conditions specified in the Permit to Operate. [District Rule 4702]
- For emissions source testing, the arithmetic average of three 30-consecutive-minute test runs shall apply. If two of three runs are above an applicable limit, the test cannot be used to demonstrate compliance with an applicable limit. VOC emissions shall be reported as methane. NOx, CO, VOC, and NH3 concentrations shall be reported in ppmv, corrected to 15% oxygen. [District Rules 2201 and 4702]
- The following methods shall be used for source testing: NOx (ppmv) - EPA Method 7E or ARB Method 100; CO (ppmv) - EPA Method 10 or ARB Method 100; VOC (ppmv) - EPA Method 18, 25A or 25B, or ARB Method 100; stack gas oxygen - EPA Method 3 or 3A or ARB Method 100; stack gas velocity - EPA Method 2 or EPA Method 19; stack gas moisture content - EPA Method 4; PM10 (filterable and condensable) - EPA Method 201 and 202, EPA Method 201a and 202, or ARB Method 5 in combination with Method 501; NH3 - BAAQMD ST-1B or SCAQMD Method 207-1. Alternative test methods as approved by the District may also be used to address the source testing requirements of this permit. [District Rules 1081 and 4702]
- Fuel sulfur content analysis shall be performed within 90 days of initial start-up using EPA Method 11 or EPA Method 15, as appropriate. [District Rules 2201 and 4702]
- Fuel sulfur analysis shall be performed at least annually using EPA Method 11 or EPA Method 15, as appropriate. Records of the fuel sulfur analysis shall be maintained and provided it to the District upon request. [District Rules 2201 and 4702]
- {109} Source testing shall be conducted using the methods and procedures approved by the District. The District must be notified at least 30 days prior to any compliance source test, and a source test plan must be submitted for approval at least 15 days prior to testing. [District Rule 1081]
- The results of each source test shall be submitted to the District within 60 days after completion of the source test. [District Rule 1081]

## 2. Monitoring

As stated above the engines are subject to District Rule 4702. Section 5.8.1 of District Rule 4702 requires engines rated at least 1,000 bhp that can operate more than 2,000 hour per calendar year or equipped with external control devices to install, operate, and maintain an APCO-approved alternate monitoring plan. Section 5.8.9 of District Rule 4702 requires monitoring of $NO_X$ emissions at least once every calendar quarter for a non-agricultural spark-ignited IC engine. Therefore, quarterly monitoring of $NO_X$, CO, and $O_2$ concentrations in accordance with pre-approved alternate monitoring plan "A" within District Policy SSP 1810 will be required. Since the engines will be equipped with SCR, quarterly monitoring of ammonia slip will also be required.

The following conditions will be placed on the engine permits to ensure compliance:

- The permittee shall monitor and record the stack concentration of NOx, CO, and O2 at least once every calendar quarter (in which a source test is not performed) using a portable emission monitor that meets District specifications. [In-stack monitors may be allowed if they satisfy the standards for portable analyzers as specified in District policies and are approved in writing by the APCO.] Monitoring shall be performed not less than once every month for 12 months if two consecutive deviations are observed during quarterly monitoring. Monitoring shall not be required if the engine is not in operation, i.e. the engine need not be started solely to perform monitoring. Monitoring shall be performed within 5 days of restarting the engine unless monitoring has been performed within the last month if on a monthly monitoring schedule, or within the last quarter if on a quarterly monitoring schedule. Records must be maintained of the dates of non-operation to validate extended monitoring frequencies. [District Rules 2201 and 4702]
- The permittee shall monitor and record the stack concentration of NH3 at least once every calendar quarter in which a source test is not performed. NH3 monitoring shall be conducted utilizing District approved gas-detection tubes or a District approved equivalent method. Monitoring shall not be required if the unit is not in operation, i.e. the unit need not be started solely to perform monitoring. Monitoring shall be performed within 5 days of restarting the unit unless monitoring has been performed within the last quarter. [District Rules 2201 and 4102]
- If the NOx, CO, or NH3 concentrations corrected to 15% O2, as measured by the portable analyzer or the District-approved ammonia monitoring equipment, exceed the respective permitted emissions concentration(s), the permittee shall return the emissions to within the acceptable range as soon as possible, but no longer than 8 hours of operation after detection. If the portable analyzer or ammonia monitoring equipment readings continue to exceed the permitted emissions concentration(s) after 8 hours of operation after detection, the permittee shall notify the District within the following 1 hour and conduct a certified source test within 60 days of the first exceedance. In lieu of conducting a source test, the permittee may stipulate a violation has occurred, subject to enforcement action. The permittee must then correct the violation, show compliance has been re-established, and resume monitoring procedures. If the deviations are the result of a qualifying breakdown condition pursuant to Rule 1100, the permittee may fully comply with Rule 1100 in lieu of the performing the notification and testing required by this condition. [District Rules 2201 and 4702]
- {3787} All alternate monitoring parameter emission readings shall be taken with the unit operating either at conditions representative of normal operations or conditions specified in the permit-to-operate. The analyzer shall be calibrated, maintained, and operated in accordance with the manufacturer's specifications and recommendations or a protocol approved by the APCO. Emission readings taken shall be averaged over a 15 consecutive-minute period by either taking a cumulative 15 consecutive-minute sample reading or by taking at least five (5) readings, evenly spaced out over the 15 consecutive-minute period. [District Rule 4702]

Because of the variable composition of digester gas, additional monitoring of the fuel sulfur content of the digester gas will be required. The following conditions will be placed on the engine permits to ensure compliance:

- The sulfur content of the digester gas used to fuel the engine shall be monitored and recorded at least once every calendar quarter in which a fuel sulfur analysis is not performed. If quarterly monitoring shows a violation of the fuel sulfur content limit of this permit, monthly monitoring will be required until six consecutive months of monitoring show compliance with the fuel sulfur content limit. Once compliance with the fuel sulfur content limit is shown for six consecutive months, then the monitoring frequency may return to quarterly. Monitoring of the sulfur content of the digester gas fuel shall not be required if the engine does not operate during that period. Records of the results of monitoring of the digester gas fuel sulfur content shall be maintained. [District Rule 2201]
- Monitoring of the digester gas sulfur content shall be performed using gas detection tubes calibrated for H2S; a Testo 350 XL portable emission monitor; a continuous fuel gas monitor that meets the requirements specified in SCAQMD Rule 431.1, Attachment A; District-approved source test methods, including EPA Method 15, ASTM Method D1072, D4084, and D5504; District-approved in-line H2S monitors; or an alternative method approved by the District. Prior to utilization of in-line monitors to demonstrate compliance with the digester gas sulfur content limit of this permit, the permittee shall submit details of the proposed monitoring system, including the make, model, and detection limits, to the District and obtain District approval for the proposed monitor(s). [District Rule 2201]

### 3. Recordkeeping

Recordkeeping is required to demonstrate compliance with the offset, public notification and daily emission limit requirements of Rule 2201.

The following conditions will be listed on the engine permits:

- The SCR catalyst shall be maintained and replaced in accordance with the recommendations of the catalyst manufacturer or emission control supplier. Records of catalyst maintenance and replacement shall be maintained. [District Rules 2201 and 4702]
- The permittee shall maintain records of: (1) the date and time of NOx, CO, O2, and NH3 measurements, (2) the O2 concentration in percent and the measured NOx, CO, and NH3 concentrations corrected to 15% O2, (3) make and model of exhaust gas analyzer, (4) exhaust gas analyzer calibration records, (5) the method of determining the NH3 emission concentration, and (6) a description of any corrective action taken to maintain the emissions within the acceptable range. [District Rules 2201 and 4702]
- The permittee shall maintain an engine operating log to demonstrate compliance. The engine operating log shall include, on a monthly basis, the following information: the total hours of operation, the type and quantity of fuel used, maintenance and modifications performed, monitoring data, compliance source test results, and any other information necessary to demonstrate compliance. Quantity of fuel used shall be recorded in standard cubic feet using a non-resettable, totalizing mass or

volumetric fuel flow meter or other APCO approved-device. [District Rules 2201 and 4702]

- All records shall be maintained and retained for a minimum of five (5) years, and shall be made available for District inspection upon request. All records may be maintained and submitted in an electronic format approved by the District. [District Rules 2201 and 4702]

**4. Reporting**

No reporting is required to demonstrate compliance with District Rule 2201.

As stated above, the proposed 1,468 bhp engines are subject to 40 CFR 60, Subpart JJJJ. 40 CFR 60, Subpart JJJJ requires uncertified engines rated 500 bhp or more to submit an initial notification to EPA. As explained above, the District has not been delegated the authority to implement this regulation for non-Major Sources; therefore, this requirement will not be included in the ATC permits. However, the applicant will be responsible for compliance with the applicable requirements of this regulation.

## F. Ambient Air Quality Analysis (AAQA)

District Rule 2201 requires that an ambient air quality analysis (AAQA) be conducted for the purpose of determining whether a new or modified Stationary Source will cause or make worse a violation of an air quality standard. The Technical Services Division of the SJVAPCD conducted the required analysis. Refer to Appendix C of this document for the AAQA summary sheet.

The proposed location is in an attainment area for $NO_X$, CO, and $SO_X$. As shown by the AAQA summary sheet the proposed equipment will not cause a violation of an air quality standard for $NO_X$, CO, or $SO_X$. The proposed location is in a non-attainment area for the state's $PM_{10}$ as well as federal and state $PM_{2.5}$ thresholds.

The results of the Criteria Pollutant Modeling conducted for the AAQA are summarized in the following table:

| Criteria Pollutant Modeling Results* | | | | | |
|---|---|---|---|---|---|
| **Digester Gas-Fired IC Engines** | **1 Hour** | **3 Hours** | **8 Hours.** | **24 Hours** | **Annual** |
| CO | Pass | X | Pass | X | X |
| $NO_X$ | Pass[1] | X | X | X | Pass |
| $SO_X$ | Pass | Pass | X | Pass | Pass |
| $PM_{10}$ | X | X | X | Pass[2] | Pass[2] |
| H2S | Pass | X | X | X | X |

* Results were taken from the PSD spreadsheet.

[1] The project was compared to the 1-hour NO2 National Ambient Air Quality Standard that became effective on April 12, 2010 using the District's approved procedures.

[2] The criteria pollutants are below EPA's level of significance as found in 40 CFR Part 51.165 (b)(2).

[3] $H_2S$ emissions must be limited to the value listed in the Proposed Permit Conditions section in order for this project to not cause an exceedance of the California Ambient Air Quality Standard (CAAQS).

**Rule 2410 Prevention of Significant Deterioration**

As shown in Section VII. C. 9. above, this project does not result in a new PSD major source or PSD major modification. No further discussion is required.

**Rule 2520 Federally Mandated Operating Permits**

Since this facility's potential emissions do not exceed any major source thresholds of Rule 2201, this facility is not a major source, and Rule 2520 does not apply.

**Rule 4101 Visible Emissions**

Rule 4101 states that no air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1 or 20% opacity.

Since the IC engines are fired solely on gaseous fuel, visible emissions are not expected to exceed Ringelmann 1 or 20% opacity.

The following condition will be listed on the proposed ATC permits to ensure compliance:

- {15} No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1 or 20% opacity. [District Rule 4101]

**Rule 4102 Nuisance**

Rule 4102 prohibits discharge of air contaminants which could cause injury, detriment, nuisance or annoyance to the public. Public nuisance conditions are not expected as a result of these operations, provided the equipment is well maintained. Therefore, compliance with this rule is expected.

**California Health & Safety Code 41700 (Health Risk Assessment)**

District Policy APR 1905 – *Risk Management Policy for Permitting New and Modified Sources* specifies that for an increase in emissions associated with a proposed new source or modification, the District perform an analysis to determine the possible impact to the nearest resident or worksite.

A Health Risk Assessment (HRA) is not required for a project with a total facility prioritization score of less than one. According to the Technical Services Memo for this project (Appendix C), the total facility prioritization score including this project was greater than one. Therefore, an HRA was required to determine the short-term acute and long-term chronic exposure from this project. The results of the health risk assessment are summarized in the table below.

| RMR Summary | | | |
|---|---|---|---|
| **Categories** | **1,468 bhp Digester Gas-Fired IC Engines (S-8637-2-0 & -3-0)** | **Project Totals** | **Facility Totals** |
| **Prioritization Score**[1] | 107 (each) | 214 | >1 |
| **Acute Hazard Index** | 0.48 (each)[1] | 0.95 | 0.95 |
| **Chronic Hazard Index** | 0.16 (each) | 0.31 | 0.31 |
| **Maximum Individual Cancer Risk ($10^{-6}$)** | 0.002 (each) | 0.004 | 0.004 |
| **T-BACT Required?** | **No** | | |
| **Special Permit Conditions?** | **Yes** | | |

[1] $H_2S$ emissions must be limited in order to achieve the acute hazard index score in this project and for the project to not cause an exceedance of the California Ambient Air Quality Standard (CAAQS). Please see special condition below.

### Discussion of T-BACT

BACT for toxic emission control (T-BACT) is required if the cancer risk exceeds one in one million. As demonstrated above, T-BACT is not required for this project because the HRA indicates that the risk is not above the District's thresholds for triggering T-BACT requirements; therefore, compliance with the District's Risk Management Policy is expected.

District policy APR 1905 also specifies that the increase in emissions associated with a proposed new source or modification not have acute or chronic indices, or a cancer risk greater than the District's significance levels (i.e. acute and/or chronic indices greater than 1 and a cancer risk greater than 20 in a million). As outlined by the HRA Summary in Appendix C of this report, the emissions increases for this project was determined to be less than significant.

To ensure compliance with the HRA; the following condition will be listed on the engine permits:

Digester Gas-Fired IC Engines (S-8637-2-0 & -3-0)

- The sulfur content of the digester gas used as fuel in this engine shall not exceed 40 ppmv as H2S. The applicant may utilize an averaging period of up to 24 hours in length for demonstration of compliance with the fuel sulfur content limit. [District Rules 2201, 4102, 4702, and 4801]

This condition, along with the engine rating in the equipment description, will ensure that the $H_2S$ emissions from the engine exhaust stack shall not exceed 1.97 lb/hr, as required by the Health Risk Assessment.

### Rule 4201 Particulate Matter Concentration

The purpose of this rule is to protect the ambient air quality by establishing a particulate matter emission standard. Section 3.1 prohibits discharge of dust, fumes, or total particulate matter

into the atmosphere from any single source operation in excess of 0.1 grain per dry standard cubic foot.

$$0.07 \quad \frac{g}{hp \cdot hr} \times \frac{1 hp \cdot hr}{2{,}545 Btu} \times \frac{10^6 Btu}{9{,}100 dscf} \times \frac{0.33 Btu_{out}}{1 Btu_{in}} \times \frac{15.43 grain}{g} = \quad 0.015 \quad \frac{grain}{dscf}$$

Since 0.015 grain/dscf is less than 0.1 grain/dscf, compliance with this rule is expected.

The following condition will be listed on the proposed ATC permits to ensure compliance:

- {14} Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201]

**Rule 4701 Stationary Internal Combustion Engines – Phase I**

The requirements of Rule 4702 are equivalent or more stringent than the requirements of this Rule. Since the proposed IC engines are subject to both Rules 4701 and 4702, compliance with Rule 4702 is sufficient to demonstrate compliance with this rule.

**Rule 4702 Internal Combustion Engines**

The purpose of this rule is to limit the emissions of nitrogen oxides ($NO_X$), carbon monoxide (CO), volatile organic compounds (VOC), and sulfur oxides ($SO_X$) from internal combustion engines.

This rule applies to any internal combustion engine with a rated brake horsepower of 25 brake horsepower or greater.

Section 5.2.1 requires that the operator of a spark-ignited non-agricultural internal combustion engine rated > 50 bhp shall not operate it in such a manner that results in emissions exceeding the limits in Table 1 of Rule 4702 until such time that the engine has demonstrated compliance with emission limits in Table 2 of Rule 4702 pursuant to the compliance deadlines in Section 7.5. In lieu of complying with Table 1 emission limits, the operator of a spark-ignited engine shall comply with the applicable emission limits pursuant to Section 8.0. The proposed new engines are required to immediately comply with the emission limits contained in Table 2 since the applicable compliance dates have passed (except for an operator with at least 12 existing engines at one stationary source); therefore, the emissions limits in Table 1 of Rule 4702 are not applicable to the proposed engines.

Section 5.2.2 requires that on and after the compliance schedule specified in Section 7.5, the operator of a spark-ignited non-agricultural internal combustion engine rated > 50 bhp shall comply with all the applicable requirements of the rule and the requirements of Section 5.2.2.1, 5.2.2.2, or 5.2.2.3, on an engine-by-engine basis.

Section 5.2.2.1 requires that on and after the compliance schedule specified in Section 7.5, the operator of a spark-ignited engine that is used exclusively in non-agricultural operations shall comply with Sections 5.2.2.1.1 through 5.2.2.1.3 on an engine-by-engine basis:

5.2.2.1.1 $NO_X$, CO, and VOC emission limits pursuant to Table 2;

5.2.2.1.2 $SO_X$ control requirements of Section 5.7, pursuant to the deadlines specified in Section 7.5; and

5.2.2.1.3 Monitoring requirements of Section 5.10, pursuant to the deadlines specified in Section 7.5.

Section 5.2.2.2 allows that in lieu of complying with the $NO_X$ emission limit requirement of Section 5.2.2.1.1, an operator may pay an annual fee to the District, as specified in Section 5.6, pursuant to Section 7.6. Pursuant to Section 5.2.2.2.1, engines in the fee payment program shall have actual emissions not greater than the applicable limits in Table 1 during the entire time the engine is part of the fee payment program. Pursuant to Section 5.2.2.2.2, compliance with Section 5.7 and 5.10, pursuant to the deadlines specified in Section 7.5, is also required as part of the fee payment option.

Section 5.2.2.3 allows that in lieu of complying with the $NO_X$, CO, and VOC limits of Table 2 on an engine-by-engine basis, an operator may elect to implement an alternative emission control plan pursuant to Section 8.0. An operator electing this option shall not be eligible to participate in the fee payment option outlined in Section 5.2.2.2 and Section 5.6.

**Rule 4702, Table 2 Emission Limits/Standards for Spark-Ignited IC Engines rated >50 bhp Used in Non-Agricultural Operations**

(Emission Limits are effective according to the compliance schedule specified in Rule 4702, Section 7.5.)

| Engine Type | $NO_X$ Emission Limit (ppmv @ 15% $O_2$, dry) | CO Emission Limit (ppmv @ 15% $O_2$, dry) | VOC Emission Limit (ppmv @ 15% $O_2$, dry) |
|---|---|---|---|
| 1. a. Rich-Burn, Waste Gas Fueled | 50 ppmv | 2,000 ppmv | 250 ppmv |
| 1. b. Rich-Burn, Cyclic Loaded, Field Gas Fueled | 50 ppmv | 2,000 ppmv | 250 ppmv |
| 1. c. Rich-Burn, Limited Use | 25 ppmv | 2,000 ppmv | 250 ppmv |
| 1. d. Rich-Burn, Not Listed Above | 11 ppmv | 2,000 ppmv | 250 ppmv |
| 2. a. Lean-Burn, 2-Stroke, Gaseous Fueled, >50 bhp & <100 bhp | 75 ppmv | 2,000 ppmv | 750 ppmv |
| 2. b. Lean-Burn, Limited Use | 65 ppmv | 2,000 ppmv | 750 ppmv |
| 2. c. Lean-Burn Engine used for gas compression | 65 ppmv or 93% reduction | 2,000 ppmv | 750 ppmv |
| 2. d. Waste Gas Fueled | 65 ppmv or 90% reduction | 2,000 ppmv | 750 ppmv |
| 2. e. Lean-Burn, Not Listed Above | 11 ppmv | 2,000 ppmv | 750 ppmv |

The proposed digester gas-fired engines will be operated as a separate stationary source than the dairy farm and the District has determined that the IC engines are a non-agricultural IC engines. The digester gas-fired, engines are waste gas-fired engines and are required to

comply with the following emissions limits from Table 2, Row 2.d: 65 ppmvd $NO_X$, 2,000 ppmvd CO, and 750 ppmvd VOC (all measured @ 15% $O_2$).

Therefore, the following previously presented condition will be listed on the proposed ATC permits for the engines to ensure compliance:

- Coincident with the end of the commissioning period, emissions from this IC engine shall not exceed any of the following limits: 0.15 g-NOx/bhp-hr (for periodic alternate monitoring, equivalent to 11 ppmvd NOx @ 15% O2), NOx referenced as NO2; 0.07 g-PM10/bhp-hr; 1.75 g-CO/bhp-hr (for periodic alternate monitoring, equivalent to 210 ppmvd CO @ 15% O2); 0.10 g-VOC/bhp-hr (for periodic alternate monitoring, equivalent to 21 ppmvd VOC @ 15% O2), VOC referenced as CH4. [District Rules 2201 and 4702]

Section 5.2.3.1 requires that the operator of a spark-ignited internal combustion engine rated > 50 bhp that is used exclusively in agricultural operations shall not operate it in such a manner that results in emissions exceeding the limits in Table 3 of Rule 4702 for the appropriate engine type on an engine-by-engine basis.

Section 5.2.3.2 allows that in lieu of complying with the $NO_X$, CO, and VOC limits of Table 3 on an engine-by-engine basis, an operator of a spark-ignited agricultural IC engine may elect to implement an alternative emission control plan pursuant to Section 8.0.

Section 5.2.3.3 requires an operator of an agricultural IC engine in that is subject to the applicable requirements of Table 3 shall not replace such engine with an engine that emits more emissions of NOx, VOC, and CO, on a ppmv basis, (corrected to 15% oxygen on a dry basis) than the engine being replaced.

As stated above, the proposed digester gas-fired engines will be operated as part of a separate non-agricultural stationary source; therefore, Section 5.2.3 does not apply to the proposed engines.

Section 5.2.4 requires the operator of a certified compression-ignited engine rated >50 bhp shall comply with the following requirements of Sections 5.2.4.1, 5.2.4.2, 5.2.4.3, 5.2.4.3, and 5.2.4.4. The proposed digester gas-fired engines are not compression-ignited engines; therefore, Section 5.2.4 does not apply to the proposed engines.

Section 5.3 requires that all continuous emission monitoring systems (CEMS) emissions measurements shall be averaged over a period of 15 consecutive minutes. Any 15-consecutive minute block average CEMS measurement exceeding the applicable emission limits of this rule shall constitute a violation of this rule. The IC engines proposed under this project will not have CEMS installed; therefore this section of the Rule is not applicable.

Section 5.4 specifies procedures to calculate percent emission reductions if percent emission reductions are used to comply with the $NO_X$ emission limits of Section 5.2. The use of percent emission reductions to comply with Section 5.2 is not being proposed for the IC engines under this project; therefore this section of the Rule is not applicable.

Section 5.5 requires the operator of an internal combustion engine that uses percent emission reduction to comply with the $NO_X$ emission limits of Section 5.2 shall provide an accessible

inlet and outlet on the external control device or the engine as appropriate for taking emission samples and as approved by the APCO. The use of percent emission reductions to comply with Section 5.2 is not being proposed for the IC engines under this project; therefore this section of the Rule is not applicable.

Section 5.6 specifies procedures that operators of non-agricultural spark-ignited IC engines who elect to comply under Section 5.2.2.2 must use for calculation of the annual emissions fee. The applicant has proposed that the digester gas-fired engines comply with the applicable emission limits of Table 2 of District Rule 4702; therefore payment of annual emissions fees for the engines is not required and this section of the Rule is not applicable.

Section 5.7 requires that on and after the compliance schedule specified in Section 7.5, operators of non-agricultural spark-ignited engines and non-agricultural compression-ignited engines shall comply shall comply with Sections 5.7.1, 5.7.2, 5.7.3, 5.7.4, 5.7.5, or 5.7.6:

5.7.1 Operate the engine exclusively on PUC-quality natural gas, commercial propane, butane, or liquefied petroleum gas, or a combination of such gases; or

5.7.2 Limit gaseous fuel sulfur content to no more than five (5) grains of total sulfur per one hundred (100) standard cubic feet; or

5.7.3 Use California Reformulated Gasoline for gasoline-fired spark-ignited engines; or

5.7.4 Use California Reformulated Diesel for compression-ignited engines; or

5.7.5 Operate the engine on liquid fuel that contains no more than 15 ppm sulfur, as determined by the test method specified in Section 6.4.6; or

5.7.6 Install and properly operate an emission control system that reduces $SO_2$ emissions by at least 95% by weight as determined by the test method specified in Section 6.4.6.

To satisfy BACT, the average sulfur content of the digester gas fuel for the engine will be limited to 40 ppmv (approximately equal to 2.4 grains sulfur per 100 standard cubic feet). The following condition will be listed on the proposed engine ATC permits to ensure compliance:

- The sulfur content of the digester gas used as fuel in this engine shall not exceed 40 ppmv as H2S. The applicant may utilize an averaging period of up to 24 hours in length for demonstration of compliance with the fuel sulfur content limit. [District Rules 2201, 4702, and 4801]

Section 5.8 requires that the operator of a non-agricultural spark-ignited IC engine subject to the requirements of Section 5.2 or any engine subject to the requirements of Section 8.0 shall comply with the following requirements of Sections 5.8.1 – 5.8.11:

Section 5.8.1 stipulates that for each engine with a rated brake horsepower of 1,000 hp or greater and which is allowed to operate more than 2,000 hours per calendar year, or with an external emission control device, shall either install, operate, and maintain continuous monitoring equipment for $NO_X$, CO, and oxygen, as identified in Rule 1080 (Stack Monitoring), or install, operate, and maintain APCO-approved alternate monitoring. The monitoring system may be a continuous emissions monitoring system (CEMS), a parametric emissions monitoring system (PEMS), or an alternative monitoring system approved by the APCO. APCO-approved alternate monitoring shall consist of one or more of the following:

5.8.1.1 Periodic $NO_X$ and CO emission concentrations,

5.8.1.2 Engine exhaust oxygen concentration,

5.8.1.3 Air-to-fuel ratio,
5.8.1.4 Flow rate of reducing agents added to engine exhaust,
5.8.1.5 Catalyst inlet and exhaust temperature,
5.8.1.6 Catalyst inlet and exhaust oxygen concentration, or
5.8.1.7 Other operational characteristics.

The applicant has proposed to comply with this section of the Rule by proposing a pre-approved alternate emissions monitoring plan that specifies that the permittee perform periodic $NO_X$, CO, and $O_2$ emissions concentrations as specified in District Policy SSP-1810, dated 4/29/04. Therefore, the following condition will be placed on the engine ATC permits:

- The permittee shall monitor and record the stack concentration of NOx, CO, and O2 at least once every calendar quarter (in which a source test is not performed) using a portable emission monitor that meets District specifications. [In-stack monitors may be allowed if they satisfy the standards for portable analyzers as specified in District policies and are approved in writing by the APCO.] Monitoring shall be performed not less than once every month for 12 months if two consecutive deviations are observed during quarterly monitoring. Monitoring shall not be required if the engine is not in operation, i.e. the engine need not be started solely to perform monitoring. Monitoring shall be performed within 5 days of restarting the engine unless monitoring has been performed within the last month if on a monthly monitoring schedule, or within the last quarter if on a quarterly monitoring schedule. Records must be maintained of the dates of non-operation to validate extended monitoring frequencies. [District Rules 2201 and 4702]

Section 5.8.2 requires that for each non-agricultural spark-ignited IC engine not subject to Section 5.8.1, the operator shall monitor operational characteristics recommended by the engine manufacturer or emission control system supplier, and approved by the APCO. The proposed engines will be subject to Section 5.8.1; therefore this section is not applicable.

Section 5.8.3 requires that for each engine with an alternative monitoring system, the operator shall submit to, and receive approval from the APCO, adequate verification of the alternative monitoring system's acceptability. The proposed ATC permits for the digester gas-fired engines include a pre-approved alternate emissions monitoring plan that specifies that the permittee perform periodic $NO_X$, CO, and $O_2$ emissions concentrations as specified in District Policy SSP-1810, dated 4/29/04. Therefore, this section is satisfied.

Section 5.8.4 requires that for each engine with an APCO approved CEMS, operate the CEMS in compliance with the requirements of 40 Code of Federal Regulations (CFR) Part 51, 40 CFR Parts 60.7 and 60.13 (except subsection h), 40 CFR Appendix B (Performance Specifications), 40 CFR Appendix F (Quality Assurance Procedures), and applicable provisions of Rule 1080 (Stack Monitoring). The IC engines proposed under this project will not have CEMS installed; therefore this section of the Rule is not applicable.

Section 5.8.5 requires that each engine have the data gathering and retrieval capabilities of an installed monitoring system described in Section 5.8 approved by the APCO. As stated above, the proposed ATC permits for the proposed digester gas-fired engines include an alternate emissions monitoring plan that has been pre-approved by the APCO. Therefore, this section is satisfied.

Section 5.8.6 requires that for each non-agricultural spark-ignited IC engine, the operator shall install and operate a nonresettable elapsed operating time meter. In lieu of installing a nonresettable time meter, the operator may use an alternative device, method, or technique in determining operating time provided that the alternative is approved by the APCO. The operator shall maintain and operate the required meter in accordance with the manufacturer's instructions. The applicant has proposed a nonresettable elapsed operating time meter for the engines in this project. Therefore, the following condition will be placed on the engine ATC permits to ensure compliance:

- This engine shall be equipped with an operational non-resettable elapsed time meter. [District Rules 2201 and 4702]

Section 5.8.7 requires that for each engine, the permittee shall implement the Inspection and Monitoring (I&M) plan submitted to and approved by the APCO pursuant to Section 6.5. The applicant has submitted an I&M program with this ATC application and the requirements of this plan will be explained in detail in the section that covers Section 6.5 of this Rule.

Section 5.8.8 requires that for each engine, collect data through the I&M plan in a form approved by the APCO. The applicant has submitted an I&M program and the requirements of this plan will be explained in detail in the section that covers Section 6.5 of this Rule.

Section 5.8.9 requires for each non-agricultural spark-ignited IC engine, use of a portable $NO_X$ analyzer to take $NO_X$ emission readings to verify compliance with the emission requirements of Section 5.2 or Section 8.0 during each calendar quarter in which a source test is not performed. If an engine is operated less than 120 calendar days per calendar year, the operator shall take one $NO_X$ emission reading during the calendar year in which a source test is not performed and the engine is operated. All emission readings shall be taken with the engine operating either at conditions representative of normal operations or conditions specified in the Permit-to-Operate or Permit-Exempt Equipment Registration. The analyzer shall be calibrated, maintained, and operated in accordance with the manufacturer's specifications and recommendations or a protocol approved by the APCO. All $NO_X$ emissions readings shall be reported to the APCO in a manner approved by the APCO. $NO_X$ emission readings taken pursuant to this section shall be averaged over a 15 consecutive-minute period by either taking a cumulative 15 consecutive minute sample reading or by taking at least five (5) readings evenly spaced out over the 15 consecutive-minute period. Therefore, the following conditions will be placed on the ATC permits:

- The permittee shall monitor and record the stack concentration of NOx, CO, and O2 at least once every calendar quarter (in which a source test is not performed) using a portable emission monitor that meets District specifications. [In-stack monitors may be allowed if they satisfy the standards for portable analyzers as specified in District policies and are approved in writing by the APCO.] Monitoring shall be performed not less than once every month for 12 months if two consecutive deviations are observed during quarterly monitoring. Monitoring shall not be required if the engine is not in operation, i.e. the engine need not be started solely to perform monitoring. Monitoring shall be performed within 5 days of restarting the engine unless monitoring has been performed within the last month if on a monthly monitoring schedule, or within the last quarter if on a quarterly monitoring schedule. Records must be maintained of the dates of non-operation to validate extended monitoring frequencies. [District Rules 2201 and 4702]

- {3787} All alternate monitoring parameter emission readings shall be taken with the unit operating either at conditions representative of normal operations or conditions specified in the permit-to-operate. The analyzer shall be calibrated, maintained, and operated in accordance with the manufacturer's specifications and recommendations or a protocol approved by the APCO. Emission readings taken shall be averaged over a 15 consecutive-minute period by either taking a cumulative 15 consecutive-minute sample reading or by taking at least five (5) readings, evenly spaced out over the 15 consecutive-minute period. [District Rule 4702]

Section 5.8.10 specifies that the APCO shall not approve an alternative monitoring system unless it is documented that continued operation within ranges of specified emissions related performance indicators or operational characteristics provides a reasonable assurance of compliance with applicable emission limits and that the operator shall source test over the proposed range of surrogate operating parameters to demonstrate compliance with the applicable emission standards. The proposed ATC permits for the digester gas-fired engines include a pre-approved alternate emissions monitoring plan that requires periodic $NO_X$, CO, and $O_2$ emissions concentrations. Therefore, this section is satisfied.

Section 5.8.11 requires that for each non-agricultural spark-ignited IC engine subject to the Alternate Emission Control Plan (AECP) of Section 8.0, the operator shall install and operate a nonresettable fuel meter. In lieu of installing a nonresettable fuel meter, the operator may use an alternative device, method, or technique in determining daily fuel consumption provided that the alternative is approved by the APCO. The operator shall maintain, operate, and calibrate the required fuel meter in accordance with the manufacturer's instructions. The use of an Alternate Emission Control Plan to comply with Section 5.2 is not being proposed for the IC engines under this project; therefore this section of the Rule is not applicable.

Section 5.9 specifies monitoring requirements for all other engines that are not subject to the requirements of Section 5.8. The proposed spark-ignited non-agricultural digester gas-fired engines are subject to the requirements of Section 5.8; therefore this section of the Rule is not applicable.

Section 5.10 specifies $SO_X$ Emissions Monitoring Requirements. On and after the compliance schedule specified in Section 7.5, an operator of a non-agricultural IC engine shall comply with the following requirements:

5.10.1 An operator of an engine complying with Sections 5.7.2 or 5.7.5 shall perform an annual sulfur fuel analysis in accordance with the test methods in Section 6.4. The operator shall keep the records of the fuel analysis and shall provide it to the District upon request,

5.10.2 An operator of an engine complying with Section 5.7.6 by installing and operating a control device with at least 95% by weight SOx reduction efficiency shall submit for approval by the APCO the proposed the key system operating parameters and frequency of the monitoring and recording not later than July 1, 2013, and

5.10.3 An operator of an engine complying with Section 5.7.6 shall perform an annual source test unless a more frequent sampling and reporting period is included in the Permit-to-Operate. Source tests shall be performed in accordance with the test methods in Section 6.4.

The following condition will be listed on the proposed ATC permits to ensure compliance:

- Fuel sulfur content analysis shall be performed at least annually using EPA Method 11 or EPA Method 15, as appropriate. Records of the fuel sulfur analysis shall be maintained and provided to the District upon request. [District Rules 2201 and 4702]

Section 5.11 requires operators of engines used exclusively in agricultural operations that are not required to have a Permit-to-Operate pursuant to California Health and Safety Code Section 42301.16 but are required to comply with Section 5.2 of Rule 4702 shall register such engines pursuant to Rule 2250 (Permit-Exempt Equipment Registration). The proposed spark-ignited non-agricultural digester gas-fired engines are required to have a District Permit to Operate; therefore this section of the Rule is not applicable.

Section 6.1 requires that the operator of an engine subject to the requirements of Rule 4702 shall submit to the APCO an approvable emission control plan of all actions to be taken to satisfy the emission requirements of Section 5.2 and the compliance schedules of Section 7.0. If there is no change to the previously-approved emission control plan, the operator shall submit a letter to the District indicating that the previously approved plan is still valid.

Section 6.1.1 specifies that the requirement to submit an emission control plan shall apply to the following engines:

6.1.1.1 Engines that have been retrofitted with an exhaust control device, except those certified per Section 9.0;
6.1.1.2 Engines subject to Section 8.0;
6.1.1.3 An agricultural spark-ignited engine that is subject to the requirements of Section 8.0;
6.1.1.4 An agricultural spark-ignited engine that has been retrofitted with a catalytic emission control and is not subject to the requirements of Section 8.0

Section 6.1.2 specifies that the emission control plan shall contain the following information, as applicable for each engine:

6.1.2.1 Permit-to-Operate number, Authority-to-Construct number, or Permit-Exempt Equipment Registration number,
6.1.2.2 Engine manufacturer,
6.1.2.3 Model designation and engine serial number,
6.1.2.4 Rated brake horsepower,
6.1.2.5 Type of fuel and type of ignition,
6.1.2.6 Combustion type: rich-burn or lean-burn,
6.1.2.7 Total hours of operation in the previous one-year period, including typical daily operating schedule,
6.1.2.8 Fuel consumption (cubic feet for gas or gallons for liquid) for the previous one-year period,
6.1.2.9 Stack modifications to facilitate continuous in-stack monitoring and to facilitate source testing,
6.1.2.10 Type of control to be applied, including in-stack monitoring specifications,
6.1.2.11 Applicable emission limits,
6.1.2.12 Documentation showing existing emissions of $NO_X$, VOC, and CO, and
6.1.2.13 Date that the engine will be in full compliance with this rule.

Section 6.1.3 requires that the emission control plan shall identify the type of emission control device or technique to be applied to each engine and a construction/removal schedule, or shall provide support documentation sufficient to demonstrate that the engine is in compliance with the emission requirements of this rule.

Section 6.1.4 requires that for an engine being permanently removed from service, the emission control plan shall include a letter of intent pursuant to Section 7.2.

The applicant has submitted all the required information for Section 6.1 in the application for the IC engines evaluated under this project.

Section 6.2.1 requires that the operator of an engine subject to the requirements of Section 5.2 shall maintain an engine operating log to demonstrate compliance with Rule 4702. This information shall be retained for a period of at least five years, shall be readily available, and be made available to the APCO upon request. The engine operating log shall include, on a monthly basis, the following information:

6.2.1.1 Total hours of operation,
6.2.1.2 Type of fuel used,
6.2.1.3 Maintenance or modifications performed,
6.2.1.4 Monitoring data,
6.2.1.5 Compliance source test results, and
6.2.1.6 Any other information necessary to demonstrate compliance with this rule.
6.2.1.7 For an engine subject to Section 8.0, the quantity (cubic feet of gas or gallons of liquid) of fuel used on a daily basis.

The following condition will be placed on the ATC permits:

- The permittee shall maintain an engine operating log to demonstrate compliance. The engine operating log shall include, on a monthly basis, the following information: the total hours of operation, the type and quantity of fuel used, maintenance and modifications performed, monitoring data, compliance source test results, and any other information necessary to demonstrate compliance. Quantity of fuel used shall be recorded in standard cubic feet using a non-resettable, totalizing mass or volumetric fuel flow meter or other APCO approved-device. [District Rules 2201 and 4702]

Section 6.2.2 requires that the data collected pursuant to the requirements of Section 5.8 and Section 5.9 shall be maintained for at least five years, shall be readily available, and made available to the APCO upon request.

The following previously presented condition will be listed on the proposed ATC permits to ensure compliance:

- All records shall be maintained and retained for a minimum of five (5) years, and shall be made available for District inspection upon request. All records may be maintained and submitted in an electronic format approved by the District. [District Rules 2201 and 4702]

Section 6.2.3 requires that an operator claiming an exemption under Section 4.2 or Section 4.3 shall maintain annual operating records. This information shall be retained for at least five

years, shall be readily available, and provided to the APCO upon request. The records shall include, but are not limited to, the following:

6.2.3.1 Total hours of operation,
6.2.3.2 The type of fuel used,
6.2.3.3 The purpose for operating the engine,
6.2.3.4 For emergency standby engines, all hours of non-emergency and emergency operation shall be reported, and
6.2.3.5 Other support documentation necessary to demonstrate claim to the exemption

The applicant is not claiming an exemption for the proposed engines under Section 4.2 or Section 4.3; therefore, this section does not apply.

Section 6.3 requires that the operator of an engine subject to the emission limits in Section 5.2 or the requirements of Section 8.2, shall comply with the compliance testing requirements of Section 6.3.

Section 6.3.1 specifies that the requirements of Section 6.3.2 through Section 6.3.4 shall apply to the following engines:

6.3.1.1 Engines that have been retrofitted with an exhaust control device, except those certified per Section 9.0;
6.3.1.2 Engines subject to Section 8.0;
6.3.1.3 An agricultural spark-ignited engine that is subject to the requirements of Section 8.0;
6.3.1.4 An agricultural spark-ignited engine that has been retrofitted with a catalytic emission control and is not subject to the requirements of Section 8.0

Section 6.3.2 requires demonstration of compliance with applicable limits, ppmv or percent reduction, in accordance with the test methods in Section 6.4, as specified below:

6.3.2.1 By the applicable date specified in Section 5.2, and at least once every 24 months thereafter, except for an engine subject to Section 6.3.2.2.
6.3.2.2 By the applicable date specified in Section 5.2 and at least once every 60 months thereafter, for an agricultural spark-ignited engine that has been retro-fitted with a catalytic emission control device.
6.3.2.3 A portable NOx analyzer may be used to show initial compliance with the applicable limits/standards in Section 5.2 for agricultural spark-ignited engines, provided the criteria specified in Sections 6.3.2.3.1 to 6.3.2.3.5 are met, and a source test is conducted in accordance with Section 6.3.2 within 12 months from the required compliance date.

The following conditions will be included the ATC permits to ensure compliance:

- Source testing to measure NOx, CO, VOC, PM10, and ammonia (NH3) emissions from this unit shall be conducted within 90 days of initial start-up. [District Rules 1081, 2201, and 4702]
- Source testing to measure NOx, CO, VOC, and ammonia (NH3) emissions from this unit shall be conducted at least once every 24 months. [District Rules 1081, 2201, and 4702]

Section 6.3.3 requires the operator to conduct emissions source testing with the engine operating either at conditions representative of normal operations or conditions specified in the

Permit-to-Operate or Permit-Exempt Equipment Registration. For emissions source testing performed pursuant to Section 6.3.2 for the purpose of determining compliance with an applicable standard or numerical limitation, the arithmetic average of three (3) 30-consecutive-minute test runs shall apply. If two (2) of three (3) runs are above an applicable limit, the test cannot be used to demonstrate compliance with an applicable limit. VOC shall be reported as methane. VOC, $NO_X$, and CO concentrations shall be reported in ppmv, corrected to 15 percent oxygen. For engines that comply with a percent reduction limit, the percent reduction of $NO_X$ emissions shall also be reported.

The following conditions will be included in the ATC permits to ensure compliance:

- {3791} Emissions source testing shall be conducted with the engine operating either at conditions representative of normal operations or conditions specified in the Permit to Operate. [District Rule 4702]
- For emissions source testing, the arithmetic average of three 30-consecutive-minute test runs shall apply. If two of three runs are above an applicable limit, the test cannot be used to demonstrate compliance with an applicable limit. VOC emissions shall be reported as methane. NOx, CO, VOC, and NH3 concentrations shall be reported in ppmv, corrected to 15% oxygen. [District Rules 2201 and 4702]

Section 6.3.4 requires that in addition to other information, the source test protocol shall describe which critical parameters will be measured and how the appropriate range for these parameters shall be established. The range for these parameters shall be incorporated into the I&M plan.

Section 6.3.5 specifies that engines that are limited by Permit-to-Operate or Permit-Exempt Equipment Registration condition to be fueled exclusively with PUC quality natural gas shall not be subject to the reoccurring source test requirements of Section 6.3.2 for VOC emissions. The proposed engines will be fueled on digester gas; therefore this section does not apply.

Section 6.3.6 specifies requirements for spark-ignited engines for testing a unit or units that represent a specified group of units, in lieu of compliance with the applicable requirements of Section 6.3.2. Testing of representative units is not being proposed for the engines; therefore this section does not apply.

Section 6.4 requires that the compliance with the requirements of Section 5.2 shall be determined, as required, in accordance with the following test procedures or any other method approved by EPA and the APCO:

6.4.1 Oxides of nitrogen - EPA Method 7E, or ARB Method 100.
6.4.2 Carbon monoxide - EPA Method 10, or ARB Method 100.
6.4.3 Stack gas oxygen - EPA Method 3 or 3A, or ARB Method 100.
6.4.4 Volatile organic compounds - EPA Method 25A or 25B, or ARB Method 100. Methane and ethane, which are exempt compounds, shall be excluded from the result of the test.
6.4.5 Operating horsepower determination - any method approved by EPA and the APCO.
6.4.6 $SO_X$ Test Methods
6.4.6.1 Oxides of sulfur – EPA Method 6C, EPA Method 8, or ARB Method 100.

6.4.6.2 Determination of total sulfur as hydrogen sulfide ($H_2S$) content – EPA Method 11 or EPA Method 15, as appropriate.

6.4.6.3 Sulfur content of liquid fuel – American Society for Testing and Materials (ASTM) D 6920-03 or ASTM D 5453-99.

6.4.6.4 The $SO_X$ emission control system efficiency shall be determined using the following:

% Control Efficiency = $[(C_{SO2,\ inlet} - C_{SO2,\ outlet}) / C_{SO2,\ inlet}] \times 100$

Where:

$C_{SO2,\ inlet}$ = concentration of $SO_X$ (expressed as $SO_2$) at the inlet side of the $SO_X$ emission control system, in lb/Dscf

$C_{SO2,\ outlet}$ = concentration of $SO_X$ (expressed as $SO_2$) at the outlet side of the $SO_X$ emission control system, in lb/Dscf

6.4.7 The Higher Heating Value (hhv) of the fuel shall be determined by one of the following test methods:

6.4.7.1 ASTM D 240-02 or ASTM D 3282-88 for liquid hydrocarbon fuels.

6.4.7.2 ASTM D 1826-94 or ASTM 1945-96 in conjunction with ASTM D 3588-89 for gaseous fuel.

The following conditions will be listed on the proposed ATC permits to ensure compliance:

- The following methods shall be used for source testing: NOx (ppmv) - EPA Method 7E or ARB Method 100; CO (ppmv) - EPA Method 10 or ARB Method 100; VOC (ppmv) - EPA Method 18, 25A or 25B, or ARB Method 100; stack gas oxygen - EPA Method 3 or 3A or ARB Method 100; stack gas velocity - EPA Method 2 or EPA Method 19; stack gas moisture content - EPA Method 4; PM10 (filterable and condensable) - EPA Method 201 and 202, EPA Method 201a and 202, or ARB Method 5 in combination with Method 501; NH3 - BAAQMD ST-1B or SCAQMD Method 207-1. Alternative test methods as approved by the District may also be used to address the source testing requirements of this permit. [District Rules 1081 and 4702]
- Fuel sulfur content analysis shall be performed at least annually using EPA Method 11 or EPA Method 15, as appropriate. Records of the fuel sulfur analysis shall be maintained and provided to the District upon request. [District Rules 2201 and 4702]
- The Higher Heating Value (HHV) of the fuel gas shall be determined using ASTM D1826, ASTM 1945 in conjunction with ASTM D3588, or an alternative method approved by the District. [District Rules 2201 and 4702]

Section 6.5 requires that the operator of an engine that is subject to the requirements of Section 5.2 or the requirements of Section 8.0 shall submit to the APCO for approval, an Inspection & Maintenance (I&M) plan that specifies all actions to be taken to satisfy the requirements of Sections 6.5.1 through Section 6.5.9 and the requirements of Section 5.8. The actions to be identified in the I&M plan shall include, but are not limited to, the information specified below. If there is no change to the previously approved I&M plan, the operator shall submit a letter to the District indicating that previously approved plan is still valid.

Section 6.5.1 specifies that the I&M plan requirements of Sections 6.5.2 through Section 6.5.9 shall apply to the following engines:

6.5.1.1 Engines that have been retrofitted with an exhaust control device, except those certified per Section 9.0;

6.5.1.2 Engines subject to Section 8.0;

6.5.1.3 An agricultural spark-ignited engine that is subject to the requirements of Section 8.0.

6.5.1.4 An agricultural spark-ignited engine that has been retrofitted with a catalytic emission control and is not subject to the requirements of Section 8.0

The digester gas-fired IC engines evaluated under this project will be equipped with SCR systems for control of $NO_X$ and oxidation catalysts for control of CO and VOC. Therefore, the requirements of Sections 6.5.2 through 6.5.9 are applicable to the engines.

Section 6.5.2 requires procedures requiring the operator to establish ranges for control equipment parameters, engine operating parameters, and engine exhaust oxygen concentrations that source testing has shown result in pollutant concentrations within the rule limits.

Section 6.5.3 requires procedures for monthly inspections as approved by the APCO. The applicable control equipment parameters and engine operating parameters will be inspected and monitored monthly in conformance with a regular inspection schedule in the I&M plan.

The digester gas-fired IC engines evaluated under this project will be equipped with SCR systems for control of $NO_X$ and oxidation catalysts for control of CO and VOC. The applicant has proposed the following alternate monitoring program to ensure compliance with Sections 6.5.2 and 6.5.3 of the Rule.

$NO_X$ Emissions:

In order to satisfy the I & M requirements for $NO_X$ emissions, the applicant has proposed to perform the following:

1. Measurement of NOx emissions concentrations with a portable analyzer at least once every calendar quarter.

2. To ensure that NOx emissions concentrations are not being exceeded between periodic NOx portable analyzer measurements, the applicant is proposing to determine a correlation between the SCR system's reagent injection rate and the catalyst control system inlet exhaust temperature and $NO_X$ emissions. The appropriate ranges for each operating load will be established during performance testing and will be monitored at least once per month.

CO and VOC Emissions:

In order to satisfy the I & M requirements for CO and VOC emissions, the applicant has proposed to perform the following:

1. Measurement of CO emissions concentrations with a portable analyzer at least once every calendar quarter. Generally, if the oxidation catalyst is controlling CO emissions, it should also be achieving the desired removal efficiency for VOC emissions. Therefore, no additional monitoring for VOC emissions is required.

2. To ensure that CO and VOC emissions concentrations are not being exceeded between periodic CO emissions concentration measurements, the applicant is proposing to determine a correlation between the catalyst control system inlet exhaust temperature and back pressure and CO emissions. The appropriate ranges for each operating load will be established during performance testing and will be monitored at least once per month.

Therefore, the following conditions will be listed on the proposed ATC permits to ensure compliance with the I & M requirements for $NO_X$, CO, and VOC:

- Within 90 days of initial start-up, the SCR system reagent injection rate and inlet temperature to the catalyst control system shall be monitored to establish acceptable values and ranges that provide a reasonable assurance of ongoing compliance with the NOx emissions limit(s) stated in this permit. Acceptable values and ranges shall be established for each load that the engine is expected to operate at, in a minimum of 10% increments (e.g. 70%, 80%, and 90%). Records of the acceptable SCR system reagent injection rate(s) and inlet temperature(s) to the catalyst control system demonstrated to result in compliance with the NOx emission limit(s) shall be maintained and made available for inspection upon request. [District Rule 4702]
- If the SCR system reagent injection rate and/or the inlet temperature to the catalyst control system is outside of the established acceptable range(s), the permittee shall return the SCR system reagent injection rate and inlet temperature to the catalyst control system to within the established acceptable range(s) as soon as possible, but no longer than 8 hours after detection. If the SCR system reagent injection rate and inlet temperature to the catalyst control system are not returned to within acceptable range(s) within 8 hours, the permittee shall notify the District within the following 1 hour and begin monitoring and recording the stack concentration of NOx and O2 at least once every month. Monthly monitoring of the stack concentration of NOx and O2 shall continue until the operator can show that the SCR system reagent injection rate and inlet temperature to the catalyst control system are operating within the acceptable range(s) demonstrated to result in compliance with the NOx emission limit(s) of this permit. [District Rule 4702]
- Within 90 days of initial start-up, the inlet temperature to the catalyst control system and the back pressure of the exhaust upstream of the catalyst control system shall be monitored to establish acceptable values and ranges that provide a reasonable assurance of ongoing compliance with the emissions limit(s) stated in this permit. Acceptable values and ranges shall be established for each load that the engine is expected to operate at, in a minimum of 10% increments (e.g. 70%, 80%, and 90%). Records of the established acceptable inlet temperature(s) and back pressure(s) demonstrated to result in compliance with the CO and VOC emission limits shall be maintained and made available for inspection upon request. [District Rule 4702]
- If the inlet temperature to the catalyst control system and/or the back pressure of the exhaust upstream of the catalyst control system is outside of the established acceptable range(s), the permittee shall return the inlet temperature to the catalyst control system and the back pressure of the exhaust upstream of the catalyst control system back to the acceptable range(s) as soon as possible, but no longer than 8 hours after detection. If the inlet temperature to the catalyst control system and the back pressure of the exhaust upstream of the catalyst control system are not returned to within acceptable range(s)

within 8 hours, the permittee shall notify the District within the following 1 hour and begin monitoring and recording the stack concentration of CO and O2 at least once every month. Monthly monitoring of the stack concentration of CO and O2 shall continue until the operator can show that the inlet temperature to the catalyst control system and the back pressure of the exhaust upstream of the catalyst control system are operating within the acceptable range(s) demonstrated to result in compliance with the CO emission limit(s) of this permit. [District Rule 4702]

- The permittee shall monitor and record the engine operating load, the SCR system reagent injection rate, the inlet temperature to the catalyst control system, and the back pressure of the exhaust upstream of the catalyst control system at least once per month. [District Rule 4702]

Section 6.5.4 requires procedures for the corrective actions on the noncompliant parameter(s) that the operator will take when an engine is found to be operating outside the acceptable range for control equipment parameters, engine operating parameters, and engine exhaust $NO_X$, CO, VOC, or oxygen concentrations.

Section 6.5.5 requires procedures for the operator to notify the APCO when an engine is found to be operating outside the acceptable range for control equipment parameters, engine operating parameters, and engine exhaust $NO_X$, CO, VOC, or oxygen concentrations.

The applicant has proposed that the alternate monitoring program will ensure compliance with these two sections of the Rule. Therefore, the following conditions will be listed on the proposed ATC permits to ensure compliance:

- If the NOx, CO, or NH3 concentrations corrected to 15% O2, as measured by the portable analyzer or the District-approved ammonia monitoring equipment, exceed the respective permitted emissions concentration(s), the permittee shall return the emissions to within the acceptable range as soon as possible, but no longer than 8 hours of operation after detection. If the portable analyzer or ammonia monitoring equipment readings continue to exceed the permitted emissions concentration(s) after 8 hours of operation after detection, the permittee shall notify the District within the following 1 hour and conduct a certified source test within 60 days of the first exceedance. In lieu of conducting a source test, the permittee may stipulate a violation has occurred, subject to enforcement action. The permittee must then correct the violation, show compliance has been re-established, and resume monitoring procedures. If the deviations are the result of a qualifying breakdown condition pursuant to Rule 1100, the permittee may fully comply with Rule 1100 in lieu of the performing the notification and testing required by this condition. [District Rules 2201 and 4702]
- If the SCR system reagent injection rate and/or the inlet temperature to the catalyst control system is outside of the established acceptable range(s), the permittee shall return the SCR system reagent injection rate and inlet temperature to the catalyst control system to within the established acceptable range(s) as soon as possible, but no longer than 8 hours after detection. If the SCR system reagent injection rate and inlet temperature to the catalyst control system are not returned to within acceptable range(s) within 8 hours, the permittee shall notify the District within the following 1 hour and begin monitoring and recording the stack concentration of NOx and O2 at least once every month. Monthly monitoring of the stack concentration of NOx and O2 shall continue until the operator can show that the SCR system reagent injection rate and inlet temperature to the catalyst control

system are operating within the acceptable range(s) demonstrated to result in compliance with the NOx emission limit(s) of this permit. [District Rule 4702]

- If the inlet temperature to the catalyst control system and/or the back pressure of the exhaust upstream of the catalyst control system is outside of the established acceptable range(s), the permittee shall return the inlet temperature to the catalyst control system and the back pressure of the exhaust upstream of the catalyst control system back to the acceptable range(s) as soon as possible, but no longer than 8 hours after detection. If the inlet temperature to the catalyst control system and the back pressure of the exhaust upstream of the catalyst control system are not returned to within acceptable range(s) within 8 hours, the permittee shall notify the District within the following 1 hour and begin monitoring and recording the stack concentration of CO and O2 at least once every month. Monthly monitoring of the stack concentration of CO and O2 shall continue until the operator can show that the inlet temperature to the catalyst control system and the back pressure of the exhaust upstream of the catalyst control system are operating within the acceptable range(s) demonstrated to result in compliance with the CO emission limit(s) of this permit. [District Rule 4702]

Section 6.5.6 requires procedures for and corrective maintenance performed for the purpose of maintaining an engine in proper operating condition. The applicant has proposed that the engines will be operated and maintained per the specifications of the manufacturer or emissions control system supplier. Therefore, the following conditions will be listed on the proposed ATC permits:

- {4261} This engine shall be operated and maintained in proper operating condition as recommended by the engine manufacturer or emissions control system supplier. [District Rule 4702]
- {3203} This engine shall be operated within the ranges that the source testing has shown result in pollution concentrations within the emissions limits as specified on this permit. [District Rule 4702]

Section 6.5.7 requires procedures and a schedule for using a portable $NO_X$ analyzer to take $NO_X$ emission readings pursuant to Section 5.8.9. The applicant has proposed that the alternate monitoring program will ensure compliance with this section of the Rule. The following previously proposed condition will be listed on the proposed ATC permits:

- {3787} All alternate monitoring parameter emission readings shall be taken with the unit operating either at conditions representative of normal operations or conditions specified in the permit-to-operate. The analyzer shall be calibrated, maintained, and operated in accordance with the manufacturer's specifications and recommendations or a protocol approved by the APCO. Emission readings taken shall be averaged over a 15 consecutive-minute period by either taking a cumulative 15 consecutive-minute sample reading or by taking at least five (5) readings, evenly spaced out over the 15 consecutive-minute period. [District Rule 4702]

Section 6.5.8 requires procedures for collecting and recording required data and other information in a form approved by the APCO including, but not limited to, data collected through the I&M plan and the monitoring systems described in Sections 5.8.1 and 5.8.2. Data collected through the I&M plan shall have retrieval capabilities as approved by the APCO. The

applicant has proposed that the alternate monitoring program will ensure compliance with this section of the Rule.

The following condition will be listed on the proposed ATC permits to ensure compliance:

- The permittee shall maintain records of: (1) the date and time of NOx, CO, O2, and NH3 measurements, (2) the O2 concentration in percent and the measured NOx, CO, and NH3 concentrations corrected to 15% O2, (3) make and model of exhaust gas analyzer, (4) exhaust gas analyzer calibration records, (5) the method of determining the NH3 emission concentration, and (6) a description of any corrective action taken to maintain the emissions within the acceptable range. [District Rules 2201 and 4702]

Section 6.5.9 specifies procedures for revising the I&M plan. The I&M plan shall be updated to reflect any change in operation. The I&M plan shall be updated prior to any planned change in operation. An engine operator that changes significant I&M plan elements must notify the District no later than seven days after the change and must submit an updated I&M plan to the APCO no later than 14 days after the change for approval. The date and time of the change to the I&M plan shall be recorded in the engine operating log. For new engines and modifications to existing engines, the I&M plan shall be submitted to and approved by the APCO prior to issuance of the Permit-to-Operate or Permit-Exempt Equipment Registration. The operator of an engine may request a change to the I&M plan at any time.

The applicant has proposed to comply with the I&M plan modification requirements per this section of the Rule. The following condition will be listed on the proposed ATC permits to ensure compliance:

- {3212} The permittee shall update the I&M plan for this engine prior to any planned change in operation. The permittee must notify the District no later than seven days after changing the I&M plan and must submit an updated I&M plan to the APCO for approval no later than 14 days after the change. The date and time of the change to the I&M plan shall be recorded in the engine's operating log. For modifications, the revised I&M plan shall be submitted to and approved by the APCO prior to issuance of the Permit to Operate. The permittee may request a change to the I&M plan at any time. [District Rule 4702]

Section 7.0 specifies the schedules for compliance with the general requirements of Section 5.0 and the Alternative Emission Control Plan (AECP) option of Section 8.0. The proposed IC engines will be required to comply with the applicable sections of District Rule 4702 upon initial startup of the equipment; therefore, compliance with this section is expected.

Section 8.0 specifies requirements for use of an Alternative Emission Control Plan (AECP) to comply with the $NO_X$ emission requirements of Section 5.2 for a group of engines. Requirements for use of an AECP include: only engines subject to Section 5.2 are eligible for inclusion in an AECP; during any seven consecutive day period, the operator shall operate all engines in the AECP to achieve an actual aggregate $NO_X$ emission level that is ≤ 90% of the $NO_X$ emissions that would be obtained by controlling the engines to comply individually with the $NO_X$ limits in Section 5.2; the operator shall establish a $NO_X$ emission factor limit for each engine; the operator must submit the AECP at least 18 months before compliance with the emission limits in Section 5.2 is required and receive approval from the APCO; the operator must submit and updated or modified AECP for approval by the APCO prior to any

modifications; and the operator must maintain records necessary to demonstrate compliance with AECP. The use of an Alternate Emission Control Plan to comply with Section 5.2 is not being proposed for the IC engines proposed under this project; therefore this section of the Rule is not applicable.

Section 9.0 specifies requirements for certification of exhaust control systems for compliance with District Rule 4702. Certification under this section for the exhaust control systems for the IC engines under this project is not currently being proposed and, in addition, certification under this section of the Rule would require that the engines or identical units with the same fuel supply and exhaust control systems were operating and could be source tested to demonstrate compliance with the applicable limits; therefore this section of the Rule is not applicable.

Conclusion

As shown above, the proposed non-agricultural, digester gas-fired, lean burn, IC engines are expected to comply with the applicable requirements of Rule 4702 upon initial operation and no further discussion is required.

**Rule 4801 Sulfur Compounds**

The purpose of this District Rule 4801 is to limit the emissions of sulfur compounds. The limit is that sulfur compound emissions (as $SO_2$) shall not exceed 0.2% by volume. Using the ideal gas equation, the sulfur compound emissions are calculated as follows:

Volume of $SO_X$ as ($SO_2$) = (n x R x T) ÷ P
Where:

n = moles $SO_X$
T (standard temperature) = 60 °F or 520 °R
R (universal gas constant) = $\frac{10.73\,\text{psi}\cdot\text{ft}^3}{\text{lb}\cdot\text{mol}\cdot{}^\circ\text{R}}$

$$0.0113 \quad \frac{lb}{MMBtu}\times\frac{1\,MMBtu}{9{,}100 scf_{exhaust}}\times\frac{1\,lb\cdot mol}{64\,lb\cdot SO_2}\times\frac{10.73\,psi\cdot ft^3}{lb\cdot mol\cdot{}^\circ R}\times\frac{520^\circ R}{14.7\,psi}\times 1{,}000{,}000\,ppm = \quad 7.4 \quad \text{ppmv}$$

Since 7.4 ppmv is ≤ 2000 ppmv, the engines are expected to comply with Rule 4801. The following condition will be placed on the engine ATC permits to ensure compliance:

- The sulfur content of the digester gas used as fuel in this engine shall not exceed 40 ppmv as H2S. The applicant may utilize an averaging period of up to 24 hours in length for demonstration of compliance with the fuel sulfur content limit. [District Rules 2201, 4102, 4702, and 4801]

**40 CFR 60 Subpart JJJJ Standards of Performance for Stationary Spark Ignition Internal Combustion Engines**

This rule incorporates the New Source Performance Standards (NSPS) from Part 60, Chapter 1, Title 40, Code of Federal Regulations (CFR); and applies to all new sources of air pollution and modifications of existing sources of air pollution listed in 40 CFR Part 60.

The purpose of 40 CFR 60 Subpart JJJJ is to establish New Source Performance Standards to reduce emissions of $NO_X$, $SO_X$, PM, CO, and VOC from new stationary spark ignition (SI) internal combustion (IC) engines.

Pursuant to Section 60.4230, compliance with this subpart is required for owners and operators of stationary SI IC engines that commence construction after June 12, 2006, where the stationary SI ICE are manufactured: (a) on or after July 1, 2007, for engines with a maximum engine power greater than or equal to 500 HP (except lean burn engines with a maximum engine power greater than or equal to 500 HP and less than 1,350 HP); (b) on or after January 1, 2008, for lean burn engines with a maximum engine power greater than or equal to 500 HP and less than 1,350 HP; (c) on or after July 1, 2008, for engines with a maximum engine power less than 500 HP; or (d) on or after January 1, 2009, for emergency engines with a maximum engine power greater than 19 KW (25 HP).

The proposed engines are 1,468 bhp SI ICEs that will be constructed after June 12, 2006 and manufactured after July 1, 2007; therefore, the engines are subject to this subpart. However, the District has not been delegated the authority to implement 40 CFR 60, Subpart JJJJ for non-Major Sources; therefore, the requirements from this subpart will not be included in the ATC permits. However, the applicant will be responsible for compliance with the applicable requirements of this regulation.

**40 CFR 63 Subpart ZZZZ National Emission Standards for Hazardous Air Pollutants for Stationary Internal Combustion Engines**

40 CFR 63 Subpart ZZZZ establishes national emission limitations and operating limitations for hazardous air pollutants (HAPs) emitted from stationary reciprocating internal combustion engines (RICE) located at major and area sources of HAP emissions. A major source of HAP emissions is a facility that has the potential to emit any single HAP at a rate of 10 tons/year or greater or any combinations of HAPs at a rate of 25 tons/year or greater. An area source of HAPs is a facility is not a major source of HAPs.

Pursuant to Section 63.6590(c), an affected source that is a new or reconstructed stationary Reciprocating Internal Combustion Engine (RICE) located at an area source must meet the requirements of 40 CFR 63, Subpart ZZZZ by meeting the requirements of 40 CFR 60, Subpart IIII, for compression ignition engines or 40 CFR 60, Subpart JJJJ, for spark ignition engines and no further requirements apply for such engines under this part. As with 40 CFR 60, Subpart JJJJ, the District has not been delegated the authority to implement 40 CFR 63, Subpart ZZZ for non-Major Sources; therefore, no requirements from this subpart will be included in the ATC permits. However, the applicant will be responsible for compliance with the applicable requirements of this regulation.

**California Health & Safety Code 42301.6 (School Notice)**

The District has verified that this site is not located within 1,000 feet of a school. Therefore, pursuant to California Health and Safety Code 42301.6, a school notice is not required.

**California Environmental Quality Act (CEQA)**

CEQA requires each public agency to adopt objectives, criteria, and specific procedures consistent with CEQA Statutes and the CEQA Guidelines for administering its responsibilities under CEQA, including the orderly evaluation of projects and preparation of environmental documents. The District adopted its *Environmental Review Guidelines* (ERG) in 2001. The basic purposes of CEQA are to:

- Inform governmental decision-makers and the public about the potential, significant environmental effects of proposed activities;
- Identify the ways that environmental damage can be avoided or significantly reduced;
- Prevent significant, avoidable damage to the environment by requiring changes in projects through the use of alternatives or mitigation measures when the governmental agency finds the changes to be feasible; and
- Disclose to the public the reasons why a governmental agency approved the project in the manner the agency chose if significant environmental effects are involved.

**Greenhouse Gas (GHG) Significance Determination**

It is determined that no other agency has or will prepare an environmental review document for the project. Thus the District is the Lead Agency for this project.

The proposed project is for construction of a renewable energy plant at an existing dairy facility. The proposed renewable energy plant will combust dairy digester gas in IC engines to produce electricity. The proposed project will involve diverting manure from existing open basin(s) and pond(s) at the dairy to covered lagoon digester(s), which will result in the capture of much of the methane that is currently released into the atmosphere from the open basins and pond at the dairy. Combustion of the dairy digester gas at the proposed renewable energy plant will oxidize the methane in the gas to carbon dioxide and water vapor. Because methane has a global warming potential at least 21 times that of carbon dioxide, combustion of the methane from the dairy digesters will result in a large net decrease in the global warming potential emitted from the dairy when compared to current levels. Therefore, the project will not result in an increase in project specific greenhouse gas emissions. The District therefore concludes that the project would have a less than cumulatively significant impact on global climate change.

**District CEQA Findings**

The District is the Lead Agency for this project because there is no other agency with broader statutory authority over this project. The District performed an Engineering Evaluation (this document) for the proposed project and determined that, although the project is considered to take place at a separate stationary source for NSR purposes,

the activity will occur on previously developed land at an existing dairy facility and the project involves negligible expansion of the existing use. Furthermore, the District determined that the activity will not have a significant effect on the environment. The District finds that the activity is categorically exempt from the provisions of CEQA pursuant to CEQA Guideline § 15301 (Existing Facilities), and finds that the project is exempt per the general rule that CEQA applies only to projects which have the potential for causing a significant effect on the environment (CEQA Guidelines §15061(b)(3)).

## IX. Recommendation

Compliance with all applicable rules and regulations is expected. Pending a successful NSR Public Noticing period, issue ATCs S-8637-1-0, -2-0, and -3-0 subject to the permit conditions on the attached draft ATC in Appendix D.

## X. Billing Information

| Annual Permit Fees | | | |
|---|---|---|---|
| Permit Number | Fee Schedule | Fee Description | Annual Fee |
| S-8367-1-0 | 3020-06 | Covered Lagoon Digester | $111.00 |
| S-8367-2-0 | 3020-10-F | 1,468 bhp IC engine | $785.00 |
| S-8367-3-0 | 3020-10-F | 1,468 bhp IC engine | $785.00 |

## Appendixes

A: Quarterly Net Emissions Change (QNEC)
B: BACT Analysis for the Proposed Digester Gas-Fired IC Engines
C: Summary of Health Risk Assessment (HRA) and Ambient Air Quality Analysis (AAQA)
D: Draft ATCs (S-8367-1-0, -2-0, & -3-0)

# APPENDIX A
## Quarterly Net Emissions Change (QNEC)

**Quarterly Net Emissions Change (QNEC)**

The Quarterly Net Emissions Change is used to complete the emission profile screen for the District's PAS database. The QNEC shall be calculated as follows:

QNEC = PE2 - PE1, where:

QNEC = Quarterly Net Emissions Change for each emissions unit, lb/qtr.
PE2 = Post Project Potential to Emit for each emissions unit, lb/qtr.
PE1 = Pre-Project Potential to Emit for each emissions unit, lb/qtr.

Using the values in Sections VII.C.2 and VII.C.1 in the evaluation above, quarterly PE2 and quarterly PE1 can be calculated as follows:

S-8637-1-0 (Digester System)

| PE1 (lb/qtr) S-8637-1-0 | | | | | |
|---|---|---|---|---|---|
| | PE1 (lb/year) | ÷ | 4 qtr/year | = | PE1 (lb/qtr) |
| $NO_X$ | 0 | ÷ | 4 qtr/year | = | 0.0 |
| $SO_X$ | 0 | ÷ | 4 qtr/year | = | 0.0 |
| $PM_{10}$ | 0 | ÷ | 4 qtr/year | = | 0.0 |
| CO | 0 | ÷ | 4 qtr/year | = | 0.0 |
| VOC | 0 | ÷ | 4 qtr/year | = | 0.0 |

| PE2 (lb/qtr) S-8637-1-0 | | | | | |
|---|---|---|---|---|---|
| | PE2 (lb/year) | ÷ | 4 qtr/year | = | PE2 (lb/qtr) |
| $NO_X$ | 0 | ÷ | 4 qtr/year | = | 0.0 |
| $SO_X$ | 0 | ÷ | 4 qtr/year | = | 0.0 |
| $PM_{10}$ | 0 | ÷ | 4 qtr/year | = | 0.0 |
| CO | 0 | ÷ | 4 qtr/year | = | 0.0 |
| VOC | 0 | ÷ | 4 qtr/year | = | 0.0 |

| Quarterly NEC [QNEC] S-8637-1-0 | | | | | |
|---|---|---|---|---|---|
| | PE2 (lb/qtr) | - | PE1 (lb/qtr) | = | NEC (lb/qtr) |
| $NO_X$ | 0.0 | - | 0.0 | = | 0.0 |
| $SO_X$ | 0.0 | - | 0.0 | = | 0.0 |
| $PM_{10}$ | 0.0 | - | 0.0 | = | 0.0 |
| CO | 0.0 | - | 0.0 | = | 0.0 |
| VOC | 0.0 | - | 0.0 | = | 0.0 |

S-8637-2-0 & -3-0 (1,468 bhp Digester Gas-Fired, Lean Burn, IC Engines)

| PE1 (lb/qtr) S-8637-2-0 & -3-0 | | | | | |
|---|---|---|---|---|---|
| | PE1 (lb/year) | ÷ | 4 qtr/year | = | PE1 (lb/qtr) |
| $NO_X$ | 0 | ÷ | 4 qtr/year | = | 0.0 |
| $SO_X$ | 0 | ÷ | 4 qtr/year | = | 0.0 |
| $PM_{10}$ | 0 | ÷ | 4 qtr/year | = | 0.0 |
| CO | 0 | ÷ | 4 qtr/year | = | 0.0 |
| VOC | 0 | ÷ | 4 qtr/year | = | 0.0 |

| PE2 (lb/qtr) S-8637-2-0 & -3-0 | | | | | |
|---|---|---|---|---|---|
| | PE2 (lb/year) | ÷ | 4 qtr/year | = | PE2 (lb/qtr) |
| $NO_X$ | 4,583 | ÷ | 4 qtr/year | = | 1,145.8 |
| $SO_X$ | 1,134 | ÷ | 4 qtr/year | = | 283.5 |
| $PM_{10}$ | 1,985 | ÷ | 4 qtr/year | = | 496.3 |
| CO | 50,818 | ÷ | 4 qtr/year | = | 12,704.5 |
| VOC | 3,185 | ÷ | 4 qtr/year | = | 796.3 |

| Quarterly NEC [QNEC] S-8637-2-0 & -3-0 | | | | | |
|---|---|---|---|---|---|
| | PE2 (lb/qtr) | - | PE1 (lb/qtr) | = | NEC (lb/qtr) |
| $NO_X$ | 1,145.8 | - | 0.0 | = | 1,145.8 |
| $SO_X$ | 283.5 | - | 0.0 | = | 283.5 |
| $PM_{10}$ | 496.3 | - | 0.0 | = | 496.3 |
| CO | 12,704.5 | - | 0.0 | = | 12,704.5 |
| VOC | 796.3 | - | 0.0 | = | 796.3 |

# APPENDIX B

## BACT Analysis for Digester Gas-Fired IC Engines

# SJVAPCD Best Available Control Technology (BACT) Guideline 3.3.15*
Last Update: 3/6/2013

## Waste Gas-Fired IC Engine**

| Pollutant | Achieved in Practice or contained in SIP | Technologically Feasible | Alternate Basic Equipment |
|---|---|---|---|
| $NO_X$ | 0.15 g/bhp-hr (lean-burn engine with SCR, rich-burn engine with 3-way catalyst, or other equivalent) | | 1. Fuel Cells (<0.05 lb/MW-hr)<br>2. Microturbines (<9 ppmv @ 15% $O_2$)<br>3. Gas Turbine (<9 ppmv @ 15% $O_2$) *(Note: gas turbines only ABE for projects ≥ 3 MW)* |
| $SO_X$ | Sulfur content of fuel gas ≤ 40 ppmv (as $H_2S$) (dry absorption, wet absorption, chemical $H_2S$ reduction, water scrubber, or equivalent) (may be averaged up to 24 hours for compliance) | | |
| $PM_{10}$ | Sulfur content of fuel gas ≤ 40 ppmv (as $H_2S$) | | |
| CO | 2.0 g/bhp-hr | | 1. Fuel Cells (<0.10 lb/MW-hr)<br>2. Microturbines (<60 ppmv @ 15% $O_2$)<br>3. Gas Turbine (<60 ppmv @ 15% $O_2$) *(Note: gas turbines only ABE for projects ≥ 3 MW)* |
| VOC | 0.10 g/bhp-hr (lean burn and positive crankcase ventilation (PCV) or a 90% efficient crankcase control device or equivalent) | | Fuel Cells (<0.02 lb-VOC/MW-hr as $CH_4$) |
| Ammonia ($NH_3$) Slip | ≤ 10 ppmv @ 15% $O_2$ | | |

*** For the purposes of this determination, waste gas is a gas produced from the digestion of material excluding municipal sources such as waste water treatment plants, landfills, or any source where siloxane impurities are a concern.*

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in s a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

***This is a Summary Page for this Class of Source - Permit Specific BACT Determinations on Next Pages**

**3.3.15**

# Top-Down BACT Analysis for Project S-1143770
# Digester Gas-Fired IC Engines

Current District BACT Guideline 3.3.15 applies to the proposed waste gas-fired IC engines. In accordance with the District BACT policy, information from District BACT Guideline 3.3.15 will be utilized for the BACT analysis for the digester gas-fired engines proposed under this project.

## I. Proposal and Process Description

ABEC #3 LLC dba Lakeview Dairy Biogas, a subsidiary of California Bioenergy, LLC, has requested Authority to Construct (ATC) permits to construct a covered lagoon anaerobic digester system (ATC S-8637-1-0) and to install two 1,468 bhp digester gas-fired IC engines (or approved engines of equal or lesser bhp) (ATCs S-8637-2-0 and -3-0) at Lakeview Farms dairy (Facility S-5254). Each engine will be equipped with a selective catalytic reduction (SCR) system for emissions control and will power an electrical generator that will produce up to 1,059 kWe. The covered lagoon digester will utilize an air injection system for biological removal of $H_2S$ from the digester gas. After initial removal of $H_2S$ in the covered lagoon digester, the digester gas will be captured by the covered the lagoon gas collection system and will be piped to the gas conditioning system for polishing to remove additional $H_2S$ by an iron sponge scrubber and/or activated carbon or an equivalent $H_2S$ removal system and for removal of moisture. The cleaned digester gas, which consists mostly of methane, the main component of natural gas, will then be sent to the engines for use as fuel to generate electricity for sale to a utility and to produce heat for the digester system.

## II. BACT Applicability

**New emissions units – PE > 2.0 lb/day**

| New Emissions Unit BACT Applicability for S-8637-2-0 & -3-0 After Commissioning | | | | |
|---|---|---|---|---|
| Pollutant | PE2 for each unit after commissioning (lb/day) | BACT Threshold (lb/day) | SSPE2 (lb/yr) | BACT Triggered? |
| $NO_X$ | 11.7 | > 2.0 | N/A | **Yes** |
| $SO_X$ | 3.1 | > 2.0 | N/A | **Yes** |
| $PM_{10}$ | 5.4 | > 2.0 | N/A | **Yes** |
| CO | 135.9 | > 2.0 and SSPE2 ≥ 200,000 lb/yr | 101,636 | No |
| VOC | 7.8 | > 2.0 | N/A | **Yes** |
| $NH_3$ | 3.9 | > 2.0 | N/A | **Yes** |

* BACT is not required for CO from a new or modified emissions unit at a Stationary Source with an SSPE2 of less than 200,000 pounds per year of CO.

## III. Top-Down BACT Analyses for the Digester Gas-Fired Engines

As stated above, the information form the existing District BACT Guideline 3.3.15 for Waste Gas-Fired IC Engines will be utilized for the BACT analysis for the proposed digester gas-fired IC engines under this project.

### 1. BACT Analysis for $NO_X$ Emissions:

#### a. Step 1 - List all control technologies

District BACT Guideline 3.3.15 lists the following options to reduce $NO_X$ emissions from waste gas-fired IC engines:

1) $NO_X$ emissions ≤ 0.15 g/bhp-hr (lean-burn engine with SCR, rich-burn engine with 3-way catalyst, or other equivalent) (Achieved in Practice)
2) Fuel Cell (≤ 0.05 lb/MW-hr) (Alternate Basic Equipment)
3) Microturbine (< 9 ppmv $NO_X$ @ 15% $O_2$) (Alternate Basic Equipment)
4) Gas Turbine (< 9 ppmv $NO_X$ @ 15% $O_2$) (Alternate Basic Equipment)

Description of Control Technologies

**1) $NO_X$ emissions ≤ 0.15 g/bhp-hr (9-11 ppmv $NO_X$ @ 15% $O_2$) (Selective Catalytic Reduction (SCR) or equivalent) (Achieved in Practice)**

A Selective Catalytic Reduction (SCR) system operates as an external control device where flue gases and a reagent (e.g. urea or ammonia) are passed through an appropriate catalyst. The reagent is used to reduce $NO_X$, over the catalyst bed, to form elemental nitrogen, water vapor, and other by-products. The use of a catalyst typically reduces the $NO_X$ emissions by up to 90%.

**2) Fuel Cell (≤ 0.05 lb- $NO_X$/MW-hr ≈ 1.5 ppmv $NO_X$ @ 15% $O_2$) (Alternate Basic Equipment)**

Fuel cells use an electrochemical process to produce a direct electric current without the combustion of fuel. Fuel cells use externally supplied reactant gases (hydrogen and oxygen) that are combined in a catalytic process. Like a battery, the electric potential generated by a fuel cell is accessed by connecting an external load to the anode and cathode plates of the fuel cell. Because the fuel for a fuel cell is supplied externally, it does not run down like a battery. However, the fuel cell stack must be periodically replaced because of deactivation of catalytic materials contained in the fuel cell, which results in reduced conversion efficiencies. Since fuel cells require pure hydrogen gas for fuel, hydrocarbons used to power fuel cells must be purified and reformed prior to use. The reformation process can occur in an external fuel processor or through internal reforming in the fuel cell. Both molten carbonate fuel cells and solid oxide fuel cells can internally reform the hydrocarbon fuel to hydrogen for use in the fuel cell. Additionally, these high temperature fuel cells are tolerant of $CO_2$ that is found biogas.

Fuel cells have recently been commercialized and offer the advantages of high efficiency, nearly negligible emissions, and very quiet power generation. The greatest deterrent to increased use of fuel cells is the significantly higher expense when compared to other generation technologies. These higher costs include the initial capital expense and, for biogas installations, the increased ongoing expenses associated with the extensive cleanup required to remove contaminants that can poison fuel cell catalysts. Although this expense can be substantial, biogas-fueled fuel cells have been installed at some wastewater treatment plants and fuel cells have also been fueled with other types of biogas (e.g. landfill gas and brewery wastewater gas).

**3) Gas Turbine (< 9 ppmv $NO_X$ @ 15% $O_2$) (Alternate Basic Equipment)**

Gas turbines are internal combustion engines that operate on the Brayton (Joule) combustion cycle rather than the Otto combustion cycle used in reciprocating internal combustion engines or the diesel cycle for diesel engines. In the Brayton cycle the air flow and fuel injection are steady, and the different parts of the cycle occur continuously within different components of the system. In a gas turbine, fuel is continually injected into the combustion chamber or combustor and air is constantly drawn into the turbine and compressed. All elements of the Brayton cycle occur simultaneously in a gas turbine.

Gas turbines are one of the cleanest means of generating electricity. With the use of lean pre-mixed combustion or catalytic exhaust cleanup, $NO_X$ emissions from large gas-fired turbines are generally in the single-digit ppmv range. These levels are generally for natural gas-fired units but they are considered technologically feasible for biogas-fired units.

Gas turbines are available in sizes ranging from 500 kW - 25 MW. Based on contacts with turbine suppliers, biogas-fired turbines used to produce electricity are expected to be available in the size range of 2 - 7 MW. According to Solar Turbines, the smaller biogas-fired turbines are no longer actively produced or marketed since this size range is generally covered by other generation technologies such as reciprocating IC engines and microturbines.

**4) Microturbine (< 9 ppmv $NO_X$ @ 15% $O_2$) (Alternate Basic Equipment)**

Microturbines are small gas turbines rated between 25 kW and 500 kW that burn gaseous and liquid fuels to generate electricity or provide mechanical power. Microturbines were developed from turbocharger technologies found in large trucks and the turbines in aircraft auxiliary power units. Microturbines can be operated on a wide variety of fuels, including natural gas, liquefied petroleum gas, gasoline, diesel, landfill gas, and digester gases. According to the California Air Resources Board (ARB), there were approximately 200 biogas-fired microturbines operating in California as of the year 2006.[5] Microturbines generally have electrical efficiencies

[5] "Staff Report: Initial Statement of Reasons for Proposed Amendments to the Distributed Generation Certification Regulation" (9/1/2006), Cal EPA - ARB, Executive Summary Pg. ii (http://www.arb.ca.gov/regact/dg06/dgisor.pdf)

of 25-30%; however, the electrical efficiency of larger microturbines (≥ 200 kW) can range from 30-33%. Microturbine manufacturers include Capstone Microturbines and FlexEnergy.

Microturbines without add-on controls can meet very stringent emission limits and have significantly lower emissions of $NO_X$, CO, and VOC than uncontrolled reciprocating engines because most microturbines operating on gaseous fuels utilize lean premixed (dry low $NO_X$, or DLN) combustion technology. Microturbines manufacturers will generally guarantee $NO_X$ emissions of 9-15 ppmv @ 15% $O_2$. However, several emission tests performed on biogas-fired microturbines have demonstrated even lower emissions. A small number of dairy digester gas-fired microturbines have been installed[6], including Twin Birch Dairy and New Hope Farm View dairy and Twin Birch Dairy in New York, and den Dulk Dairy in Michigan.

The proposed project is for a large waste gas to energy facility and, although larger microturbines have recently become available, several microturbines (at least 4) would still be required to replace each engine. The applicant states that when they investigated microturbines they found that they could not secure the necessary financing for a waste gas to energy project of this size using microturbines and that the major microturbines vendors were unable to secure the debt. Although microturbines may not currently be a practical option for this particular project, they will be considered in the cost analysis below.

**b. Step 2 - Eliminate technologically infeasible options**

Option 3 - Gas Turbine (≤ 9 ppmv $NO_X$ @ 15% $O_2$) (Alternate Basic Equipment)

Option 3, Gas Turbine, was determined to be infeasible for the proposed project because the available information indicates that the principal suppliers of gas turbines (Solar Turbines, Allison, and General Electric) do not currently produce or market waste gas-fired gas turbines rated less than 3 MW since this size range is generally covered by other generation technologies such as reciprocating IC engines and microturbines.

The cost information given in the US EPA Combined Heat and Power Partnership Catalog of CHP Technologies[7] (March 2015) and the SGIP 2015 Self-Generation Incentive Program Cost Effectiveness Study [Final Report][8] (October 5, 2015) also supports that gas turbines rated approximately 3 MW are not generally available. The smallest turbine for which the US EPA Combined Heat and Power Partnership Catalog of CHP Technologies provides cost information is 3,304 kW and the smallest turbine for which the SGIP 2015 Self-Generation Incentive Program Cost Effectiveness Study [Final Report] provides cost information is 2,500 kW.

[6] See EPA AgStar Program "AgStar Project Profiles", http://www2.epa.gov/agstar/agstar-project-profiles
[7] US EPA Combined Heat and Power Partnership "Catalog of CHP Technologies" (March 2015) http://www.epa.gov/chp/catalog-chp-technologies
[8] SGIP 2015 Self-Generation Incentive Program Cost Effectiveness Study [Final Report] (October 5, 2015) http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=7889

The proposed project would require gas turbines rated 1,059 kW each, which is below the range that is currently being marketed by turbine manufacturers; therefore, gas turbines are not considered feasible for this particular project and will be eliminated from consideration at this time.

**c. Step 3 - Rank remaining options by control effectiveness**

1) Fuel Cell (≤ 0.05 lb/MW-hr ≈ 1.5 ppmv $NO_X$ @ 15% $O_2$) (Alternate Basic Equipment)
2) Digester gas-fueled microturbines (Alternate Basic Equipment)
3) $NO_X$ emissions ≤ 0.15 g/bhp-hr (lean-burn engine with SCR, rich-burn engine with 3-way catalyst, or other equivalent) (Achieved in Practice)

**d. Step 4 - Cost Effectiveness Analysis**

Pursuant to Section IX.D of District Policy APR 1305 – BACT Policy, a cost effectiveness analysis is required for the options that have not been determined to be achieved in practice. In accordance with the District's Revised BACT Cost Effectiveness Thresholds Memo (5/14/08), to determine the cost effectiveness of particular technologically feasible control options or alternate equipment options, the amount of emissions resulting from each option will be quantified and compared to the District Standard Emissions allowed by the District Rule that is applicable to the particular unit. The emission reductions will be equal to the difference between the District Standard Emissions and the emissions resulting from the particular option being evaluated.

The District has determined that the proposed digester gas-fueled IC engines are non-agricultural IC engines. The lean burn, digester gas-fired, engines are subject to the following emission limits for non-agricultural, lean burn, waste gas fueled IC engines contained in District Rule 4702, Section 5.2.2, Table 2, 2.d: 65 ppmvd $NO_X$ (or 90% reduction), 2,000 ppmvd CO, and 750 ppmvd VOC (all measured @ 15% $O_2$). The proposed digester engines are also subject to the New Source Performance Standards (NSPS) for IC Engines contained in 40 CFR 60 Subpart JJJJ, which includes a more stringent VOC emissions limit of 1.0 g/bhp-hr (or 80 ppmv @ 15% $O_2$ reported as propane) for landfill and digester gas-fired IC engines. Therefore, the District Standard Emissions used for the BACT cost analysis below for the proposed engines will be based on the emission limits contained in these applicable regulations.

Option 1: Fuel Cells (≤ 0.05 lb/MW-hr ≈ 1.5 ppmv $NO_X$ @ 15% $O_2$) (Alternate Basic Equipment)

Because fuel cells have reduced $NO_X$ and VOC emissions in comparison to a reciprocating IC engine, a Multi-Pollutant Cost Effectiveness Threshold (MCET) will be used to determine if this option is cost-effective. The following cost analysis demonstrates that replacement of the proposed engines with a fuel cell is not cost effective even when the additional operation costs of a fuel cell are not considered.

**Assumptions**

- Digester Gas F-Factor: 9,100 dscf/MMBtu (dry, adjusted to 60 °F)
- Higher Heating Value for Dairy Digester Gas: 600 Btu/scf
- Molar Specific Volume = 379.5 scf/lb-mol (at 60°F)
- Price for electricity: $127.72/MW-hr (*based on the California Bioenergy Market Adjusting Tariff (BioMAT) initial contract price offered by Investor Owned Utilities (PG&E, SCE, and SDG&E)[9] in February 2016*)
- bhp-hr to Btu conversion: 2,545 Btu/hp-hr
- Btu to kW-hr conversion: 3,413 Btu/kW-hr
- The initial capital costs and the operation costs for the digester gas-fueled IC engines and fuel cells will be based on information given in the US EPA Combined Heat and Power Partnership Catalog of CHP Technologies[7] and the SGIP 2015 Self-Generation Incentive Program Cost Effectiveness Study [Final Report][8]
- Because the US EPA Combined Heat and Power Partnership Catalog of CHP Technologies only provides cost information for natural gas-fueled engines and fuel cells, additional capital costs for the use of biogas are taken from the SGIP 2015 Self-Generation Incentive Program Cost Effectiveness Study [Final Report] [8]

Assumptions for Proposed Digester Gas-Fired IC Engines (S-8637-2-0 & -3-0)

- Each engine will operate at full load for 24 hours/day and 8,760 hours/year
- Typical efficiency for IC engines: 33% (*Conservative estimate, as discussed above, US EPA Combined Heat and Power Partnership Catalog of CHP Technologies lists HHV electrical efficiencies of 34.5% for a 633 kW system and 36.8% for a 1,121 kW system*)
- The maximum total daily heating value of the digester gas used by each engine will be: 271.71 MMBtu/day (*1,468 $bhp_{out}$/engine x 1 $bhp_{in}$/0.33 $bhp_{out}$ x 2,545 $Btu_{in}$/$bhp_{in}$-hr x 1 MMBtu/$10^6$ Btu x 24 hr/day x 1 engine*)
- The maximum total annual heating value for of the digester gas used by each engine will be: 99,175.4 MMBtu/year (*1,468 $bhp_{out}$/engine x 1 $bhp_{in}$/0.33 $bhp_{out}$ x 2,545 $Btu_{in}$/$bhp_{in}$-hr x 1 MMBtu/$10^6$ Btu x 8,760 hr/year x 1 engine*)
- Estimated purchase and installation cost for CHP IC engine rated approximately 1,059 kW without add-on air pollution control equipment: $1,752/kW (*average of interpolated values from US EPA Combined Heat and Power Partnership Catalog of CHP Technologies and SGIP 2015 Self-Generation Incentive Program Cost Effectiveness Study [Final Report]*)
- Additional capital investment for biogas conditioning and cleanup for IC engines: $387/kW (*SGIP 2015 Self-Generation Incentive Program Cost Effectiveness Study [Final Report]*)

[9] See: http://www.pge.com/en/b2b/energysupply/wholesaleelectricsuppliersolicitation/BioMAT/index.page, https://scebiomat.accionpower.com/biomat/home.asp, and http://www.sdge.com/procurement/bioenergy-market-adjusting-tariff-bio-mat)

- Total Installation Cost for biogas-fueled IC engine rated 1,059 kW: $2,139/kW
- Estimated operation costs for CHP IC engine rated 1,059 kW without add-on air pollution control costs: $0.020/kW-hr (*average of interpolated values from US EPA Combined Heat and Power Partnership Catalog of CHP Technologies and SGIP 2015 Self-Generation Incentive Program Cost Effectiveness Study [Final Report]*)
- The SGIP 2015 Self-Generation Incentive Program Cost Effectiveness Study [Final Report] indicates that biogas conditioning/cleanup costs are highly dependent on the quantity of biogas being processed and contaminants being removed and that the differences in clean-up costs for biogas-fueled IC engines, microturbines, and gas turbines "reflect the greater rigor in the removal of the hydrogen sulfide". The digester gas used to fuel the engines must be limited to a sulfur content of no more than 40 ppmv as $H_2S$ to satisfy BACT for $SO_X$. Because required level of sulfur removal is adequate for use in the engines, there will be no increase in operating costs related to cleaning the digester gas for use in IC engines.
- Rule 4702 $NO_X$ emission limit for non-agricultural, lean burn IC engines: 65 ppmv @ 15% $O_2$ = 0.2540 lb/MMBtu
- Rule 4702 VOC emission limit for non-agricultural, lean burn IC engines: 750 ppmv @ 15% $O_2$ as $CH_4$ = 1.0193 lb/MMBtu
- 40 CFR 60 Subpart JJJJ VOC emission limit for landfill and digester gas-fired IC engines: 1.0 g/bhp-hr (or 80 ppmv @ 15% $O_2$ reported as propane)

Assumptions for Fuel Cell System

- Net electrical efficiency for a molten carbonate fuel cell (MCFC): 45% (*US EPA Combined Heat and Power Partnership Catalog of CHP Technologies gives efficiencies of 47% for a 300 kW MCFC and 42.5% for a 1,400 kW MCFC*)
- Size of fuel cell system needed to replace each proposed engine: 1,500 kW (estimated based on 271.71 MMBtu/day and 45% efficiency)
- Estimated Purchase and Installation Cost for Molten Carbonate Fuel Cell: $4,550/kW (*Average of the two costs for largest Molten Carbonate Fuel Cells given in US EPA Combined Heat and Power Partnership document Catalog of CHP Technologies and SGIP 2015 Self-Generation Incentive Program Cost Effectiveness Study [Final Report]; The U.S. Department of Energy Federal energy management Program (FEMP) document "Fuel Cells and Renewable Energy" (last updated 12-1-2014 and available at: http://www.wbdg.org/resources/fuelcell.php) states, "Installation costs of a fuel cell system can range from $5,000/kW to $10,000/kW." Therefore, this estimate may be actually too low based on the recently reported costs for fuel cell power plants, such as the "Bloom Box".*)
- Additional capital investment for biogas conditioning and cleanup for fuel cells: $563/kW (*SGIP 2015 Self-Generation Incentive Program Cost Effectiveness Study [Final Report]*)
- Total Installation Cost for biogas-fueled fuel cells rated ≥ 1,200 kW: $5,113/kW

- Typical operation costs for natural gas-fueled fuel cells, including stack replacement costs: $0.04/kW-hr (*SGIP 2015 Self-Generation Incentive Program Cost Effectiveness Study [Final Report]*)
- Additional operational costs for biogas conditioning and cleanup for large fuel cells: $0.15/kW-hr (*SGIP 2015 Self-Generation Incentive Program Cost Effectiveness Study [Final Report]*)
- Total Operation Cost for biogas-fueled fuel cells rated ≥ 1,200 kW: $0.19/kW-hr
- Fuel Cell $NO_X$ emissions: 0.01 - 0.02 lb/MW-hr *(Note: Fuel cells have been certified to the ARB Distributed Generation Certification level of 0.07 lb-$NO_X$/MW-hr but measured emissions from fuel cells are generally much lower)*
- Fuel Cell VOC emissions: 0.02 lb-VOC/MW-hr (≤ 2.0 ppmv VOC @ 15% $O_2$ as $CH_4$ based on ARB Distributed Generation Certification level of 0.02 lb-VOC/MW-hr and emission tests on fuel cells)
- Unlike the proposed engines, a high-temperature fuel cell power plant must primarily operate at steady state conditions; there would not be the ability to store gas to generate more electricity during peak hours, which is the current business plan of the applicant. Because the price paid for electricity is greater during peak hours and less during other times, the price paid for electricity generated by a fuel cell power plant would be less. This would require the operator to alter their plans of operation and result in less revenue per kW-hr of electricity generated potentially offsetting the revenue from increased power generating capacity because of the higher efficiency of a fuel cell power plant. For more conservative analysis, the difference in the cost of peak and off-peak electricity was not considered in this comparison.

Capital Cost

The estimated increased incremental capital cost for replacement of the proposed engines with fuel cells is calculated based on the difference in cost of a fuel cell power plant and the proposed IC engines.

The incremental capital cost for replacement of the proposed IC engines with a fuel cell power plant is calculated as follows:

(1,500 kW x $5,113/kW) - (1,059 kW x $2,139/kW) = $5,404,299

Annualized Capital Cost

Pursuant to District Policy APR 1305, section X (11/09/99), the incremental capital cost for the purchase of the fuel cell system will be spread over the expected life of the system using the capital recovery equation. The expected life of the entire system will be estimated at 10 years. A 10% interest rate is assumed in the equation and the assumption will be made that the equipment has no salvage value at the end of the ten-year cycle.

$A = [P \times i(I+1)^n]/[(I+1)^n-1]$

Where: A = Annual Cost
P = Present Value
I = Interest Rate (10%)
N = Equipment Life (10 years)

$A = [\$5,404,299 \times 0.1(1.1)^{10}]/[(1.1)^{10}-1]$
= **$879,525/year**

Annual Costs

Electricity Generated

The amount of electricity potentially generated by each option is calculated as follows:

Each Proposed IC Engine
1,059 kW x 8,760 hr/yr = 9,276,840 kW-hr/year

Fuel Cells (Alternate Equipment)
271.71 MMBtu/day x $10^6$ Btu/MMBtu x 1 day/24 hr x 1 kW-hr/3,413 Btu x 0.45 (electrical efficiency) = 1,493 kW

99,175.4 MMBtu/yr x $10^6$ Btu/MMBtu x 1 kW-hr/3,413 Btu x 0.45 (electrical efficiency) = 13,076,159 kW-hr /year

Cost Decrease from Increased Revenue for Power Generation from Replacing each Proposed 1,059 kW Engine with a Fuel Cell
(9,276,840 kW-hr/yr - 13,076,159 kW-hr/yr) x 1 MW/1,000 kW x $127.72/MW-hr = -$485,249/year

Annual Operation and Maintenance Cost
The annual operation and maintenance costs for each option are calculated as follows:

Each Proposed 1,059 IC kW Engine
9,276,840 kW-hr/yr x $0.020/kW-hr = $185,537/year

Fuel Cells (Alternate Equipment)
13,076,159 kW-hr/yr x $0.19/kW-hr = $2,484,470/year

Annual Costs of Increased Maintenance
$2,484,470/yr - $185,537/yr = $2,298,933/year

Total Increased Annual Costs for Fuel Cell as an Alternative to Each Proposed Engine

$879,525/year + (-$485,249/year) + $2,298,933/year = **$2,693,209/year**

Emission Reductions:

$NO_X$ and VOC Emission Factors:

Pursuant to the District's Revised BACT Cost Effectiveness Thresholds Memo (5/14/08), District Standard Emissions that will be used to calculate the emission reductions from alternative equipment.

The District Standard Emissions for $NO_X$ emissions from the engines will be based on the $NO_X$ emission limit for non-agricultural, lean burn IC engines from District Rule 4702, Section 5.2.1, Table 1, 2.b. The District Standard Emissions for VOC emissions from the engines will be based on the New Source Performance Standard (NSPS) VOC emission limit for landfill and digester gas-fired IC engines from 40 CFR 60 Subpart JJJJ, since this limit is more stringent than the applicable emission limit in District Rule 4702.

The following emissions factors will be used for the cost analysis:

District Standard Emissions: 0.2540 lb-$NO_X$/MMBtu (65 ppmv $NO_X$ @ 15% $O_2$) and 1.0 g-VOC/bhp-hr

Emissions from Fuel Cells as Alternative Equipment: 0.01 lb-$NO_X$/MW-hr and 0.02 lb-VOC/MW-hr as $CH_4$

Emission Reductions:

Each Proposed Engine Compared to Fuel Cells based on District Standard Emission Reductions

$NO_X$ Emission Reductions (65 ppmv @ 15% $O_2$ → 0.01 lb-$NO_X$/MW-hr)
(99,175.4 MMBtu/yr x 0.2540 lb-$NO_X$/MMBtu) – (13,076,159 kW-hr/yr x 1 MW/1,000 kW x 0.01 lb-$NO_X$/MW)
= 25,060 lb-$NO_X$/year (12.53 ton-$NO_X$/year)

VOC Emission Reductions (1.0 g/bhp-hr → 0.02 lb-VOC/MW-hr)
(1,468 bhp/engine x 8,760 hr/yr x 1 engine x 1.0 g-VOC/bhp-hr x 1 lb/453.59 g) – (13,076,159 kW-hr/yr x 1 MW/1,000 kW x 0.02 lb-VOC/MW)
= 28,089 lb-VOC/year (14.04 ton-VOC/year)

Multi-Pollutant Cost Effectiveness Thresholds (MCET) for $NO_X$ and VOC Reductions based on District Standard Emission Reductions

(12.53 ton-$NO_X$/year x $24,500/ton-$NO_X$) + (14.04 ton-VOC/year x $17,500/ton-VOC)
= **$552,685/year**

As shown above, the annualized capital cost of this alternate option exceeds the Multi-Pollutant Cost Effectiveness Threshold (MCET) calculated for the $NO_X$ and VOC emission reductions. Therefore, this option is not cost effective and is being removed from consideration.

Option 2 - Microturbines (≤ 9 ppmv $NO_X$ @ 15% $O_2$) (Alternate Basic Equipment)

The cost analysis below demonstrates that the $NO_X$ emission reductions achieved by replacement of the proposed engines with microturbines would not be cost effective based on the District's Revised BACT Cost Effectiveness Thresholds (May 14, 2008).

In addition, it should be noted that large lean burn IC engines generally have higher overall efficiencies than microturbines. The difference in efficiency between engines and microturbines will minimize and possibly eliminate any overall differences in $NO_X$ emissions between these options. For example, information from a Capstone Turbine Corporation specification sheet indicates that the guaranteed $NO_X$ emissions rate of 9 ppmvd @ 15% $O_2$ for their 1,000 kW renewable gas fuel microturbine package is equivalent to 0.14 g-$NO_X$/hp-hr.[10] This level is not significantly different than the current BACT requirement for waste gas-fired engines of 0.15 g-$NO_X$/bhp-hr.

The following discussion demonstrates how the difference the efficiency of engines and microturbines can affect the emission rate. $NO_X$ emissions from the engines will be limited to no more than 0.15 g/bhp-hr (approximately 11 ppmv $NO_X$ @ 15% $O_2$). Microturbine suppliers will generally guarantee $NO_X$ emissions ≤ 9 ppmv @ 15% $O_2$ For digester gas-fired microturbines. The US EPA Combined Heat and Power Partnership "Catalog of CHP Technologies"[11] (March 2015), Table 2-2: Gas Spark Ignition Engine CHP - Typical Performance Parameters, lists HHV electrical efficiencies of 34.5% for a 633 kW system and 36.8% for a 1,121 kW system. The SGIP 2015 Self-Generation Incentive Program Cost Effectiveness Study [Final Report][12] (October 5, 2015), Page A-28 indicates that "Typical observed efficiencies on IC engines deployed in the SGIP are 27% for electrical conversion (HHV)..." Therefore, the expected HHV electrical efficiency of each of the proposed 1,059 kW engines is between 27-36.8%.

The US EPA Combined Heat and Power Partnership "Catalog of CHP Technologies"[11], Table 5-2: Gas Spark Ignition Engine CHP - Microturbine Cost and Performance Characteristics, lists HHV electrical efficiencies of 26-28% for microturbine systems rated at least 200 kW. The SGIP 2015 Self-Generation Incentive Program Cost Effectiveness Study [Final Report][12], Table A-15: Microturbine Electrical Conversion Efficiency, lists a HHV electrical efficiencies of 21% for microturbines based on SGIP metered data. Therefore, the expected HHV electrical efficiency of large microturbines is between 21-28%.

The maximum expected $NO_X$ emission factor for the proposed engine-generator sets is approximately 0.47 lb/MW-hr (based on 0.15 g/bhp-hr and 95% generator efficiency). Based on 9 ppmv $NO_X$ @ 15% O2 and the expected range of microturbine electrical conversion efficiency given above, the $NO_X$ emission factor from large digester gas-

[10] See: http://www.adigo.no/wordpress/wp-content/uploads/2015/02/CR1000-teknisk-spesifikasjon-engelsk.pdf. Note that because of lower efficiencies for smaller microturbines, the guaranteed emission rate of 9 ppmvd $NO_X$ @ 15% $O_2$ from smaller units will actually be higher than 0.15 g-$NO_X$/bhp-hr

[11] US EPA Combined Heat and Power Partnership "Catalog of CHP Technologies" (March 2015) http://www.epa.gov/chp/catalog-chp-technologies

[12] SGIP 2015 Self-Generation Incentive Program Cost Effectiveness Study [Final Report] (October 5, 2015) http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=7889

fueled microturbines is expected to range from 0.43 – 0.57 lb/MW-hr. Because, the maximum $NO_X$ emission factor for the proposed engine-generator sets falls within this range, the options could be considered equivalent.

**Assumptions**

- Digester Gas F-Factor: 9,100 dscf/MMBtu (dry, adjusted to 60 °F)
- Higher Heating Value for Dairy Digester Gas: 600 Btu/scf
- Molar Specific Volume = 379.5 scf/lb-mol (at 60°F)
- bhp-hr to Btu conversion: 2,545 Btu/hp-hr
- Btu to kW-hr conversion: 3,413 Btu/kW-hr
- The initial capital costs and the operation costs for the digester gas-fueled IC engines and microturbines will be based on information given in the US EPA Combined Heat and Power Partnership Catalog of CHP Technologies[11] and the SGIP 2015 Self-Generation Incentive Program Cost Effectiveness Study [Final Report][12]
- Because the US EPA Combined Heat and Power Partnership Catalog of CHP Technologies only provides cost information for natural gas-fueled engines and microturbines, additional capital costs for the use of biogas are taken from the SGIP 2015 Self-Generation Incentive Program Cost Effectiveness Study [Final Report] [12]
- The SGIP 2015 Self-Generation Incentive Program Cost Effectiveness Study [Final Report] indicates that biogas conditioning/cleanup costs are highly dependent on the quantity of biogas being processed and contaminants being removed and that the differences in clean-up costs for biogas-fueled IC engines, microturbines, and gas turbines "reflect the greater rigor in the removal of the hydrogen sulfide". The digester gas used to fuel the engines or microturbines must be limited to a sulfur content of no more than 40 ppmv as $H_2S$ to satisfy BACT for $SO_X$. Because required level of sulfur removal is adequate for use in both engines and microturbines and the same amount of total digester gas will be available for either option, there will be no difference in operating costs related to cleaning the digester gas for use in IC engines or microturbines.
- Price for electricity: $127.72/MW-hr (based on the California Bioenergy Market Adjusting Tariff (BioMAT) initial contract price offered by Investor Owned Utilities (PG&E, SCE, and SDG&E)[9] in February 2016)

Assumptions for Proposed Digester Gas-Fired IC Engines (S-8637-2-0 & -3-0)

- Each engine will operate at full load for 24 hours/day and 8,760 hours/year
- Typical efficiency for IC engines: 33% (*Conservative estimate, as discussed above, the US EPA Combined Heat and Power Partnership Catalog of CHP Technologies lists HHV electrical efficiencies of 34.5% for a 633 kW system and 36.8% for a 1,121 kW system*)
- The maximum total daily heating value of the digester gas used by each engine will be: 271.71 MMBtu/day (*1,468 $bhp_{out}$/engine x 1 $bhp_{in}$/0.33 $bhp_{out}$ x 2,545 $Btu_{in}$/$bhp_{in}$-hr x 1 MMBtu/$10^6$ Btu x 24 hr/day x 1 engine*)

- The maximum total annual heating value for of the digester gas used by each engine will be: 99,175.4 MMBtu/year (*1,468 $bhp_{out}$/engine x 1 $bhp_{in}$/0.33 $bhp_{out}$ x 2,545 $Btu_{in}$/$bhp_{in}$-hr x 1 MMBtu/$10^6$ Btu x 8,760 hr/year x 1 engine*)
- Estimated purchase and installation cost for CHP IC engine rated approximately 1,059 kW without add-on air pollution control equipment: $1,752/kW (*average of interpolated values from US EPA Combined Heat and Power Partnership Catalog of CHP Technologies and SGIP 2015 Self-Generation Incentive Program Cost Effectiveness Study [Final Report]*)
- Additional capital investment for biogas conditioning and cleanup for IC engines: $387/kW (*SGIP 2015 Self-Generation Incentive Program Cost Effectiveness Study [Final Report]*)
- Total Installation Cost for biogas-fueled IC engine rated 1,059 kW: $2,139/kW
- Estimated operation costs for CHP IC engine rated 1,059 kW without add-on air pollution control costs: $0.020/kW-hr (*average of interpolated values from US EPA Combined Heat and Power Partnership Catalog of CHP Technologies and SGIP 2015 Self-Generation Incentive Program Cost Effectiveness Study [Final Report]*)
- Rule 4702 $NO_X$ emission limit for non-agricultural, lean burn IC engines: 65 ppmv @ 15% $O_2$ = 0.2540 lb/MMBtu

Assumptions for Microturbines

- Net HHV electrical efficiency for a 950 kW net (1,000 kW nominal capacity) microturbine package: 24.5% (*conservative estimate, SGIP metered data indicates an efficiency of 21%*)
- Estimated Size of microturbine system needed to replace each engine: 950 kW net (1,000 kW nominal capacity)
- Estimated Purchase and Installation Cost for 950 kW net (1,000 kW nominal capacity) microturbine package: $2,500/kW (*from US EPA Combined Heat and Power Partnership Catalog of CHP Technologies*)
- Estimated additional capital investment for biogas conditioning and cleanup for microturbines: $744/kW (*SGIP 2015 Self-Generation Incentive Program Cost Effectiveness Study [Final Report]*)
- Total Installation Cost for biogas-fueled microturbine system rated 950 kW net (1,000 kW nominal capacity): $3,244/kW
- Typical operation costs for a 950 kW net (1,000 kW nominal capacity) microturbine package: $0.012/kW-hr (*from US EPA Combined Heat and Power Partnership Catalog of CHP Technologies*)
- $NO_X$ Emissions for Digester gas-fueled microturbines: ≤ 9 ppmv $NO_X$ @ 15% $O_2$ (~ 0.0352 lb-NOx/MMBtu)

Capital Cost

The estimated increased incremental capital cost for replacement of each the proposed engines with microturbines is calculated based on the difference in cost of a microturbine system and the proposed IC engines.

The incremental capital cost for replacement of the proposed IC engines with a microturbine system is calculated as follows:

(950 kW x $3,244/kW) - (1,059 kW x $2,139/kW) = $816,599

Annualized Capital Cost

Pursuant to District Policy APR 1305, section X (11/09/99), the incremental capital cost for the purchase of the fuel cell system will be spread over the expected life of the system using the capital recovery equation. The expected life of the entire system will be estimated at 10 years. A 10% interest rate is assumed in the equation and the assumption will be made that the equipment has no salvage value at the end of the ten-year cycle.

$$A = [P \times i(I+1)^n]/[(I+1)^n-1]$$

Where: A = Annual Cost
P = Present Value
I = Interest Rate (10%)
N = Equipment Life (10 years)

$$A = [\$816,599 \times 0.1(1.1)^{10}]/[(1.1)^{10}-1]$$
$$= \mathbf{\$132,898/year}$$

Annual Costs

Electricity Generated

The amount of electricity potentially generated by each option is calculated as follows:

Each Proposed IC Engine
1,059 kW x 8,760 hr/yr = 9,276,840 kW-hr/year

950 kW (net) Microturbine Package (Alternate Equipment)
271.71 MMBtu/day x $10^6$ Btu/MMBtu x 1 day/24 hr x 1 kW-hr/3,413 Btu x 0.245 (electrical efficiency) = 813 kW

99,175.4 MMBtu/yr x $10^6$ Btu/MMBtu x 1 kW-hr/3,413 Btu x 0.245 (electrical efficiency) = 7,119,242 kW-hr /year

Cost of Decreased Revenue from Power Generation from Replacing each Proposed 1,059 kW Engine with Microturbines
(9,276,840 kW-hr/yr - 7,119,242 kW-hr/yr) x 1 MW/1,000 kW x $127.72/MW-hr = $275,568/year

Annual Operation and Maintenance Cost
The annual operation and maintenance costs for each option are calculated as follows:

Each Proposed 1,059 kW IC Engine
9,276,840 kW-hr/yr x $0.020/kW-hr = $185,537/year

Microturbines (Alternate Equipment)
7,119,242 kW-hr/yr x $0.012/kW-hr = $85,431/year

Cost from Annual Decrease in Maintenance Costs
$85,431/yr - $185,537/yr = -$100,106/year

Total Increased Annual Costs for Microturbines as an Alternative to Each Proposed Engine

$132,898/year + $275,568/year + (-$100,106/year) = **$308,360/year**

Emission Reductions:

$NO_X$ Emission Factors:

Pursuant to the District's Revised BACT Cost Effectiveness Thresholds Memo (5/14/08), District Standard Emissions that will be used to calculate the emission reductions from alternative equipment.

The District Standard Emissions for $NO_X$ emissions from the engines will be based on the $NO_X$ emission limit for non-agricultural, lean burn IC engines from District Rule 4702, Section 5.2.1, Table 1, 2.b.

The following emissions factors will be used for the cost analysis:

District Standard Emissions: 0.2540 lb-$NO_X$/MMBtu (65 ppmv $NO_X$ @ 15% $O_2$)

Emissions from Microturbines as Alternative Equipment: 0.0352 lb-$NO_X$/MMBtu (9 ppmv $NO_X$ @ 15% $O_2$)

Emission Reductions for Each Proposed Engine Compared to Microturbines based on District Standard Emission Reductions

$NO_X$ Emission Reductions (65 ppmv @ 15% $O_2$ → 9 ppmv @ 15% $O_2$)
99,175.4 MMBtu/yr x (0.2540 lb-$NO_X$/MMBtu – 0.0352 lb-$NO_X$/MMBtu)
= 21,700 lb-$NO_X$/year (10.85 ton-$NO_X$/year)

Cost of $NO_X$ Emission Reductions

Cost of reductions = ($308,360/year)/[(21,700 lb-$NO_X$/year)(1 ton/2000 lb)]
= **$28,420/ton of $NO_X$ reduced**

As shown above, the cost of the $NO_X$ emission reductions for replacing each of the proposed engines with microturbines exceeds the $24,500/ton cost effectiveness

threshold of the District BACT policy. Therefore, this option is not cost effective and is being removed from consideration.

Option 3: $NO_X$ emissions ≤ 0.15 g/bhp-hr (lean-burn engine with SCR, rich-burn engine with 3-way catalyst, or other equivalent) (Achieved in Practice)

This option is achieved practice and has been proposed by the applicant; therefore a cost analysis is not required.

**e. Step 5 - Select BACT**

Pursuant to the above BACT Analysis, BACT for the Digester Gas-fired Engines must be satisfied with the following: $NO_X$: $NO_X$ emissions to ≤ 0.15 g/bhp-hr

The applicant has proposed to use SCR systems for the digester gas-fired lean burn IC engines to reduce $NO_X$ emissions to ≤ 0.15 g/bhp-hr. Therefore, the BACT requirements are satisfied.

**2. BACT Analysis for $SO_X$ Emissions:**

**a. Step 1 - Identify all control technologies**

The following options were identified to reduce $SO_X$ emissions from the proposed engine:

1) Sulfur Content of fuel gas not exceeding 40 ppmv as $H_2S$ (Achieved in Practice/Contained in SIP)

There are no options listed in the SJVUAPCD BACT Clearinghouse as alternate basic equipment.

**b. Step 2 - Eliminate technologically infeasible options**

There are no technologically infeasible options to eliminate from step 1.

**c. Step 3 - Rank remaining options by control effectiveness**

The control efficiency of each of the options above is estimated and the controls are ranked below based on the control effectiveness.

1) Sulfur Content of fuel gas not exceeding 40 ppmv as $H_2S$ (Achieved in Practice)

**d. Step 4 - Cost Effectiveness Analysis**

The only option above is achieved practice and has been proposed by the applicant; therefore a cost analysis is not required.

**e. Step 5 - Select BACT**

Pursuant to the above BACT Analysis, BACT for $SO_X$ emissions from the proposed engines is fuel gas sulfur content not exceeding 40 ppmv as $H_2S$. The applicant has proposed to use a biological sulfur removal system and iron sponge and/or carbon canister scrubbers (or an equivalent sulfur removal system) to reduce the sulfur content of the digester gas combusted in the engines to ≤ 40 ppmv as $H_2S$. Therefore, the BACT requirements for $SO_X$ are satisfied.

**3. BACT Analysis for $PM_{10}$ Emissions:**

**a. Step 1 - Identify all control technologies**

Combustion of gaseous fuels generally does not result in significant emissions of particulate matter. Dairy anaerobic digester gas is the planned fuel for the proposed IC engines. The anaerobic digester gas will be composed primarily of methane (approximately 60% molar composition) and $CO_2$ (approximately 40% molar composition) and is expected to burn in a fairly clean manner. Particulate emissions from combustion of the digester gas are expected to primarily result from the incineration of fuel-born sulfur compounds (mostly $H_2S$) resulting in the formation of sulfur-containing particulate. Therefore, scrubbing of the digester gas is the principal means to reduce particulate emissions.

The following control was identified to reduce particulate matter emissions from combustion of the digester gas as fuel in the proposed engines:

1) Sulfur Content of fuel ≤ 40 ppmv as $H_2S$ (Achieved in Practice)

**b. Step 2 - Eliminate technologically infeasible options**

There are no technologically infeasible options to eliminate from step 1.

**c. Step 3 - Rank remaining options by control effectiveness**

1) Sulfur Content of fuel gas ≤ 40 ppmv as $H_2S$ (Achieved in Practice)

**d. Step 4 - Cost Effectiveness Analysis**

The only option listed above has been identified as achieved in practice. Therefore, the option required and is not subject to a cost analysis.

**e. Step 5 - Select BACT**

Pursuant to the above BACT Analysis, BACT for $PM_{10}$ emissions from the proposed engines is fuel gas sulfur content not exceeding 40 ppmv as $H_2S$. The applicant has proposed to use a biological sulfur removal system and iron sponge and/or carbon canister scrubbers (or an equivalent sulfur removal system) to reduce the sulfur content

of the digester gas combusted in the engines to ≤ 40 ppmv as $H_2S$. Therefore, the BACT requirements for $SO_X$ are satisfied.

**4. BACT Analysis for VOC Emissions:**

**a. Step 1 - Identify all control technologies**

The following options were identified to reduce VOC emissions:

1) VOC emissions ≤ 0.10 g/bhp-hr (lean burn or equivalent and positive crankcase ventilation) (Achieved in Practice)
2) Fuel Cell (≤ 0.02 lb/MW-hr) (Alternate Basic Equipment)

**b. Step 2 - Eliminate technologically infeasible options**

There are no technologically infeasible options to eliminate from step 1.

**c. Step 3 - Rank remaining options by control effectiveness**

1) Fuel Cell (≤ 0.02 lb/MW-hr) (Alternate Basic Equipment)
2) VOC emissions ≤ 0.10 g/bhp-hr (Achieved in Practice)

**d. Step 4 - Cost Effectiveness Analysis**

Option 1: Fuel Cell (≤ 0.02 lb/MW-hr VOC as $CH_4$) (Alternate Basic Equipment)

The multi-pollutant cost analysis performed above for the $NO_X$ and VOC emissions demonstrated that the annualized cost of this alternate option exceeds the Multi Pollutant Cost Effectiveness Threshold calculated for the $NO_X$ and VOC emission reductions achieved by this technology. Therefore, this option is not cost effective and is being removed from consideration.

Option 2: VOC emissions ≤ 0.10 g/bhp-hr (Achieved in Practice)

This has been identified as achieved in practice and has been proposed by the applicant. Therefore, the option required and is not subject to a cost analysis.

**e. Step 5 - Select BACT**

Pursuant to the above BACT Analysis, BACT for VOC emissions from the proposed engines is VOC emissions ≤ 0.10 g/bhp-hr. The applicant has proposed IC engines with VOC emissions ≤ 0.10 g/bhp-hr. Therefore, the BACT requirements for VOC are satisfied.

**5. BACT Analysis for $NH_3$ Slip Emissions:**

A Selective Catalytic Reduction (SCR) system operates as an external control device where flue gases and a reagent (e.g. urea or ammonia) are passed through an appropriate catalyst. The reagent is used to reduce $NO_X$, over the catalyst bed, to form elemental

nitrogen, water vapor, and other by-products. The use of a catalyst typically reduces the $NO_X$ emissions by up to 90%. Ammonia slip is the result of unreacted ammonia exiting the SCR system.

**a. Step 1 - Identify all control technologies**

The District has not established a cost effectiveness threshold for ammonia. Therefore, only options that are determined to be Achieved-in-Practice controls will be considered for ammonia in this analysis.

District BACT Guideline 3.3.15 lists an ammonia slip emission limit of 10 ppmvd @ 15% $O_2$ as an Achieved in Practice BACT requirement for waste gas-fired IC engines.

1) $NH_3$ emissions ≤ 10 ppmvd @ 15% $O_2$ (Achieved in Practice)

**b. Step 2 - Eliminate technologically infeasible options**

There are no technologically infeasible options to eliminate from step 1.

**c. Step 3 - Rank remaining options by control effectiveness**

1) $NH_3$ emissions ≤ 10 ppmvd @ 15% $O_2$ (Achieved in Practice)

**d. Step 4 - Cost Effectiveness Analysis**

The only option above is achieved in practice and has been proposed by the applicant. Additionally, as stated above, a cost effectiveness threshold for ammonia has not been established by the District. Therefore a cost analysis is not required.

**e. Step 5 - Select BACT**

Pursuant to the above BACT Analysis, BACT for $NH_3$ slip emissions from the proposed engines is $NH_3$ slip emissions ≤ 10 ppmvd @ 15% $O_2$. The applicant has proposed IC engines with $NH_3$ slip emissions ≤ 10 ppmvd @ 15% $O_2$. Therefore, the BACT requirements for $NH_3$ slip are satisfied.

# APPENDIX C

## Summary of Health Risk Assessment (HRA) and Ambient Air Quality Analysis (AAQA)

# San Joaquin Valley Air Pollution Control District
# *REVISED* Risk Management Review

| | |
|---|---|
| To: | Ramon Norman – Permit Services |
| From: | Yu Vu – Technical Services |
| Date: | October 22, 2015 |
| Facility Name: | ABEC #3 dba Lakeview Dairy Biogas |
| Location: | 17702 Bear Mountain Blvd, Bakersfield, CA 93311<br>at Lakeview Dairy (S-5254) |
| Application #(s): | S-8637-2-0, 3-0 |
| Project #: | S-1143770 |

## A. RMR SUMMARY

| RMR Summary | | | |
|---|---|---|---|
| **Categories** | **1,468 BHP Bio Gas Engines (Unit 2-0 & 3-0)** | **Project Totals** | **Facility Totals** |
| **Prioritization Score** | 107 (ea.) | 214 | >1 |
| **Acute Hazard Index** | 0.48 (ea.)[1] | 0.95 | 0.95 |
| **Chronic Hazard Index** | 0.16 (ea.) | 0.31 | 0.31 |
| **Maximum Individual Cancer Risk ($10^{-6}$)** | 0.002 (ea.) | 0.004 | 0.004 |
| **T-BACT Required?** | **No** | | |
| **Special Permit Conditions?** | **Yes** | | |

[1] $H_2S$ emissions must be limited in order to achieve the acute hazard index score in this project and for the project to not cause an exceedance of the California Ambient Air Quality Standard (CAAQS). Please see special condition below.

### Proposed Permit Conditions

To ensure that human health risks will not exceed District allowable levels; the following permit conditions must be included for:

Unit # 2-0, 3-0

1) The $H_2S$ emissions from the engine shall not exceed 1.97 lbs/hr. as determined by source testing. [District Rule 2201]

## B. RMR REPORT

### I. Project Description

Technical Services received a request on October 7, 2015, to perform a revised Risk Management Review for a proposed installation of two 1,468 BHP Dairy Bio gas-fired full time IC engines. Per the project engineer, the following changes to the project were made in this revision:

1) An increase in each engine's rating from 1,412 bhp to 1,468 bhp.
2) An increase in digester gas consumption of each engine from 16,303 scf/hr and 142,812,528 scf/yr to 16,327 scf/hr and 143,024,520 scf/yr.
3) A change in the stack parameters, resulting in the stack exit velocity of each engine increasing from 19.766 m/s to 23.636 m/s.

### II. Analysis

Technical Services performed a prioritization using the District's HEARTs database. Since the total facility prioritization score was greater than one, a refined health risk assessment was required. Emissions calculated using District approved Dairy Bio Gas emission factors for internal combustion were input into the HEARTs database. The AERMOD model was used, with the parameters outlined below and meteorological data for 2004-2008 from Fellows to determine the dispersion factors (i.e., the predicted concentration or X divided by the normalized source strength or Q) for a receptor grid. These dispersion factors were input into the Hot Spots Analysis and Reporting Program (HARP) risk assessment module to calculate the chronic and acute hazard indices and the carcinogenic risk for the project.

The following parameters were used for the review:

| Analysis Parameters<br>Unit 2-0, 3-0 | | | |
|---|---|---|---|
| **Source Type** | Point | **Location Type** | Rural |
| **Stack Height (m)** | 9.144 | **Closest Receptor (m)** | Various |
| **Stack Diameter. (m)** | 0.4572 | **Type of Receptor** | Business |
| **Stack Exit Velocity (m/s)** | 23.636 | **Max Hours per Year** | 8,760 |
| **Stack Exit Temp. (°K)** | 699.817 | **Fuel Type** | Dairy Bio Gas |
| **BHP** | 1,468 | | |

Technical Services performed modeling for criteria pollutants CO, NOx, SOx and $PM_{10}$; as well as a RMR. The emission rates used for criteria pollutant modeling were:

| Pollutant | lb/hr | lb/yr |
|---|---|---|
| CO | 15.6966 | 50,818 |
| $NO_x$ | 3.2364 | 4,582.7 |
| $SO_x$ | 0.1295 | 1,134.0 |
| $PM_{10}$ | 0.2265 | 1,984.6 |
| $H_2S$ | 6.0834 | N/A |

The results from the Criteria Pollutant Modeling are as follows:

**Criteria Pollutant Modeling Results***

| Bio-Gas Engine | 1 Hour | 3 Hours | 8 Hours | 24 Hours | Annual |
|---|---|---|---|---|---|
| CO | Pass | X | Pass | X | X |
| $NO_x$ | Pass[1] | X | X | X | Pass |
| $SO_x$ | Pass | Pass | X | Pass | Pass |
| $PM_{10}$ | X | X | X | Pass[2] | Pass[2] |
| $H_2S$ | Pass[3] | X | X | X | X |

*Results were taken from the attached PSD spreadsheet.
[1]The project was compared to the 1-hour NO2 National Ambient Air Quality Standard that became effective on April 12, 2010 using the District's approved procedures.
[2]The criteria pollutants are below EPA's level of significance as found in 40 CFR Part 51.165 (b)(2).
[3]$H_2S$ emissions must be limited to the value listed in the Proposed Permit Conditions section in order for this project to not cause an exceedance of the California Ambient Air Quality Standard (CAAQS).

## III. Conclusion

The acute and chronic indices are below 1.0 and the cancer risk factor associated with the project is less than 1.0 in a million. **In accordance with the District's Risk Management Policy, the project is approved without Toxic Best Available Control Technology (T-BACT).**

To ensure that human health risks will not exceed District allowable levels; the permit conditions listed on page 1 of this report must be included for this proposed unit.

These conclusions are based on the data provided by the applicant and the project engineer. Therefore, this analysis is valid only as long as the proposed data and parameters do not change.

The emissions from the proposed equipment will not cause or contribute significantly to a violation of the State and National AAQS.

## IV. Attachments

A. RMR request from the project engineer
B. Additional information from the applicant/project engineer
C. Toxic emissions summary
D. Prioritization score
E. Facility Summary

# APPENDIX D
## Draft ATCs
## (S-8637-1-0, -2-0, & -3-0)

# FOR PROJECT FILE
## Emissions Profiles

San Joaquin Valley
Air Pollution Control District

# AUTHORITY TO CONSTRUCT

DRAFT

**PERMIT NO:** S-8637-1-0 **ISSUANCE DATE:** DRAFT

**LEGAL OWNER OR OPERATOR:** ABEC #3 LLC DBA LAKEVIEW DAIRY BIOGAS
**MAILING ADDRESS:** 2828 ROUTH ST, SUITE 500
DALLAS, TX 75201-1438

**LOCATION:** 17702 BEAR MOUNTAIN BLVD
BAKERSFIELD, CA 93311

**EQUIPMENT DESCRIPTION:**
ANAEROBIC DIGESTER SYSTEM CONSISTING OF COVERED LAGOON ANAEROBIC DIGESTER CELL(S) WITH PRESSURE/VACUUM VALVE(S) AND AN AIR INJECTION SYSTEM FOR CONTROL OF H2S

## CONDITIONS

1. {271} All equipment shall be maintained in good operating condition and shall be operated in a manner to minimize emissions of air contaminants into the atmosphere. [District Rule 2201]
2. {98} No air contaminant shall be released into the atmosphere which causes a public nuisance. [District Rule 4102]
3. The VOC content of the digester gas produced by the digester system shall not exceed 10% by weight. [District Rule 2201]
4. The digester system cover(s) shall be designed and installed in accordance with Natural Resources Conservation Services (NRCS) Practice Standard Code 367 - Roofs and Covers. [District Rule 2201]
5. The digester system shall be designed to allow gas generated during summer conditions to be stored for more than 24 hours prior to venting in the event that the gas cannot be combusted in digester gas-fired engines or sent to another device with a VOC control efficiency of at least 95% by weight as determined by the APCO. [District Rule 2201]
6. The air injection system shall be maintained and operated in accordance with the supplier's recommendations to minimize the concentration of hydrogen sulfide (H2S) in the digester gas. [District Rule 2201]
7. All records shall be maintained and retained for a minimum of five (5) years, and shall be made available for District inspection upon request. All records may be maintained and submitted in an electronic format approved by the District. [District Rules 1070 and 2201]

CONDITIONS CONTINUE ON NEXT PAGE

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Seyed Sadredin, Executive Director / APCO

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Arnaud Marjollet, Director of Permit Services
S-8637-1-0: Mar 16 2016 1:06PM – NORMANR : Joint Inspection NOT Required

8. {3658} This permit does not authorize the violation of any conditions established for this facility in the Conditional Use Permit (CUP), Special Use Permit (SUP), Site Approval, Site Plan Review (SPR), or other approval documents issued by a local, state, or federal agency. [Public Resources Code 21000-21177: California Environmental Quality Act]

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San Joaquin Valley
Air Pollution Control District

# AUTHORITY TO CONSTRUCT

DRAFT

**PERMIT NO:** S-8637-2-0 **ISSUANCE DATE:** DRAFT

**LEGAL OWNER OR OPERATOR:** ABEC #3 LLC DBA LAKEVIEW DAIRY BIOGAS
**MAILING ADDRESS:** 2828 ROUTH ST, SUITE 500
DALLAS, TX 75201-1438

**LOCATION:** 17702 BEAR MOUNTAIN BLVD
BAKERSFIELD, CA 93311

**EQUIPMENT DESCRIPTION:**
1,468 BHP GE JENBACHER MODEL J 320 GS-C82 (OR DISTRICT APPROVED EQUIVALENT) DIGESTER GAS-FIRED LEAN-BURN IC ENGINE WITH A SELECTIVE CATALYTIC REDUCTION (SCR) SYSTEM, AND AN IRON SPONGE AND/OR CARBON H2S REMOVAL SYSTEM (OR APPROVED EQUIVALENT H2S REMOVAL SYSTEM) POWERING AN ELECTRICAL GENERATOR

## CONDITIONS

1. This facility (Facility S-8637) and the adjacent dairy operation (Facility S-5254) shall be operated as separate stationary sources. [District Rule 2201]
2. All equipment shall be maintained in good operating condition and shall be operated in a manner consistent with good air pollution control practice to minimize emissions of air contaminants. [District Rule 2201]
3. {98} No air contaminant shall be released into the atmosphere which causes a public nuisance. [District Rule 4102]
4. {14} Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201]
5. {15} No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1 or 20% opacity. [District Rule 4101]
6. {1898} The exhaust stack shall vent vertically upward. The vertical exhaust flow shall not be impeded by a rain cap (flapper ok), roof overhang, or any other obstruction. [District Rule 4102]
7. {4261} This engine shall be operated and maintained in proper operating condition as recommended by the engine manufacturer or emissions control system supplier. [District Rule 4702]
8. {3203} This engine shall be operated within the ranges that the source testing has shown result in pollution concentrations within the emissions limits as specified on this permit. [District Rule 4702]

CONDITIONS CONTINUE ON NEXT PAGE

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Seyed Sadredin, Executive Director / APCO

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Arnaud Marjollet, Director of Permit Services
S-8637-2-0 : Mar 16 2016 1:06PM – NORMANR : Joint Inspection NOT Required

9. This engine shall only be fueled with digester gas except in the case that sufficient digester gas is unavailable for the engine at the time that the required one-time initial utility interconnect testing is scheduled. If sufficient digester gas is unavailable for the engine at the time that the required initial utility interconnect testing is scheduled, the engine will be permitted to use sufficient natural gas fuel to complete the required utility interconnect testing. [District Rule 2201]
10. During times this engine is fueled with natural gas for required initial utility interconnect testing, the engine shall continue to comply with all emission standards and limitations contained in this permit. [District Rule 2201]
11. The total amount of electrical energy produced by this engine while fueled on natural gas for required one-time initial utility interconnect testing shall not exceed 96,000 kW-hrs. The following records shall be maintained: 1) date(s) and time(s) that this engine is fueled with natural gas for utility testing, 2) the total amount of electrical energy (kW-hr) produced by this engine when fueled with natural gas for utility testing, and 3) the total number of hours that this engine is fueled with natural gas. [District Rule 2201]
12. The sulfur content of the digester gas used as fuel in this engine shall not exceed 40 ppmv as H2S. The applicant may utilize an averaging period of up to 24 hours in length for demonstration of compliance with the fuel sulfur content limit. [District Rules 2201, 4102, 4702, and 4801]
13. This engine shall be equipped with an operational non-resettable elapsed time meter. [District Rules 2201 and 4702]
14. {1897} This engine shall be equipped with either a positive crankcase ventilation (PCV) system that recirculates crankcase emissions into the air intake system for combustion, or a crankcase emissions control device of at least 90% control efficiency. [District Rule 2201]
15. Commissioning activities are defined as, but not limited to, all testing, adjustment, tuning, and calibration activities recommended by the equipment manufacturers and the construction contractor to ensure safe and reliable operation of the reciprocating IC engine, emission control equipment, and associated electrical delivery systems. [District Rule 2201]
16. Commissioning period shall commence when all mechanical, electrical, and control systems are installed and individual system startup has been completed, or when the reciprocating engine is first fired, whichever occurs first. The commissioning period shall terminate when the engine has completed initial performance testing, completed initial engine tuning, and the engine is available for commercial operation. The total duration of the commissioning period for this engine shall not exceed 120 hours of operation. [District Rule 2201]
17. The owner/operator shall minimize the emissions from the engine to the maximum extent possible during the commissioning period. [District Rule 2201]
18. At the earliest feasible opportunity, in accordance with the recommendations of the equipment supplier and/or the construction contractor, the engine shall be tuned to minimize emissions. [District Rule 2201]
19. At the earliest feasible opportunity, in accordance with the recommendations of the equipment supplier and/or the construction contractor, the emission control catalyst system(s) shall be installed, adjusted, and operated to minimize emissions from this unit. [District Rule 2201]
20. The permittee shall submit a summary of activities to be performed during the commissioning period to the District at least two weeks prior to the first firing of this engine. The summary shall include a list of each commissioning activity, the anticipated duration of each activity in hours, and the purpose of the activity. The activities described shall include, but are not limited to, the tuning of the engine, the installation and operation of the SCR system, the installation, calibration, and testing of emissions monitors, and any activities requiring the firing of this unit without abatement by the SCR system. [District Rule 2201]
21. During the commissioning period emission rates from this IC engine shall not exceed any of the following limits: 1.0 g-NOx/bhp-hr, 0.07 g-PM10/bhp-hr, 4.85 g-CO/bhp-hr, 1.0 g-VOC/bhp-hr. [District Rule 2201]
22. The total number of firing hours of this unit without abatement of emissions by the SCR system shall not exceed 120 hours during the commissioning period. Such operation of this unit without abatement shall be limited to discrete commissioning activities that can only be properly executed without the SCR system. Upon completion of these activities, the unused balance of the 120 firing hours without abatement shall expire. [District Rule 2201]
23. The permittee shall record total operating time of the engine in hours during the commissioning period. [District Rule 2201]

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CONDITIONS CONTINUE ON NEXT PAGE

24. Coincident with the end of the commissioning period, emissions from this IC engine shall not exceed any of the following limits: 0.15 g-NOx/bhp-hr (for periodic alternate monitoring, equivalent to 11 ppmvd NOx @ 15% O2), NOx referenced as NO2; 0.07 g-PM10/bhp-hr; 1.75 g-CO/bhp-hr (for periodic alternate monitoring, equivalent to 210 ppmvd CO @ 15% O2); 0.10 g-VOC/bhp-hr (for periodic alternate monitoring, equivalent to 21 ppmvd VOC @ 15% O2), VOC referenced as CH4. [District Rules 2201 and 4702]
25. The SCR catalyst shall be maintained and replaced in accordance with the recommendations of the catalyst manufacturer or emission control supplier. Records of catalyst maintenance and replacement shall be maintained. [District Rules 2201 and 4702]
26. Ammonia (NH3) emissions from this engine shall not exceed 10 ppmvd @ 15% O2. [District Rules 2201 and 4102]
27. Source testing to measure NOx, CO, VOC, PM10, and ammonia (NH3) emissions from this unit shall be conducted within 90 days of initial start-up. [District Rules 1081, 2201, and 4702]
28. Source testing to measure NOx, CO, VOC, and ammonia (NH3) emissions from this unit shall be conducted at least once every 24 months. [District Rules 1081, 2201, and 4702]
29. Fuel sulfur content analysis shall be performed within 90 days of initial start-up using EPA Method 11 or EPA Method 15, as appropriate. [District Rules 2201 and 4702]
30. Fuel sulfur content analysis shall be performed at least annually using EPA Method 11 or EPA Method 15, as appropriate. Records of the fuel sulfur analysis shall be maintained and provided to the District upon request. [District Rules 2201 and 4702]
31. {3791} Emissions source testing shall be conducted with the engine operating either at conditions representative of normal operations or conditions specified in the Permit to Operate. [District Rule 4702]
32. For emissions source testing, the arithmetic average of three 30-consecutive-minute test runs shall apply. If two of three runs are above an applicable limit, the test cannot be used to demonstrate compliance with an applicable limit. VOC emissions shall be reported as methane. NOx, CO, VOC, and NH3 concentrations shall be reported in ppmv, corrected to 15% oxygen. [District Rules 2201 and 4702]
33. The following methods shall be used for source testing: NOx (ppmv) - EPA Method 7E or ARB Method 100; CO (ppmv) - EPA Method 10 or ARB Method 100; VOC (ppmv) - EPA Method 18, 25A or 25B, or ARB Method 100; stack gas oxygen - EPA Method 3 or 3A or ARB Method 100; stack gas velocity - EPA Method 2 or EPA Method 19; stack gas moisture content - EPA Method 4; PM10 (filterable and condensable) - EPA Method 201 and 202, EPA Method 201a and 202, or ARB Method 5 in combination with Method 501; NH3 - BAAQMD ST-1B or SCAQMD Method 207-1. Alternative test methods as approved by the District may also be used to address the source testing requirements of this permit. [District Rules 1081 and 4702]
34. The Higher Heating Value (HHV) of the fuel gas shall be determined using ASTM D1826, ASTM 1945 in conjunction with ASTM D3588, or an alternative method approved by the District. [District Rules 2201 and 4702]
35. {109} Source testing shall be conducted using the methods and procedures approved by the District. The District must be notified at least 30 days prior to any compliance source test, and a source test plan must be submitted for approval at least 15 days prior to testing. [District Rule 1081]
36. The results of each source test shall be submitted to the District within 60 days after completion of the source test. [District Rule 1081]
37. The sulfur content of the digester gas used to fuel the engine shall be monitored and recorded at least once every calendar quarter in which a fuel sulfur analysis is not performed. If quarterly monitoring shows a violation of the fuel sulfur content limit of this permit, monthly monitoring will be required until six consecutive months of monitoring show compliance with the fuel sulfur content limit. Once compliance with the fuel sulfur content limit is shown for six consecutive months, then the monitoring frequency may return to quarterly. Monitoring of the sulfur content of the digester gas fuel shall not be required if the engine does not operate during that period. Records of the results of monitoring of the digester gas fuel sulfur content shall be maintained. [District Rule 2201]

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CONDITIONS CONTINUE ON NEXT PAGE

38. Monitoring of the digester gas sulfur content shall be performed using gas detection tubes calibrated for H2S; a Testo 350 XL portable emission monitor; a continuous fuel gas monitor that meets the requirements specified in SCAQMD Rule 431.1, Attachment A; District-approved source test methods, including EPA Method 15, ASTM Method D1072, D4084, and D5504; District-approved in-line H2S monitors; or an alternative method approved by the District. Prior to utilization of in-line monitors to demonstrate compliance with the digester gas sulfur content limit of this permit, the permittee shall submit details of the proposed monitoring system, including the make, model, and detection limits, to the District and obtain District approval for the proposed monitor(s). [District Rule 2201]

39. The exhaust stack shall be equipped with permanent provisions to allow collection of stack gas samples consistent with EPA test methods and shall be equipped with safe permanent provisions to sample stack gases with a portable NOx, CO, and O2 analyzer during District inspections. The sampling ports shall be located in accordance with the CARB regulation titled California Air Resources Board Air Monitoring Quality Assurance Volume VI, Standard Operating Procedures for Stationary Emission Monitoring and Testing. [District Rule 1081]

40. The permittee shall monitor and record the stack concentration of NOx, CO, and O2 at least once every calendar quarter (in which a source test is not performed) using a portable emission monitor that meets District specifications. [In-stack monitors may be allowed if they satisfy the standards for portable analyzers as specified in District policies and are approved in writing by the APCO.] Monitoring shall be performed not less than once every month for 12 months if two consecutive deviations are observed during quarterly monitoring. Monitoring shall not be required if the engine is not in operation, i.e. the engine need not be started solely to perform monitoring. Monitoring shall be performed within 5 days of restarting the engine unless monitoring has been performed within the last month if on a monthly monitoring schedule, or within the last quarter if on a quarterly monitoring schedule. Records must be maintained of the dates of non-operation to validate extended monitoring frequencies. [District Rules 2201 and 4702]

41. The permittee shall monitor and record the stack concentration of NH3 at least once every calendar quarter in which a source test is not performed. NH3 monitoring shall be conducted utilizing District approved gas-detection tubes or a District approved equivalent method. Monitoring shall not be required if the unit is not in operation, i.e. the unit need not be started solely to perform monitoring. Monitoring shall be performed within 5 days of restarting the unit unless monitoring has been performed within the last quarter. [District Rules 2201 and 4102]

42. If the NOx, CO, or NH3 concentrations corrected to 15% O2, as measured by the portable analyzer or the District-approved ammonia monitoring equipment, exceed the respective permitted emissions concentration(s), the permittee shall return the emissions to within the acceptable range as soon as possible, but no longer than 8 hours of operation after detection. If the portable analyzer or ammonia monitoring equipment readings continue to exceed the permitted emissions concentration(s) after 8 hours of operation after detection, the permittee shall notify the District within the following 1 hour and conduct a certified source test within 60 days of the first exceedance. In lieu of conducting a source test, the permittee may stipulate a violation has occurred, subject to enforcement action. The permittee must then correct the violation, show compliance has been re-established, and resume monitoring procedures. If the deviations are the result of a qualifying breakdown condition pursuant to Rule 1100, the permittee may fully comply with Rule 1100 in lieu of the performing the notification and testing required by this condition. [District Rules 2201 and 4702]

43. {3787} All alternate monitoring parameter emission readings shall be taken with the unit operating either at conditions representative of normal operations or conditions specified in the permit-to-operate. The analyzer shall be calibrated, maintained, and operated in accordance with the manufacturer's specifications and recommendations or a protocol approved by the APCO. Emission readings taken shall be averaged over a 15 consecutive-minute period by either taking a cumulative 15 consecutive-minute sample reading or by taking at least five (5) readings, evenly spaced out over the 15 consecutive-minute period. [District Rule 4702]

44. The permittee shall maintain records of: (1) the date and time of NOx, CO, O2, and NH3 measurements, (2) the O2 concentration in percent and the measured NOx, CO, and NH3 concentrations corrected to 15% O2, (3) make and model of exhaust gas analyzer, (4) exhaust gas analyzer calibration records, (5) the method of determining the NH3 emission concentration, and (6) a description of any corrective action taken to maintain the emissions within the acceptable range. [District Rules 2201 and 4702]

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CONDITIONS CONTINUE ON NEXT PAGE

45. Within 90 days of initial start-up, the SCR system reagent injection rate and inlet temperature to the catalyst control system shall be monitored to establish acceptable values and ranges that provide a reasonable assurance of ongoing compliance with the NOx emissions limit(s) stated in this permit. Acceptable values and ranges shall be established for each load that the engine is expected to operate at, in a minimum of 10% increments (e.g. 70%, 80%, and 90%). Records of the acceptable SCR system reagent injection rate(s) and inlet temperature(s) to the catalyst control system demonstrated to result in compliance with the NOx emission limit(s) shall be maintained and made available for inspection upon request. [District Rule 4702]

46. If the SCR system reagent injection rate and/or the inlet temperature to the catalyst control system is outside of the established acceptable range(s), the permittee shall return the SCR system reagent injection rate and inlet temperature to the catalyst control system to within the established acceptable range(s) as soon as possible, but no longer than 8 hours after detection. If the SCR system reagent injection rate and inlet temperature to the catalyst control system are not returned to within acceptable range(s) within 8 hours, the permittee shall notify the District within the following 1 hour and begin monitoring and recording the stack concentration of NOx and O2 at least once every month. Monthly monitoring of the stack concentration of NOx and O2 shall continue until the operator can show that the SCR system reagent injection rate and inlet temperature to the catalyst control system are operating within the acceptable range(s) demonstrated to result in compliance with the NOx emission limit(s) of this permit. [District Rule 4702]

47. Within 90 days of initial start-up, the inlet temperature to the catalyst control system and the back pressure of the exhaust upstream of the catalyst control system shall be monitored to establish acceptable values and ranges that provide a reasonable assurance of ongoing compliance with the emissions limit(s) stated in this permit. Acceptable values and ranges shall be established for each load that the engine is expected to operate at, in a minimum of 10% increments (e.g. 70%, 80%, and 90%). Records of the established acceptable inlet temperature and back pressure demonstrated to result in compliance with the CO and VOC emission limits shall be maintained and made available for inspection upon request. [District Rule 4702]

48. If the inlet temperature to the catalyst control system and/or the back pressure of the exhaust upstream of the catalyst control system is outside of the established acceptable range(s), the permittee shall return the inlet temperature to the catalyst control system and the back pressure of the exhaust upstream of the catalyst control system back to the acceptable range(s) as soon as possible, but no longer than 8 hours after detection. If the inlet temperature to the catalyst control system and the back pressure of the exhaust upstream of the catalyst control system are not returned to within acceptable range(s) within 8 hours, the permittee shall notify the District within the following 1 hour and begin monitoring and recording the stack concentration of CO and O2 at least once every month. Monthly monitoring of the stack concentration of CO and O2 shall continue until the operator can show that the inlet temperature to the catalyst control system and the back pressure of the exhaust upstream of the catalyst control system are operating within the acceptable range(s) demonstrated to result in compliance with the CO emission limit(s) of this permit. [District Rule 4702]

49. The permittee shall monitor and record the engine operating load, the SCR system reagent injection rate, the inlet temperature to the catalyst control system, and the back pressure of the exhaust upstream of the catalyst control system at least once per month. [District Rule 4702]

50. The permittee shall maintain an engine operating log to demonstrate compliance. The engine operating log shall include, on a monthly basis, the following information: the total hours of operation, the type and quantity of fuel used, maintenance and modifications performed, monitoring data, compliance source test results, and any other information necessary to demonstrate compliance. Quantity of fuel used shall be recorded in standard cubic feet using a non-resettable, totalizing mass or volumetric fuel flow meter or other APCO approved-device. [District Rules 2201 and 4702]

51. {3212} The permittee shall update the I&M plan for this engine prior to any planned change in operation. The permittee must notify the District no later than seven days after changing the I&M plan and must submit an updated I&M plan to the APCO for approval no later than 14 days after the change. The date and time of the change to the I&M plan shall be recorded in the engine's operating log. For modifications, the revised I&M plan shall be submitted to and approved by the APCO prior to issuance of the Permit to Operate. The permittee may request a change to the I&M plan at any time. [District Rule 4702]

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CONDITIONS CONTINUE ON NEXT PAGE

52. All records shall be maintained and retained for a minimum of five (5) years, and shall be made available for District inspection upon request. All records may be maintained and submitted in an electronic format approved by the District. [District Rules 2201 and 4702]

53. The permittee shall obtain written District approval for the use of any equivalent control equipment not specifically approved by this Authority to Construct. Approval of the equivalent control equipment shall be made only after the District's determination that the submitted design and performance of the proposed alternate control equipment is equivalent to the specifically authorized equipment. [District Rule 2010]

54. The permittee's request for approval of equivalent equipment shall include the make, model, manufacturer's maximum rating, manufacturer's guaranteed emission rates, equipment drawing(s), and operational characteristics/parameters. [District Rule 2010]

55. Alternate equipment shall be of the same class and category of source as the equipment authorized by the Authority to Construct. [District Rule 2201]

56. No emission factor and no emissions shall be greater for the alternate equipment than for the proposed equipment. No changes in the hours of operation, operating rate, throughput, or firing rate may be authorized for any alternate equipment. [District Rule 2201]

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San Joaquin Valley
Air Pollution Control District

# AUTHORITY TO CONSTRUCT

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**PERMIT NO:** S-8637-3-0 **ISSUANCE DATE:** DRAFT

**LEGAL OWNER OR OPERATOR:** ABEC #3 LLC DBA LAKEVIEW DAIRY BIOGAS
**MAILING ADDRESS:** 2828 ROUTH ST, SUITE 500
DALLAS, TX 75201-1438

**LOCATION:** 17702 BEAR MOUNTAIN BLVD
BAKERSFIELD, CA 93311

**EQUIPMENT DESCRIPTION:**
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## CONDITIONS

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2. All equipment shall be maintained in good operating condition and shall be operated in a manner consistent with good air pollution control practice to minimize emissions of air contaminants. [District Rule 2201]
3. {98} No air contaminant shall be released into the atmosphere which causes a public nuisance. [District Rule 4102]
4. {14} Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201]
5. {15} No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1 or 20% opacity. [District Rule 4101]
6. {1898} The exhaust stack shall vent vertically upward. The vertical exhaust flow shall not be impeded by a rain cap (flapper ok), roof overhang, or any other obstruction. [District Rule 4102]
7. {4261} This engine shall be operated and maintained in proper operating condition as recommended by the engine manufacturer or emissions control system supplier. [District Rule 4702]
8. {3203} This engine shall be operated within the ranges that the source testing has shown result in pollution concentrations within the emissions limits as specified on this permit. [District Rule 4702]

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Seyed Sadredin, Executive Director / APCO

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Arnaud Marjollet, Director of Permit Services



Southern Regional Office • 34946 Flyover Court • Bakersfield, CA 93308 • (661) 392-5500 • Fax (661) 392-5585

9. This engine shall only be fueled with digester gas except in the case that sufficient digester gas is unavailable for the engine at the time that the required one-time initial utility interconnect testing is scheduled. If sufficient digester gas is unavailable for the engine at the time that the required initial utility interconnect testing is scheduled, the engine will be permitted to use sufficient natural gas fuel to complete the required utility interconnect testing. [District Rule 2201]
10. During times this engine is fueled with natural gas for required initial utility interconnect testing, the engine shall continue to comply with all emission standards and limitations contained in this permit. [District Rule 2201]
11. The total amount of electrical energy produced by this engine while fueled on natural gas for required one-time initial utility interconnect testing shall not exceed 96,000 kW-hrs. The following records shall be maintained: 1) date(s) and time(s) that this engine is fueled with natural gas for utility testing, 2) the total amount of electrical energy (kW-hr) produced by this engine when fueled with natural gas for utility testing, and 3) the total number of hours that this engine is fueled with natural gas. [District Rule 2201]
12. The sulfur content of the digester gas used as fuel in this engine shall not exceed 40 ppmv as H2S. The applicant may utilize an averaging period of up to 24 hours in length for demonstration of compliance with the fuel sulfur content limit. [District Rules 2201, 4102, 4702, and 4801]
13. This engine shall be equipped with an operational non-resettable elapsed time meter. [District Rules 2201 and 4702]
14. {1897} This engine shall be equipped with either a positive crankcase ventilation (PCV) system that recirculates crankcase emissions into the air intake system for combustion, or a crankcase emissions control device of at least 90% control efficiency. [District Rule 2201]
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16. Commissioning period shall commence when all mechanical, electrical, and control systems are installed and individual system startup has been completed, or when the reciprocating engine is first fired, whichever occurs first. The commissioning period shall terminate when the engine has completed initial performance testing, completed initial engine tuning, and the engine is available for commercial operation. The total duration of the commissioning period for this engine shall not exceed 120 hours of operation. [District Rule 2201]
17. The owner/operator shall minimize the emissions from the engine to the maximum extent possible during the commissioning period. [District Rule 2201]
18. At the earliest feasible opportunity, in accordance with the recommendations of the equipment supplier and/or the construction contractor, the engine shall be tuned to minimize emissions. [District Rule 2201]
19. At the earliest feasible opportunity, in accordance with the recommendations of the equipment supplier and/or the construction contractor, the emission control catalyst system(s) shall be installed, adjusted, and operated to minimize emissions from this unit. [District Rule 2201]
20. The permittee shall submit a summary of activities to be performed during the commissioning period to the District at least two weeks prior to the first firing of this engine. The summary shall include a list of each commissioning activity, the anticipated duration of each activity in hours, and the purpose of the activity. The activities described shall include, but are not limited to, the tuning of the engine, the installation and operation of the SCR system, the installation, calibration, and testing of emissions monitors, and any activities requiring the firing of this unit without abatement by the SCR system. [District Rule 2201]
21. During the commissioning period emission rates from this IC engine shall not exceed any of the following limits: 1.0 g-NOx/bhp-hr, 0.07 g-PM10/bhp-hr, 4.85 g-CO/bhp-hr, 1.0 g-VOC/bhp-hr. [District Rule 2201]
22. The total number of firing hours of this unit without abatement of emissions by the SCR system shall not exceed 120 hours during the commissioning period. Such operation of this unit without abatement shall be limited to discrete commissioning activities that can only be properly executed without the SCR system. Upon completion of these activities, the unused balance of the 120 firing hours without abatement shall expire. [District Rule 2201]
23. The permittee shall record total operating time of the engine in hours during the commissioning period. [District Rule 2201]

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24. Coincident with the end of the commissioning period, emissions from this IC engine shall not exceed any of the following limits: 0.15 g-NOx/bhp-hr (for periodic alternate monitoring, equivalent to 11 ppmvd NOx @ 15% O2), NOx referenced as NO2; 0.07 g-PM10/bhp-hr; 1.75 g-CO/bhp-hr (for periodic alternate monitoring, equivalent to 210 ppmvd CO @ 15% O2); 0.10 g-VOC/bhp-hr (for periodic alternate monitoring, equivalent to 21 ppmvd VOC @ 15% O2), VOC referenced as CH4. [District Rules 2201 and 4702]

25. The SCR catalyst shall be maintained and replaced in accordance with the recommendations of the catalyst manufacturer or emission control supplier. Records of catalyst maintenance and replacement shall be maintained. [District Rules 2201 and 4702]

26. Ammonia (NH3) emissions from this engine shall not exceed 10 ppmvd @ 15% O2. [District Rules 2201 and 4102]

27. Source testing to measure NOx, CO, VOC, PM10, and ammonia (NH3) emissions from this unit shall be conducted within 90 days of initial start-up. [District Rules 1081, 2201, and 4702]

28. Source testing to measure NOx, CO, VOC, and ammonia (NH3) emissions from this unit shall be conducted at least once every 24 months. [District Rules 1081, 2201, and 4702]

29. Fuel sulfur content analysis shall be performed within 90 days of initial start-up using EPA Method 11 or EPA Method 15, as appropriate. [District Rules 2201 and 4702]

30. Fuel sulfur content analysis shall be performed at least annually using EPA Method 11 or EPA Method 15, as appropriate. Records of the fuel sulfur analysis shall be maintained and provided to the District upon request. [District Rules 2201 and 4702]

31. {3791} Emissions source testing shall be conducted with the engine operating either at conditions representative of normal operations or conditions specified in the Permit to Operate. [District Rule 4702]

32. For emissions source testing, the arithmetic average of three 30-consecutive-minute test runs shall apply. If two of three runs are above an applicable limit, the test cannot be used to demonstrate compliance with an applicable limit. VOC emissions shall be reported as methane. NOx, CO, VOC, and NH3 concentrations shall be reported in ppmv, corrected to 15% oxygen. [District Rules 2201 and 4702]

33. The following methods shall be used for source testing: NOx (ppmv) - EPA Method 7E or ARB Method 100; CO (ppmv) - EPA Method 10 or ARB Method 100; VOC (ppmv) - EPA Method 18, 25A or 25B, or ARB Method 100; stack gas oxygen - EPA Method 3 or 3A or ARB Method 100; stack gas velocity - EPA Method 2 or EPA Method 19; stack gas moisture content - EPA Method 4; PM10 (filterable and condensable) - EPA Method 201 and 202, EPA Method 201a and 202, or ARB Method 5 in combination with Method 501; NH3 - BAAQMD ST-1B or SCAQMD Method 207-1. Alternative test methods as approved by the District may also be used to address the source testing requirements of this permit. [District Rules 1081 and 4702]

34. The Higher Heating Value (HHV) of the fuel gas shall be determined using ASTM D1826, ASTM 1945 in conjunction with ASTM D3588, or an alternative method approved by the District. [District Rules 2201 and 4702]

35. {109} Source testing shall be conducted using the methods and procedures approved by the District. The District must be notified at least 30 days prior to any compliance source test, and a source test plan must be submitted for approval at least 15 days prior to testing. [District Rule 1081]

36. The results of each source test shall be submitted to the District within 60 days after completion of the source test. [District Rule 1081]

37. The sulfur content of the digester gas used to fuel the engine shall be monitored and recorded at least once every calendar quarter in which a fuel sulfur analysis is not performed. If quarterly monitoring shows a violation of the fuel sulfur content limit of this permit, monthly monitoring will be required until six consecutive months of monitoring show compliance with the fuel sulfur content limit. Once compliance with the fuel sulfur content limit is shown for six consecutive months, then the monitoring frequency may return to quarterly. Monitoring of the sulfur content of the digester gas fuel shall not be required if the engine does not operate during that period. Records of the results of monitoring of the digester gas fuel sulfur content shall be maintained. [District Rule 2201]

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38. Monitoring of the digester gas sulfur content shall be performed using gas detection tubes calibrated for H2S; a Testo 350 XL portable emission monitor; a continuous fuel gas monitor that meets the requirements specified in SCAQMD Rule 431.1, Attachment A; District-approved source test methods, including EPA Method 15, ASTM Method D1072, D4084, and D5504; District-approved in-line H2S monitors; or an alternative method approved by the District. Prior to utilization of in-line monitors to demonstrate compliance with the digester gas sulfur content limit of this permit, the permittee shall submit details of the proposed monitoring system, including the make, model, and detection limits, to the District and obtain District approval for the proposed monitor(s). [District Rule 2201]

39. The exhaust stack shall be equipped with permanent provisions to allow collection of stack gas samples consistent with EPA test methods and shall be equipped with safe permanent provisions to sample stack gases with a portable NOx, CO, and O2 analyzer during District inspections. The sampling ports shall be located in accordance with the CARB regulation titled California Air Resources Board Air Monitoring Quality Assurance Volume VI, Standard Operating Procedures for Stationary Emission Monitoring and Testing. [District Rule 1081]

40. The permittee shall monitor and record the stack concentration of NOx, CO, and O2 at least once every calendar quarter (in which a source test is not performed) using a portable emission monitor that meets District specifications. [In-stack monitors may be allowed if they satisfy the standards for portable analyzers as specified in District policies and are approved in writing by the APCO.] Monitoring shall be performed not less than once every month for 12 months if two consecutive deviations are observed during quarterly monitoring. Monitoring shall not be required if the engine is not in operation, i.e. the engine need not be started solely to perform monitoring. Monitoring shall be performed within 5 days of restarting the engine unless monitoring has been performed within the last month if on a monthly monitoring schedule, or within the last quarter if on a quarterly monitoring schedule. Records must be maintained of the dates of non-operation to validate extended monitoring frequencies. [District Rules 2201 and 4702]

41. The permittee shall monitor and record the stack concentration of NH3 at least once every calendar quarter in which a source test is not performed. NH3 monitoring shall be conducted utilizing District approved gas-detection tubes or a District approved equivalent method. Monitoring shall not be required if the unit is not in operation, i.e. the unit need not be started solely to perform monitoring. Monitoring shall be performed within 5 days of restarting the unit unless monitoring has been performed within the last quarter. [District Rules 2201 and 4102]

42. If the NOx, CO, or NH3 concentrations corrected to 15% O2, as measured by the portable analyzer or the District-approved ammonia monitoring equipment, exceed the respective permitted emissions concentration(s), the permittee shall return the emissions to within the acceptable range as soon as possible, but no longer than 8 hours of operation after detection. If the portable analyzer or ammonia monitoring equipment readings continue to exceed the permitted emissions concentration(s) after 8 hours of operation after detection, the permittee shall notify the District within the following 1 hour and conduct a certified source test within 60 days of the first exceedance. In lieu of conducting a source test, the permittee may stipulate a violation has occurred, subject to enforcement action. The permittee must then correct the violation, show compliance has been re-established, and resume monitoring procedures. If the deviations are the result of a qualifying breakdown condition pursuant to Rule 1100, the permittee may fully comply with Rule 1100 in lieu of the performing the notification and testing required by this condition. [District Rules 2201 and 4702]

43. {3787} All alternate monitoring parameter emission readings shall be taken with the unit operating either at conditions representative of normal operations or conditions specified in the permit-to-operate. The analyzer shall be calibrated, maintained, and operated in accordance with the manufacturer's specifications and recommendations or a protocol approved by the APCO. Emission readings taken shall be averaged over a 15 consecutive-minute period by either taking a cumulative 15 consecutive-minute sample reading or by taking at least five (5) readings, evenly spaced out over the 15 consecutive-minute period. [District Rule 4702]

44. The permittee shall maintain records of: (1) the date and time of NOx, CO, O2, and NH3 measurements, (2) the O2 concentration in percent and the measured NOx, CO, and NH3 concentrations corrected to 15% O2, (3) make and model of exhaust gas analyzer, (4) exhaust gas analyzer calibration records, (5) the method of determining the NH3 emission concentration, and (6) a description of any corrective action taken to maintain the emissions within the acceptable range. [District Rules 2201 and 4702]

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45. Within 90 days of initial start-up, the SCR system reagent injection rate and inlet temperature to the catalyst control system shall be monitored to establish acceptable values and ranges that provide a reasonable assurance of ongoing compliance with the NOx emissions limit(s) stated in this permit. Acceptable values and ranges shall be established for each load that the engine is expected to operate at, in a minimum of 10% increments (e.g. 70%, 80%, and 90%). Records of the acceptable SCR system reagent injection rate(s) and inlet temperature(s) to the catalyst control system demonstrated to result in compliance with the NOx emission limit(s) shall be maintained and made available for inspection upon request. [District Rule 4702]

46. If the SCR system reagent injection rate and/or the inlet temperature to the catalyst control system is outside of the established acceptable range(s), the permittee shall return the SCR system reagent injection rate and inlet temperature to the catalyst control system to within the established acceptable range(s) as soon as possible, but no longer than 8 hours after detection. If the SCR system reagent injection rate and inlet temperature to the catalyst control system are not returned to within acceptable range(s) within 8 hours, the permittee shall notify the District within the following 1 hour and begin monitoring and recording the stack concentration of NOx and O2 at least once every month. Monthly monitoring of the stack concentration of NOx and O2 shall continue until the operator can show that the SCR system reagent injection rate and inlet temperature to the catalyst control system are operating within the acceptable range(s) demonstrated to result in compliance with the NOx emission limit(s) of this permit. [District Rule 4702]

47. Within 90 days of initial start-up, the inlet temperature to the catalyst control system and the back pressure of the exhaust upstream of the catalyst control system shall be monitored to establish acceptable values and ranges that provide a reasonable assurance of ongoing compliance with the emissions limit(s) stated in this permit. Acceptable values and ranges shall be established for each load that the engine is expected to operate at, in a minimum of 10% increments (e.g. 70%, 80%, and 90%). Records of the established acceptable inlet temperature and back pressure demonstrated to result in compliance with the CO and VOC emission limits shall be maintained and made available for inspection upon request. [District Rule 4702]

48. If the inlet temperature to the catalyst control system and/or the back pressure of the exhaust upstream of the catalyst control system is outside of the established acceptable range(s), the permittee shall return the inlet temperature to the catalyst control system and the back pressure of the exhaust upstream of the catalyst control system back to the acceptable range(s) as soon as possible, but no longer than 8 hours after detection. If the inlet temperature to the catalyst control system and the back pressure of the exhaust upstream of the catalyst control system are not returned to within acceptable range(s) within 8 hours, the permittee shall notify the District within the following 1 hour and begin monitoring and recording the stack concentration of CO and O2 at least once every month. Monthly monitoring of the stack concentration of CO and O2 shall continue until the operator can show that the inlet temperature to the catalyst control system and the back pressure of the exhaust upstream of the catalyst control system are operating within the acceptable range(s) demonstrated to result in compliance with the CO emission limit(s) of this permit. [District Rule 4702]

49. The permittee shall monitor and record the engine operating load, the SCR system reagent injection rate, the inlet temperature to the catalyst control system, and the back pressure of the exhaust upstream of the catalyst control system at least once per month. [District Rule 4702]

50. The permittee shall maintain an engine operating log to demonstrate compliance. The engine operating log shall include, on a monthly basis, the following information: the total hours of operation, the type and quantity of fuel used, maintenance and modifications performed, monitoring data, compliance source test results, and any other information necessary to demonstrate compliance. Quantity of fuel used shall be recorded in standard cubic feet using a non-resettable, totalizing mass or volumetric fuel flow meter or other APCO approved-device. [District Rules 2201 and 4702]

51. {3212} The permittee shall update the I&M plan for this engine prior to any planned change in operation. The permittee must notify the District no later than seven days after changing the I&M plan and must submit an updated I&M plan to the APCO for approval no later than 14 days after the change. The date and time of the change to the I&M plan shall be recorded in the engine's operating log. For modifications, the revised I&M plan shall be submitted to and approved by the APCO prior to issuance of the Permit to Operate. The permittee may request a change to the I&M plan at any time. [District Rule 4702]

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52. All records shall be maintained and retained for a minimum of five (5) years, and shall be made available for District inspection upon request. All records may be maintained and submitted in an electronic format approved by the District. [District Rules 2201 and 4702]

53. The permittee shall obtain written District approval for the use of any equivalent control equipment not specifically approved by this Authority to Construct. Approval of the equivalent control equipment shall be made only after the District's determination that the submitted design and performance of the proposed alternate control equipment is equivalent to the specifically authorized equipment. [District Rule 2010]

54. The permittee's request for approval of equivalent equipment shall include the make, model, manufacturer's maximum rating, manufacturer's guaranteed emission rates, equipment drawing(s), and operational characteristics/parameters. [District Rule 2010]

55. Alternate equipment shall be of the same class and category of source as the equipment authorized by the Authority to Construct. [District Rule 2201]

56. No emission factor and no emissions shall be greater for the alternate equipment than for the proposed equipment. No changes in the hours of operation, operating rate, throughput, or firing rate may be authorized for any alternate equipment. [District Rule 2201]

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