September 30, 2024

Clerk of the Board
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812

Submitted electronically via: https://ww2.arb.ca.gov/applications/public-comments

RE: POET COMMENTS ON AUGUST 16, 2024, RECIRCULATED DRAFT ENVIRONMENTAL IMPACT ANALYSIS FOR THE PROPOSED LOW CARBON FUEL STANDARD REGULATION

Dear CARB Members:

POET appreciates the opportunity to provide comments on the California Air Resources Board's ("CARB") August 16, 2024, Recirculated Draft Environmental Impact Analysis ("Recirculated DEIA") for the Proposed Low Carbon Fuel Standard ("LCFS") Amendments ("Revised Proposed Amendments"). POET has participated actively in CARB's ongoing rulemaking and submitted detailed comments on its own behalf and as part of a coalition on February 20, 2024, regarding the Amendments initially proposed in December 2023 ("Original Proposed Amendments"), and the Draft Environmental Impact Statement that was published in conjunction with the Original Proposed Amendments ("Original DEIA"). POET attended the LCFS rulemaking workshop held on April 10, 2024, and submitted written comments regarding the matters discussed and presented during the workshop. POET also submitted comments on August 27, 2024, in response to CARB's August 12, 2024, Revised Proposed Amendments.

As the global leader in biofuels and California's leading bioethanol supplier, POET has been a key supplier of LCFS credits, meeting the program's incentives to lower the carbon intensity ("CI") of its fuel and delivering greenhouse gas ("GHG") reductions and public health benefits to the State of California. We write to express our concerns with CARB's analysis of environmental impacts associated with the Revised Proposed Amendments. Although the Recirculated DEIA includes a revised project description and updated air quality and GHG evaluations in light of the Revised Proposed Amendments,[1] CARB's environmental impacts analysis remains deficient under the California Environmental Quality Act and the California Administrative Procedure Act.

I. Background on CEQA

The California Environmental Quality Act ("CEQA"), enacted in 1970, requires state and local agencies to assess the environmental impact of proposed projects before making decisions.[2] CEQA mandates that agencies identify and disclose significant environmental impacts, consider feasible alternatives, and implement mitigation measures to reduce or avoid adverse effects when possible.[3] CEQA requirements include the preparation of an initial study and then either an Environmental

[1] Recirculated DEIA at 2.
[2] Cal. Pub. Res. Code §§ 21000-21189 (West 2024).
[3] *Id.*

Impact Report ("EIR"), or a Negative Declaration if no significant impact is found, ensuring that environmental considerations are integrated into the governmental decision-making process.[4]

CARB is subject to a regulatory program certified by the Secretary of the Natural Resources Agency[5] that exempts it from certain CEQA requirements, including but not limited to preparing environmental impact reports, negative declarations, and initial studies.[6] However, courts have emphasized that "[c]ertification of a program is effectively a determination that the agency's regulatory program includes procedures for environmental review that are the functional equivalent of CEQA."[7] CARB actions "remain subject to other provisions of CEQA[,]"[8] including CEQA's requirements as to the scope of an environmental assessment.[9] Accordingly, a CARB Environmental Impact Analysis ("EIA") is the "functional equivalent" of an Environmental Impact Report ("EIR") under CEQA.[10]

Pursuant to its regulations implementing the certified regulatory program, CARB is required to prepare an EIA pursuant to CEQA if the agency determines that "any aspect of [a proposed rule of policy], either individually or cumulatively, may have a significant effect on the environment[.]"[11] In the EIA, CARB must discuss and evaluate the proposal's environmental impacts, including cumulative and growth-inducing impacts, consider a reasonable range of alternatives to the proposed project, and examine feasible mitigation measures to minimize significant adverse impacts.[12] An EIA meets these requirements when it provides enough "facts from which to evaluate the pros and cons" of a project[13] and sufficient information to allow for informed public participation.[14] To determine whether an effect on the environment is "significant," CARB must evaluate how a proposal may interact with existing regulatory frameworks and examine the overall cumulative effects of the proposal.[15]

Although CARB need not consider "every conceivable alternative" to a project, the Agency must consider a reasonable range of potentially feasible alternatives that will foster informed decision

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[4] Cal. Pub. Res. Code § 21000.
[5] Cal. Code Regs. tit. 17, §§ 60000-60008 (West 2024).
[6] Cal. Code Regs. tit. 14, §§ 15250, 15251(d) (West 2024).
[7] *John R. Lawson Rock & Oil, Inc. v. State Air Res. Bd.* (2018) 20 Cal. App. 5th 77, 95 (citing *Californians for Alternatives to Toxics v. Cal. Dep't of Pesticide Regul.* (2006) 136 Cal. App. 4th 1049, 1059 (citing Cal. Code Regs. tit. 14, § 15251)).
[8] *POET, LLC v. State Air Res. Bd*. (2013) 218 Cal. App. 4th 681, 710.
[9] *See Communities for a Better Env't v. City of Richmond* (2010) 184 Cal. App. 4th 70, 83 (discussing a court's evaluation of "an EIR [or substitute environmental document] for CEQA compliance").
[10] Original DEIA at 37.
[11] Cal. Code Regs. tit. 17, § 60004(b)(1).
[12] Cal. Code Regs. tit. 17, §§ 60004.2(a)(3), (5).
[13] *Santiago Cnty. Water Dist. v. Cnty. of Orange* (1981) 118 Cal. App. 3d 818, 820.
[14] *Barthelemy v. Chino Basin Mun. Water Dist*. (1995) 38 Cal. App. 4th 1609, 1617.
[15] *See e.g.*, *AquAlliance v. U.S. Bureau of Reclamation*, 287 F. Supp. 3d 969, 1036 (E.D. Cal. 2018) ("The relevant issue was not the relative amount of traffic noise resulting from the project when compared to existing traffic noise, but whether any additional amount of traffic noise should be considered significant given the nature of the existing traffic noise problem.") (quoting *Communities for a Better Env't v. Cal. Res. Agency* (2002) 103 Cal. App. 4th 98, 117-18; citing *Los Angeles Unified Sch. Dist. v. City of L.A.* (1997) 58 Cal. App. 4th 1019).

making and public participation.[16] CARB "may not define the objectives of its action in terms so unreasonably narrow that only one alternative from among the environmentally benign ones in the agency's power would accomplish the goals of the agency's action, and the [EIA] would become a foreordained formality."[17]

II. CARB's DEIA Does Not Comply with CEQA.

To comply with CEQA, CARB's certified regulatory program regulations require that the agency's environmental analysis contain "[a] discussion and consideration of environmental impacts, adverse or beneficial, and feasible mitigation measures which could minimize significant adverse impacts identified," as well as "[a] discussion of cumulative and growth-inducing impacts[.]"[18] Courts have emphasized that agencies must interpret this requirement to "afford the fullest possible protection of the environment."[19] Further, because mitigation is a requirement under CEQA, it is critical that CARB assess any potential negative impacts of the proposal in sufficient detail that a mitigation plan can be accurately set forth.

In conducting an environmental assessment, CARB is required to consider a reasonable range of alternatives that "shall include those that could feasibly accomplish most of the basic objectives of the project and could avoid or substantially lessen one or more of the significant effects."[20] An alternative is "feasible" if it is "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors."[21] Factors impacting feasibility include "economic viability, availability of infrastructure, general plan consistency, other plans or regulatory limitations, [and] jurisdictional boundaries[.]"[22]

As discussed further below, CARB failed to consider and properly evaluate environmental impacts associated with the proposed sustainability certification requirements, the proposed definition of waste feedstocks, and the increased demand for electricity and electric vehicles ("EVs") that would result from the proposed LCFS program changes. CARB also failed to consider sufficient alternatives to its proposed LCFS rule.

A. CARB Does Not Address Any Negative Emissions Impacts that Could Arise from the Sustainability Requirements.

Neither the Original DEIA nor the Recirculated DEIA address any possible negative emissions impacts resulting from the sustainability requirements in the proposed LCFS amendments. Therefore, CARB did not properly analyze the environmental impacts of the proposed LCFS rule as required under CEQA and CARB's certified regulatory program. CEQA requires an EIA to

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[16] *California Native Plant Soc'y v. City of Santa Cruz* (2009) 177 Cal. App. 4th 957, 980 (quoting Cal. Code Regs. tit. 14, § 15126.6, subd. (a); citing *In re Bay–Delta Programmatic Env't Impact Report Coordinated Proceedings*, 184 P.3d 709, 722 (Cal. 2008).
[17] *Friends of Southeast's Future v. Morrison*, 153 F.3d 1059, 1066 (9th Cir. 1998) (quoting *Citizens Against Burlington, Inc. v. Busey*, 938 F.2d 190 (D.C. Cir. 1991)).
[18] Cal. Code Regs. tit. 17, § 60004.2(a).
[19] *Friends of the Eel River v. Sonoma Cnty. Water Agency* (2003) 108 Cal. App. 4th 859, 868-69 (citations omitted).
[20] Cal. Code Regs. tit. 14, § 15126.6(c).
[21] Cal. Pub. Res. Code, § 21061.1; *see also* Cal. Code Regs. tit. 14, § 15364; *see also Bay Area Citizens v. Ass'n of Bay Area Gov'ts* (2016) 248 Cal. App. 4th 966, 1018.
[22] Cal. Code Regs. tit. 14, § 15126.6(f)(1).

"reflect a good faith effort at full disclosure[.]"[23] Additionally, the agency must assess "reasonably foreseeable" significant environmental impacts.[24] In determining whether an impact is a "significant environmental impact" and must be assessed in the EIA, adverse economic or social effects "may be used as a factor in determining whether…[the impact] is significant."[25]

Here, CARB did not make a good faith effort to disclose and assess all reasonably foreseeable significant emissions impacts resulting from the sustainability requirements in either the Original or Recirculated DEIA. As discussed in POET's comment letter on the Original and Revised Proposed Amendments, it is reasonably foreseeable that the Proposed Amendments could result in less ethanol being blended into fuel, as the requirements would place additional costs on the ethanol supply chain. Lower levels of ethanol blending would result in increased PM and other pollutant emissions, in contravention of California's goals to reduce levels of these very pollutants. Additionally, reduced ethanol blend levels in California would have significant adverse economic effects. Economic analysis has shown that blending ethanol with gasoline results in lower gas prices.[26] Lower ethanol blending in California would thus increase gas prices as ethanol volumes would be replaced with higher-cost fossil fuels. Additionally, the price of ethanol that remains in the California market likely will increase as the cost of complying with sustainability requirements is passed onto consumers. The economic impacts of complying with the sustainability requirements and increased gas prices resulting from reduced ethanol blend levels in California are significant environmental impacts CARB must address in its EIA. Yet, the DEIA fails to acknowledge or evaluate any potential downsides to CARB's imposition of new requirements on biofuels.

Further, CARB's system of penalizing biofuels that do not meet the sustainability requirements eliminates incentives for non-compliant facilities to reduce GHG emissions. If a biofuel facility fails to meet the sustainability requirements, all fuel shipped from the facility will receive a default CI score equal to gasoline or diesel. As a result, a facility that does not meet sustainability requirements will have no incentive to reduce GHG emissions, as reductions will no longer receive a CI premium. This means that some biofuel facilities may abandon measures that currently reduce GHG emissions (in addition to foregoing plans for future emissions reductions), increasing levels of those pollutants. CARB's refusal to weigh these reasonably foreseeable impacts of its new requirements violates CEQA.

1. *CARB's DEIA Does Not Assess PM Emissions Impacts Associated with Lower Ethanol Blend Levels Resulting from the Sustainability Requirements.*

In response to public comment, CARB "reassessed and expanded" the air quality and GHG evaluations for the Modified Proposed Rule.[27] The Recirculated DEIA acknowledges that the substitution of low CI fuels, including biofuels, for fossil fuels "may result in reductions in criteria

[23] *Kings Cnty. Farm Bureau v. City of Hanford* (1990) 221 Cal. App. 3d 692, 712, *reh'g denied & opinion modified, review denied* (1990).
[24] *County Sanitation Dist. No. 2 v. Cnty. of Kern* (2005) 127 Cal. App. 4th 1544, 1581-84.
[25] Cal. Code Regs. tit. 14 § 15064(e).
[26] Zilberman, David et al., *Impact of Ethanol on Gasoline Prices in the U.S.: New Evidence*, at 3 (2023), https://d35t1syewk4d42.cloudfront.net/file/2425/Impact%20of%20ethanol%20on%20gasoline%20prices%202023.pdf.
[27] Recirculated DEIA at 1.

pollutants and air toxics. Lifecycle analyses of these alternative fuels (from production through their use as transportation fuel) shows that they have a lower carbon intensity and thus emit fewer GHGs on a lifecycle basis than fossil fuels[.]"[28] Despite this general recognition, the Recirculated DEIA does not acknowledge the $PM_{2.5}$ and other emissions reduction benefits of ethanol and the potential loss of those benefits due to the proposed amendments.

CARB states that the Modified Proposed Rule will achieve $PM_{2.5}$ and NOx reductions through 2046 in part due to "increased use of renewable diesel and alternative jet fuel[.]"[29] The Recirculated DEIA and Original DEIA mention that fossil fuels "contain benzene, toluene, ethyl benzene, and xylenes (BTEX compounds), which can be emitted into the air and contaminate soil and water. Gasoline engine exhaust contains benzene, 1,3-butadiene, formaldehyde, and acetaldehyde."[30] However, neither the Original nor Recirculated DEIA acknowledges that ethanol blending reduces these emissions. A recent study by Environmental Health & Engineering shows that increasing ethanol blends lowers BTEX, 1-3 butadiene, black carbon, and $PM_{2.5}$.[31] For each 10% increase in ethanol content, primary PM emissions decrease by 15-18% on average.[32] In part, these emissions decreases are because ethanol is used to replace aromatics that are responsible for emissions of these pollutants. Aromatic levels decrease by about 7% for each 10% volume increase in ethanol.[33] Analyses by professors at Tufts University show that the associated health benefits may be most significant in disadvantaged communities in areas of high traffic density and congestion.[34] If less ethanol is blended into gasoline to replace aromatics, more pollutive aromatics will replace the ethanol. Effects of this increased pollution may be felt most strongly in disadvantaged communities. CARB fails to account for these impacts.

CARB also fails to account for inconsistencies between its goal to reduce PM emissions and its plans to penalize and disincentivize ethanol. CEQA requires CARB to discuss "inconsistencies between the proposed project and applicable general plans, specific plans and regional plans," which includes the State Implementation Plan ("SIPs") and plans for the reduction of GHG emissions.[35] As discussed in POET's comments submitted in response to the December 2023 Proposed LCFS amendments, lower ethanol blending in California could result in higher emissions of PM and other pollutants. EPA recently tightened the PM NAAQS,[36] which will cause most of California to be in non-attainment for PM. In assessing environmental impacts under CEQA, CARB was required to but failed to address whether additional emissions resulting from

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[28] Recirculated DEIA at 44.
[29] Recirculated DEIA at 45.
[30] Recirculated DEIA at 44; *see* Original DEIA at 57.
[31] EH&E, *Potential Air Quality and Public Health Benefits of Real-World Ethanol Fuels*, at 2-4, attached as Appendix A (hereinafter "Appendix A").
[32] *Id*. at 2
[33] *Id*.
[34] *See* Tufts University Department of Civil and Environmental Engineering, *Air Quality and Public Health Comments to RFS* (Feb. 3, 2022), attached as Appendix B (hereinafter "Appendix B"); *see also* Appendix A at 8-9.
[35] Cal. Code Regs. tit. 14, § 15125(d).
[36] *See* Reconsideration of the National Ambient Air Quality Standards for Particulate Matter, 89 Fed. Reg. 16202 (Mar. 6, 2024) (to be codified at 40 C.F.R. pts. 50, 53, and 58).

potentially lower ethanol blending due to the sustainability requirements should be considered significant in light of the existing nature of air emissions problems in the area.[37]

2. *CARB's DEIA Does Not Assess GHG Emissions Impacts Associated with Lower Ethanol Blend Levels Resulting from the Sustainability Requirements.*

CARB's Original and Recirculated DEIA do not fully recognize the GHG benefits of ethanol or assess emissions impacts of reduced ethanol sold into California as a response to the proposed amendments. Studies show that blending ethanol into the transportation fuel supply results in significantly lower lifecycle GHG emissions compared to petroleum-based gasoline. Emissions reductions attributable to bioethanol range from 41 to 46% compared to emissions associated with petroleum-based gasoline. According to the Department of Energy's Argonne National Laboratory ("ANL"), typical corn ethanol provides a 44% GHG reduction compared to gasoline.[38] Similarly, researchers affiliated with Harvard University, MIT, and Tufts University conducted a meta-analysis showing that corn ethanol as of 2021 offers an average GHG reduction of 46% compared to gasoline.[39] The California LCFS recognizes ethanol's emissions reduction benefits compared to gasoline: CARB's website indicates that ethanol currently has an average CI value of around 60 g/MJ under the LCFS.[40] E85 (gasoline blended with 51-83% ethanol) also has significant emissions and cost benefits that CARB failed to consider in its environmental analysis. E85 can only be used in flex-fuel vehicles ("FFVs"). California is the largest market of FFVs, and sales of E85 have increased in California in recent years.[41] In 2023, E85 usage in California reduced emissions by nearly 370,000 metric tons of CO_2.[42] Increased costs associated with the sustainability requirements will result in reduced E85 usage. If ethanol volumes in California decrease and are replaced by conventional gasoline, California's GHG transportation emissions will increase. CARB's failure to address this potential impact of the sustainability requirements renders its DEIA insufficient under CEQA.

The Recirculated DEIA states that a possible compliance response to the Revised Proposed Amendments is "incremental improvements to ethanol production methods to reduce the CI of the fuel as the program benchmarks become more stringent. In addition, ethanol producers may choose to install CCS technology to further reduce their CI."[43] This brief discussion fails to analyze impacts of imposing sustainability certification requirements on ethanol's CI or the CI of gasoline-

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[37] *Kings Cnty. Farm Bureau* 221 Cal. App. 3d at 718 ("The relevant question to be addressed in the EIR is…whether any additional amount of precursor emissions [resulting from the project] should be considered significant in light of the serious nature of the ozone problems in this air basin.").

[38] *See* Lee, Uisung et al., *Retrospective Analysis of the U.S. Corn Ethanol Industry for 2005–2019: Implications for Greenhousegas Emission Reductions*, Biofpr Vol. 15 Issue 5, at 1328 (May 4, 2021) https://doi.org/10.1002/bbb.2225.

[39] Scully, Melissa et al., *Carbon Intensity of Corn Ethanol in the United States: State of the Science*, Environmental Research Letters, Vol. 16, No. 4 (Mar. 10, 2021), https://iopscience.iop.org/article/10.1088/1748-9326/abde08; *see also* Appendix A.

[40] California Air Resources Board, *LCFS [Low Carbon Fuel Standard] Data Dashboard* (last accessed Sept. 30, 2024), https://ww2.arb.ca.gov/resources/documents/lcfs-data-dashboard.

[41] Thomas G. Leone, *Future Scenarios for E85 in the U.S.*, Southwest Research Institute, at 18 (June 19, 2024), https://d35t1syewk4d42.cloudfront.net/file/2818/RFA_E85_Report_2024-06-19_03.28491_A.pdf.

[42] Renewable Fuels Association, *Record E85 Sales Save California Drivers $99 Million, Slash Carbon Emissions* (Mar. 13, 2024), https://ethanolrfa.org/media-and-news/category/news-releases/article/2024/03/record-e85-sales-save-california-drivers-99-million-slash-carbon-emissions.

[43] Recirculated DEIA at 23.

ethanol blends if the sustainability requirements lead to lower levels of ethanol blending. It also fails to recognize the ethanol industry's efforts to become a zero carbon and even carbon negative fuel. For example, the Recirculated DEIA acknowledges that over time, electricity production emissions will decrease as state clean energy and renewable electricity requirements approach.[44] However, the analysis does not recognize that ethanol is decarbonizing rapidly to meet the LCFS' emissions reduction requirements as well.

B. CARB Improperly Assesses Environmental Impacts Associated with Its Proposed Definition of Waste Feedstocks.

CARB's analyses of environmental impacts are based on the predicted compliance responses the agency identifies.[45] In the Recirculated DEIA, CARB projects that one compliance response to the proposed LCFS amendments is that more cellulosic fuels will be sold into California.[46] However, CARB's failure to exempt certain cellulosic feedstocks from the sustainability requirements are likely to undermine this projection.

CARB's proposal excludes biomass listed in Section 95488.8(g)(1)(A) ("specified source feedstocks") from the sustainability requirements.[47] Cellulosic feedstocks such as corn kernel fiber and corn stover are not included in this definition. As a result, these waste agriculture streams will have to go through the onerous process of sustainability certification, unlike the other waste products listed in Section 95488.8(g)(1)(A).

The sustainability requirements, then, may place a burden on cellulosic feedstocks (unlike other waste feedstock streams) that will discourage their use in California markets. Accordingly, CARB's projected emissions reductions based on increased cellulosic fuel production are overly optimistic. Further, higher CI renewable fuels or gasoline may fill the void created by fewer corn kernel fiber ethanol sales, resulting in increased emissions and fewer LCFS credits available on the market. CARB's environmental assessment fails to consider the impact of the narrow definition of waste feedstocks on cellulosic fuels like corn kernel fiber ethanol currently sold into California and overestimates growth in the cellulosic fuel market.

C. CARB Does Not Discuss the Impacts of Increased Electricity and EV Demand Due to the Proposed Amendments.

Under the proposed rule CARB expects that starting in 2030, electricity will outpace ethanol, renewable diesel, and RNG combined in LCFS credit generation.[48] Despite this, although CARB assessed the upstream impacts of these other fuels, it failed to conduct sufficient analysis of the potentially negative environmental impacts of significantly increased demand for electricity and

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[44] Recirculated DEIA at 32.
[45] Original DEIA at 2.
[46] Recirculated DEIA at 30.
[47] California Air Resources Board, *Attachment A-1.2, Proposed 15-Day Changes and 45-Day Changes Compared to the Current Regulation, Proposed Amendments to the Low Carbon Fuel Standard Regulation*, § 95488.9(g)(1) (Aug. 12, 2024), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2024/lcfs2024/15day_atta-1.2.docx.
[48] Recirculated DEIA at 21.

EVs. Specifically, the DEIA did not sufficiently analyze the impacts of increased electricity generation and transmission or of EV battery production.[49]

The analysis in the Original DEIA was inadequate in its assessment of these issues in part because the Revised Proposed Amendments contained material changes with respect to the program's demand for electricity. The Recirculated DEIA notes that the revised proposed CI reduction requirements differ from the originally proposed CI reductions.[50] Specifically, the proposed CI reduction targets for years 2025 through 2029 are steeper than in the originally proposed LCFS amendments.[51] In the Recirculated DEIA, CARB also notes that the revised proposed LCFS amendments expand the fast-charging Infrastructure provisions, and that the LCFS proposed amendments likely will result in increased construction and operation of renewable energy production facilities and electric charging infrastructure.[52] Under CEQA, CARB must analyze all significant direct, indirect, and cumulative environmental impacts of the proposed rule, and it is clear that this rule will have direct, indirect, and cumulative impacts by incentivizing electricity use in electric vehicles and the manufacturing of those vehicles.

Because of the increased CI stringency and projected increase in energy demand, renewable energy production facilities, and EVs, CARB should have assessed a range of potential impacts regarding issues concerning electricity generation and transmission and EV battery production. CARB's failure to analyze the likely effects of this rule results in an inadequate DEIA because there are not sufficient "facts from which to evaluate the pros and cons" of a project[53] and there is not sufficient information to allow for informed public participation[54] under CEQA.

1. CARB Failed to Consider Impacts Related to Electricity Generation and Transmission.

The incentives for increased transportation electricity usage could exacerbate existing challenges with the state's already overburdened electrical grid, leading to significant environmental consequences. California's grid is frequently under strain, especially during summer months when energy demand peaks due to high temperatures and air conditioning usage.[55] Increasing incentives for using electricity for transportation could further push the grid beyond its capacity and increases the likelihood of blackouts and brownouts. Without substantial and significant grid improvements, and a massive roll-out of new renewable energy development projects[56] (which as discussed below have their own environmental impact) California could face increased reliance on fossil fuel-based power generation during peak demand, potentially undermining the state's environmental goals by

[49] Although the 2022 Scoping Plan and related EIA conceptualizes some of these issues as they relate to the specifics described in the Scoping Plan, the proposed rule imposes additional EV and electricity demand that must be considered, particularly with respect to the cumulative impacts that the LCFS proposal would contribute to. Neither the Original DEIA nor the Recirculated DEIA acknowledge or discuss these issues in any meaningful way, which makes them deficient.
[50] Recirculated DEIA at 9-10.
[51] *Id.*
[52] Recirculated DEIA at 32.
[53] *Santiago Cnty Water Dist.*, 118 Cal. App. 3d at 820.
[54] *Barthelemy*, 38 Cal. App. 4th at 1617.
[55] California Independent System Operator, *Summer Loads and Resources Assessment 2023*, at 1–2 (2023), https://www.caiso.com/Documents/2023-Summer-Loads-and-Resources-Assessment.pdf.
[56] There is a question as to whether the generation and transmission overhaul that would be necessary to update the grid to accommodate the effects of the proposed rule is even feasible—this is discussed further in section III below.

leading to higher GHG emissions. CARB failed to examine the potential environmental consequences of this scenario.

To avoid relying on inefficient fossil fuel power plants or building new fossil fuel power plants, California would need to undertake significant grid upgrades, expansions, and renewable energy development projects to manage the growing electricity demand. These types of developments, if they were actually feasible at all within CARB's timeline, would be both costly and environmentally disruptive. However, CARB did not include an assessment of these updates in the Original or Recirculated DEIA. CARB's Original DEIA states that the final EIA for the 2022 Scoping Plan Update is incorporated by reference into this EIA, but the Scoping Plan EIA does not sufficiently assess the feasibility and economic impact of grid expansions either.[57] CARB's Scoping Plan EIA states that electricity grid infrastructure expansion may be a compliance response to the Scoping Plan; however, the EIA does not assess in detail the feasibility of this expansion.[58] With regard to emissions impacts, for 100% of all cars sold in California to be EV's by 2035, assuming that about 1.6 million new cars are sold in the State each year,[59] and one EV requires about 4,320 kWh of energy each year,[60] this would mean that by 2035, California would need to add nearly 7 billion kWh of energy to the already-stretched electric grid. A one-acre solar array generates between 350,000 to 450,000 kWh per year, so to generate the new electricity for the EV's that CARB expects to put online, California would need to build 17,500 acres, or 762,300,000 square feet of solar before 2035.[61] So even if this is a feasible endeavor, CARB must consider the environmental impacts of such large expansion—for example, threatened species of desert tortoise have faced habitat loss, fragmentation, and displacement due to solar farms.[62] CARB must also assess the environmental aesthetic impacts of such a significant expansion.[63] Under CEQA, CARB may not ignore the environmental impacts of the large-scale renewable electricity transition it anticipates, and, as with other transportation fuel types must assess the full environmental impacts of its proposal to develop a well-informed regulatory outcome and provide the public with the information needed to evaluate CARB's choices.

Additionally, California's grid is uniquely vulnerable to wildfires, which are often caused by faults in power lines and equipment during periods of high heat and dry conditions. Although the initial DEIA suggests that the proposal will have "less than significant short-term construction related and long-term operational impact on wildfire" CARB does not acknowledge or specifically assess

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[57] Original EIA at 143.
[58] *Final 2022 Scoping Plan, Appendix B: Final Environmental Analysis*, at 110 (Dec. 2022), https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/2022-scoping-plan-documents.
[59] CNCDA, *California New Car Dealers Association Releases Year-End 2023 Auto Outlook Report* (Jan. 29, 2024), https://www.cncda.org/news/california-new-car-dealers-association-releases-year-end-2023-auto-outlook-report/.
[60] Shelli Zargary, GenCell, *How Much Electricity Does an Electric Car Use?* (Nov. 12, 2023), https://www.gencellenergy.com/resources/blog/ev-charging-power-car-electricity-usage/.
[61] Sungold, *How many homes would an acre of solar panels provide?* (Sep. 14, 2024), https://www.sungoldsolar.us/how-many-homes-would-an-acre-of-solar-panels-provide/.
[62] Jeniffer Solis, *Solar Power Project Threatens Prime Desert Tortoise Habitat, Conservationists Warn* (Mar. 21, 2024), https://nevadacurrent.com/2024/03/21/solar-power-project-threatens-prime-desert-tortoise-habitat-conservationists-warn/#:~:text=In%20the%20Pahrump%20Valley%2C%20federal,drought%2C%20according%20to%20wildlife%20managers.
[63] Argonne National Laboratory, *Visual Impacts of Utility-scale Solar Energy Facilities on Southwestern Desert Landscapes*, https://blmwyomingvisual.anl.gov/docs/solar_visual_impacts.pdf.

the risks related to an overburdened electric grid in the Original or Recirculated DEIA. In the past, the state's utility companies have had to resort to Public Safety Power Shutoffs ("PSPS"), which involve shutting down large portions of the grid to prevent wildfire outbreaks. If EV adoption continues to surge without adequate grid upgrades, more frequent PSPS events could leave many EV users without a reliable means of transportation during critical times. This not only poses a safety risk but could also result in increased air pollution if people turn to backup generators powered by fossil fuels during outages. Furthermore, as EV charging often occurs at night, when renewable energy sources like solar power are unavailable, the grid may rely more heavily on natural gas plants, further eroding the environmental benefits of EVs by increasing carbon emissions during peak charging hours.

2. *CARB Failed to Consider Impacts of EV Battery Production.*

The production of batteries for EVs, particularly lithium-ion batteries, has significant environmental consequences that CARB did not sufficiently address. EV batteries require a variety of metals, including lithium, cobalt, nickel, and graphite, the mining of which can have severe environmental and human rights impacts.[64] Lithium, for example, is extracted primarily from brine pools, the extraction of which involves pumping large quantities of water, which can deplete water resources in arid regions, threatening local ecosystems and communities.[65] Cobalt extraction frequently leads to soil degradation and water pollution.[66] Although CARB noted in the initial DEIA that "[s]ome of the recommended actions and associated compliance responses could require the extraction of minerals (*e.g.*, lithium or platinum) used to manufacture fuel cell and battery technologies[,]" the DEIA cursorily concluded that "implementation of these measures would not substantially deplete the supply of lithium or platinum and both are currently used in auto manufacturing processes."[67] In making this statement, CARB evinced a misunderstanding of CEQA's requirements relating to environmental analysis. CEQA requires CARB to analyze the direct, indirect, and cumulative impacts of a government action. By suggesting that the proposed rule itself would not substantially deplete the supply of lithium or platinum, CARB ignores the cumulative effects of how the proposal may be compounded with other developments given the nature of the existing frameworks.[68]

Producing EV batteries is also an energy-intensive process. The manufacturing of a typical lithium-ion battery can result in significant carbon emissions due to the shipping and supply process as well as the manufacturing process—both of which are typically powered by fossil fuels. Although CARB acknowledges that "manufacturing facilities may be necessary to produce lithium-ion batteries" it does not address the increased carbon emissions related to this expansion.

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[64] International Energy Agency, *The Role of Critical Minerals in Clean Energy Transitions*, at 9–12 (2021), https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions.
[65] World Resources Institute, *More Critical Minerals Mining Could Strain Water Supplies in Stressed Regions* (Jan. 20, 2024), https://www.wri.org/insights/critical-minerals-mining-water-impacts#:~:text=This%20evaporation%20method%20uses%20up,and%20mix%20with%20salt%20water.
[66] Muimba-Kankolongo A., Banza et al., J Environ Public Health, *Impacts of Trace Metals Pollution of Water, Food Crops, and Ambient Air on Population Health in Zambia and the DR Congo*, at 1-2 (July 5, 2022), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9277192/.
[67] Original DEIA at 160.
[68] *See, e.g.*, *AquAlliance*, 287 F. Supp. 3d at 1036 ("The relevant issue was not the relative amount of traffic noise resulting from the project when compared to existing traffic noise, but whether any additional amount of traffic noise should be considered significant given the nature of the existing traffic noise problem.") (citations omitted).

The materials used during manufacturing are also finite, which raises concerns about the long-term sustainability of mass EV adoption unless recycling infrastructure improves significantly.

Without these elements being raised and considered in sufficient detail in the DEIA, "meaningful assessment of the true scope of numerous potentially serious adverse environmental effects [is] thwarted."[69] Specifically, without providing information on the environmental, including cumulative, impacts of increased mineral extraction, it is not possible to understand the costs and benefits of this proposal, as required under CEQA.[70]

3. The DEIA is Inadequate Because It Fails to Discuss the Environmental Impacts of Increased Electricity and EV Demand.

Although POET understands that EVs are a significant component of California's strategy to reduce transportation emissions, the environmental impacts related to EV production and grid integration must be clearly defined in the DEIA. The purpose of any DEIA is to provide CARB and the public with a full picture of the environmental impacts of the proposed rule and the alternatives. By failing to assess these impacts, CARB does not achieve the goals of CEQA. If CARB looks at the full picture of environmental impacts, this will further highlight the need for diverse alternative fuel options, including increased ethanol use, to achieve the California's environmental goals.

III. CARB Did Not Assess a Reasonable Range of Alternatives.

In conducting an environmental assessment, CARB "must consider a range of alternatives sufficient to permit the agency to evaluate the project and make an informed decision, and to meaningfully inform the public."[71] CARB's analysis regarding a reasonable range of alternatives "shall include those that could feasibly accomplish most of the basic objectives of the project and could avoid or substantially lessen one or more of the significant effects."[72] An alternative is "feasible" if it is "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors."[73] Additional factors impacting feasibility include "economic viability, availability of infrastructure, general plan consistency, other plans or regulatory limitations, [and] jurisdictional boundaries[.]"[74]

Under CEQA, an EIA must consider alternatives that will "attain most of the basic objectives" of the project while avoiding or substantially reducing the environmental impacts of the project.[75] Assessments that omit these alternatives or that include an "inadequate discussion of alternatives"

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[69] *Bakersfield Citizens for Loc. Control v. City of Bakersfield* (2004) 124 Cal. App. 4th 1184, 1220-21.

[70] *Barthelemy*, 38 Cal. App. 4th at 1617.

[71] *Id.* at § 15126.6(f); *see also Federation of Hillside & Canyon Associations v. City of Los Angeles* (2000) 83 Cal. App. 4th 1252, 1264.

[72] Cal. Code Regs. tit. 14, § 15126.6(c).

[73] *Bay Area Citizens*, 248 Cal. App. 4th at 1018 (citing Pub. Res. Code, § 21061.1; Cal. Code Regs. tit. 14, § 15364).

[74] Cal. Code Regs. tit. 14, § 15126.6(f)(1).

[75] *Watsonville Pilots Ass'n v. City of Watsonville* (2010) 183 Cal. App. 4th 1059, 1087 (citing CEQA Guidelines, Cal. Code Regs. tit. 14, § 15126.6(b) and finding that EIR for general plan contemplating residential development adjacent to public use airport was required to discuss a reduced development alternative, where a reduced development alternative could have fully satisfied ten of the city's twelve objectives and partially satisfied the two remaining objectives).

constitute an abuse of agency discretion.[76] At every step of the way, CARB's alternatives analysis fails to meet these standards.

First, CARB fails to address the feasibility of its proposed approach, which involves emphasizing electrification while phasing out biofuels use. Likely because of this failure, CARB does not propose or analyze feasible CI reduction alternatives that would be more favorable to ethanol. For example, CARB does not evaluate whether it should use its own regulatory authority to approve E15, nor does it meaningfully evaluate elimination of the sustainability requirements, even though CARB admits that its current regulations already account for LUC.

In both the DEIAs and Scoping Plan EIA, CARB glosses over the significant grid infrastructure improvements and energy generation expansion that will be necessary to support the compliance responses from this rule (*i.e.*, additional demand of at least 7 billion kWh) and does not grapple with whether this massive overhaul of the electric grid and energy generation is feasible in the first place. As noted above, CARB provides no analysis of electric generation and transmission in the "additional infrastructure needs" section of the Recirculated DEIA,[77] and the Original DEIA bizarrely states that the LCFS will result in a *reduction* in energy demand.[78] Accordingly, CARB provides no detailed explanation on how the proposed rule, and the accompanying foreseeable compliance responses requiring increased electricity generation and transmission capabilities is "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors."[79] As discussed below, there are a range of alternatives that CARB did not consider that involve low carbon transportation options that would not require such a large-scale grid overhaul and would increase the feasibility of the proposal. These include providing CI credit for farming emissions reductions required under the sustainability requirements, eliminating the sustainability certification requirements, and considering higher ethanol blend levels.

A. CARB Failed to Analyze Any Alternatives to the Proposed Sustainability Certification Requirements.

In CARB's Original DEIA, CARB mentions the sustainability certification requirements in only one alternative, Alternative 4, where sustainability criteria would not be required. However, CARB does not discuss or evaluate any potential negative impacts resulting from imposing the sustainability requirements, including the potential lost PM, GHG, and other environmental benefits of ethanol. Indeed, CARB did not address or evaluate in any detail what environmental impacts would result from a "no action" scenario in which CARB did not adopt the sustainability criteria. Eliminating the sustainability requirements should be evaluated fully as an alternative. As a result, CARB's evaluation of a program without the sustainability requirements is inadequate.

This is especially the case since CARB states in the Recirculated DEIA that LUC concerns (the primary reason for adopting the sustainability requirements) are already addressed in the current LCFS regulations. CARB admits that its current approach to addressing LUC is adequate, stating that the likelihood of LUC impacts resulting from biofuel demand "is at least partially (and

[76] *Kings Cnty. Farm Bureau*, 221 Cal. App. 3d at 699.
[77] Recirculated DEIA at 36.
[78] Original DEIA at 78.
[79] *Supra* fn. 73.

potentially fully) accounted for by LUC scores added to crop-derived pathways."[80] Furthermore, direct LUC is not a concern in light of the Environmental Protection Agency's ("EPA") analysis of direct LUC under the Renewable Fuel Standard. EPA uses an approach called "aggregate compliance" under which it monitors agricultural land annually to determine total agricultural land increases above a 2007 baseline.[81] If the 2007 baseline is not exceeded, EPA determines that new land outside of the baseline is not being devoted to crop production and direct LUC has not occurred.[82] In the most recent 2023 RFS rulemaking, EPA determined that the baseline was not exceeded and that no net direct LUC has occurred.[83] Because EPA already assesses direct LUC annually, LUC should not be a concern under the California LCFS. CARB must consider why moving forward with the sustainability requirements is wise given their superfluous nature.

B. CARB Failed to Include Readily Available Alternatives Within the Scope of Its Assessment.

While CEQA does not require the consideration of specific alternatives within the scope of an environmental assessment, the failure to consider readily available, feasible alternatives that advance program goals while reducing costs is indication that the agency preparing the assessment has foreordained the outcome and that the assessment is therefore inadequate. In this case, CARB's failure to include at least two regulatory mechanisms (low-CI farming and E15 approval) in its assessment indicates that the environmental assessment performed by CARB is inadequate.

As discussed at length in POET's prior comments, CARB could award CI credit for carbon beneficial farming practices, either in conjunction with or in lieu of the sustainability requirements. The implementation of sustainable farming practices would reduce ethanol's CI by 56%,[84] and ethanol has historically been the largest or one of the largest sources of CI credits under the program. But CARB's DEIA does not assess the decarbonization potential of sustainable farming practices or discuss the possibility of crediting such practices as an alternative to the proposed sustainability requirements.

CARB fails to evaluate the approval of E15 within the scope of regulatory alternatives. The Recirculated DEIA does not assess ethanol blends beyond E10, assuming ethanol will "continue[] to be blended into gasoline at up to 10% by volume."[85] However, CARB is currently conducting a multimedia review of E15 for potential adoption and certification in California. The approval of E15 is entirely within CARB's control and could be accomplished in conjunction with the LCFS rulemaking. As discussed in POET's prior comments, E15 has significant air pollutant and GHG emissions reductions. A 2022 University of California Riverside study, *funded in part by CARB*, assessing the impact of E15 on air pollutant emissions for model year vehicles 2016 to 2021 was consistent with these results, finding that replacing E10 with E15 reduced PM emissions by 18%,

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[80] Recirculated DEIA at 35.
[81] Regulation of Fuels and Fuel Additives: Changes to Renewable Fuel Standard Program, 75 Fed. Reg. 14700, 14701 (Mar. 26, 2010) (to be codified at 40 C.F.R. pt. 80).
[82] Renewable Fuel Standard (RFS) Program: Standards for 2023-2025 and Other Changes, 88 Fed. Reg. 44468, 44522 (July 12, 2023) (to be codified at 40 C.F.R. pts. 80, 1090).
[83] *Id*.
[84] Moniz, Ernest et al., *A Strategic Roadmap for Decarbonizing the U.S. Ethanol Industry - EFI Foundation,* at 36 (Sept. 19, 2024), https://efifoundation.org/foundation-reports/a-strategic-roadmap-for-decarbonizing-ethanol-in-the-united-states/.
[85] Recirculated DEIA at 23.

with cold-start emissions being reduced by 17%.[86] CARB recently published a Multimedia Evaluation of E11- E15 Tier 1 Report with conclusions consistent with these studies.[87] Despite CARB's own involvement in the E15 regulatory process, the Recirculated DEIA does not even mention E15. CARB's failure to consider E15 as a program alternative, a regulatory measure that would reduce costs for consumers while increasing volumes of a critical source of CI credits, again demonstrates that CARB's analysis of alternatives was insufficient in scope.

IV. Conclusion

POET appreciates the opportunity to comment and looks forward to working with CARB to make the LCFS a continued success for California. If you have any questions, please contact me at Josh.Wilson@POET.com or (202) 940-6487.

Sincerely,

Joshua Wilson

[86] Karavalakis, Georgios et al., *Final Report: Comparison of Exhaust Emissions Between E10 CaRFG and Splash Blended E15* at 22-23, 36 (June 2022), https://ww2.arb.ca.gov/resources/documents/comparison-exhaust-emissions-between-e10-carfg-and-splash-blended-e15; *see* Appendix B at 5.

[87] *See* Renewable Fuels Association and Growth Energy, *California Multimedia Evaluation of E11-E15 Gasoline-Ethanol Blends Tier 1 Report* (June 4, 2020), https://ww2.arb.ca.gov/sites/default/files/2022-07/E15_Tier_I_Report_June_2020.pdf.

APPENDIX A

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Potential Air Quality and Public Health Benefits of Real-World Ethanol Fuels

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Introduction

For over twenty years, ethanol has been used as a fuel additive in gasoline to boost octane without the harmful impacts on the environment posed by previous fuel additives such as MTBE and lead. While ethanol's benefits to groundwater and lead contamination are well established, uncertainty remains regarding the impacts of ethanol on air quality and public health based on existing literature. This uncertainty largely results from the previous lack of studies that have been conducted using fuels that reflect the actual or real-world composition of gasoline with differing ethanol content.

This document addresses this uncertainty by providing new scientific evidence of the air quality and public health benefits provided by higher ethanol blends. We specifically present findings from our two recent studies, which characterized ethanol blending effects on light duty vehicle regulated emissions of criteria air pollutants[1] and air toxics. Findings from these studies demonstrate ethanol-associated reductions in emissions of key air pollutants and by extension, provide further evidence of the potential for ethanol-blended fuels to improve air quality and public health, particularly for environmental justice communities.

Impact of Ethanol-Containing Fuels on Air Pollutant Emissions

Kazemiparkouhi et al. (2022a) and Kazemiparkouhi et al. (2022b) are the first large-scale analyses of data from light-duty vehicle emissions studies to examine real-world impacts of ethanol-blended fuels on air pollutant emissions, including PM, NOx, CO, and THC (Kazemiparkouhi et al., 2022a), as well as BTEX (benzene, toluene, ethylbenzene, xylene) and 1,3-butadiene (Kazemiparkouhi et al., 2022b). In each study, we used similar approaches. We extracted data from a comprehensive set of emissions and market fuel studies conducted in the US. Using these data, we (1) estimated composition of market fuels for different ethanol volumes and (2) developed regression models to estimate the impact of changes in ethanol volumes in market fuels on air pollutant emissions for different engine types and operating conditions. Importantly, our models estimated these changes accounting for not only ethanol

[1] https://doi.org/10.1016/j.scitotenv.2021.151426

volume fraction, but also aromatic volume fraction, 90% volume distillation temperature (T90) and Reid Vapor Pressure (RVP). Further, our models examined the impacts of ethanol fuels on emissions under both cold start and hot stabilized running conditions and for gasoline-direct injection engines (GDI) and port-fuel injection (PFI) engine types. In doing so, our two papers provided important new information about real-world market fuels and their corresponding air pollutant emissions, as highlighted below.

- ***Aromatic levels in market fuels decreased by ~7% by volume for each 10% by volume increase in ethanol content*** (Table 1)**.** Our findings of lower aromatic content with increasing ethanol content are consistent with market fuel studies by EPA and others, and with octane blending studies (Anderson et al., 2010, Anderson et al., 2012, Stratiev et al., 2017, US EPA, 2017). As discussed in EPA's Fuel Trends Report, for example, ethanol volume in market fuels increased by approximately 6.66% between 2006 and 2016, while aromatics over the same time period were found to drop by 5.4% (US EPA, 2017).

  We note that our estimated market fuel properties differ from those used in the recent US EPA Anti-Backsliding Study (ABS), which examined the impacts of changes in vehicle and engine emissions from ethanol-blended fuels on air quality (US EPA, 2020). Contrary to our study, ABS was based on fuels with targeted properties that were intended to satisfy experimental considerations rather than mimic real-world fuels. It did not consider published fuel trends; rather, the ABS used inaccurate fuel property adjustment factors in its modeling, reducing aromatics by only 2% (Table 5.3 of ABS 2020), substantially lower than the reductions found in our paper and in fuel survey data (Kazemiparkouhi et al., 2022a, US EPA, 2017). As a result, ABS's findings and their extension to public health impacts are not generalizable to real world conditions.

Table 1. Estimated market fuel properties

Fuel ID	EtOH Vol (%)	T50 (^{o}F)	T90 (^{o}F)	Aromatics Vol (%)	AKI	RVP (psi)
E0	0	219	325	30	87	8.6
E10	10	192	320	22	87	8.6
E15	15	162	316	19	87	8.6
E20	20	165	314	15	87	8.6
E30	30	167	310	8	87	8.6

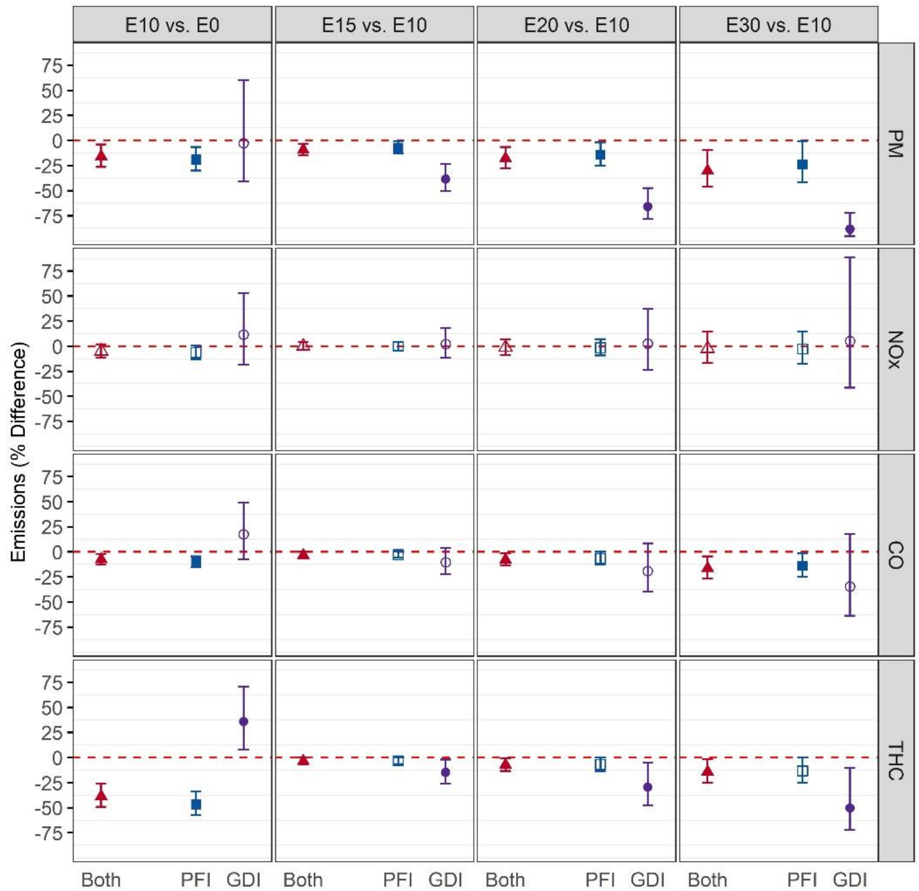
Abbreviations: EtOH = ethanol volume; T50 = 50% volume distillation temperature; T90 = 90% volume distillation temperature; Aromatics=aromatic volume; AKI = Anti-knock Index; RVP = Reid Vapor Pressure.

- ***PM emissions decreased with increasing ethanol content under cold-start conditions.*** Primary PM emissions decreased by 15-18% on average for each 10% increase in ethanol content under cold-start conditions (Figure 1). While statistically significant for both engine types, PM emission reductions were larger for GDI as compared to PFI engines, with 88% and 24% lower PM emissions, respectively, when engines burned E30 as compared to E10. In contrast, ethanol content in market fuels had no association with PM emissions during hot-running conditions.

Importantly, our findings are consistent with recent studies that examined the effect of ethanol blending on light duty vehicle PM emissions. Karavalakis et al. (2014), (2015), Yang et al. (2019a), (2019b), Schuchmann and Crawford (2019), for example, assessed the influence of different mid-level ethanol blends – with proper adjustment for aromatics – on the PM emissions from GDI engines and Jimenez and Buckingham (2014) from PFI engines. As in our study, which also adjusted for aromatics, each of these recent studies found higher ethanol blends to emit lower PM as compared to lower or zero ethanol fuels. Our findings of PM reductions are also consistent with recently published studies, for example from a California Air Resources Board (CARB) study (Karavalakis et al., 2022, Tang et al., 2022) that assessed the impact of splash-blending E10 to E15 on PM and other air pollutant emissions for late model year vehicles (2016-2021). The CARB study found a 16.6% reduction in cold start PM in comparison to a 23% PM reduction for E15S versus E10 in our study.

Together, our findings support the ability of ethanol-blended fuels to offer important PM emission reduction opportunities. Cold start PM emissions have consistently been shown to account for a substantial portion of all direct tailpipe PM emissions from motor vehicles, with data from the EPAct study estimating this portion to equal 42% (Darlington et al., 2016, US EPA, 2013). The cold start contribution to total PM vehicle emissions, together with our findings of emission reductions during cold starts, suggest that a ***10% increase in ethanol fuel content from E10 to E20 would reduce total tailpipe PM emissions from motor vehicles by 6-8%.***

Figure 1. Change (%) in cold-start emissions for comparisons of different ethanol-content market fuels[a]

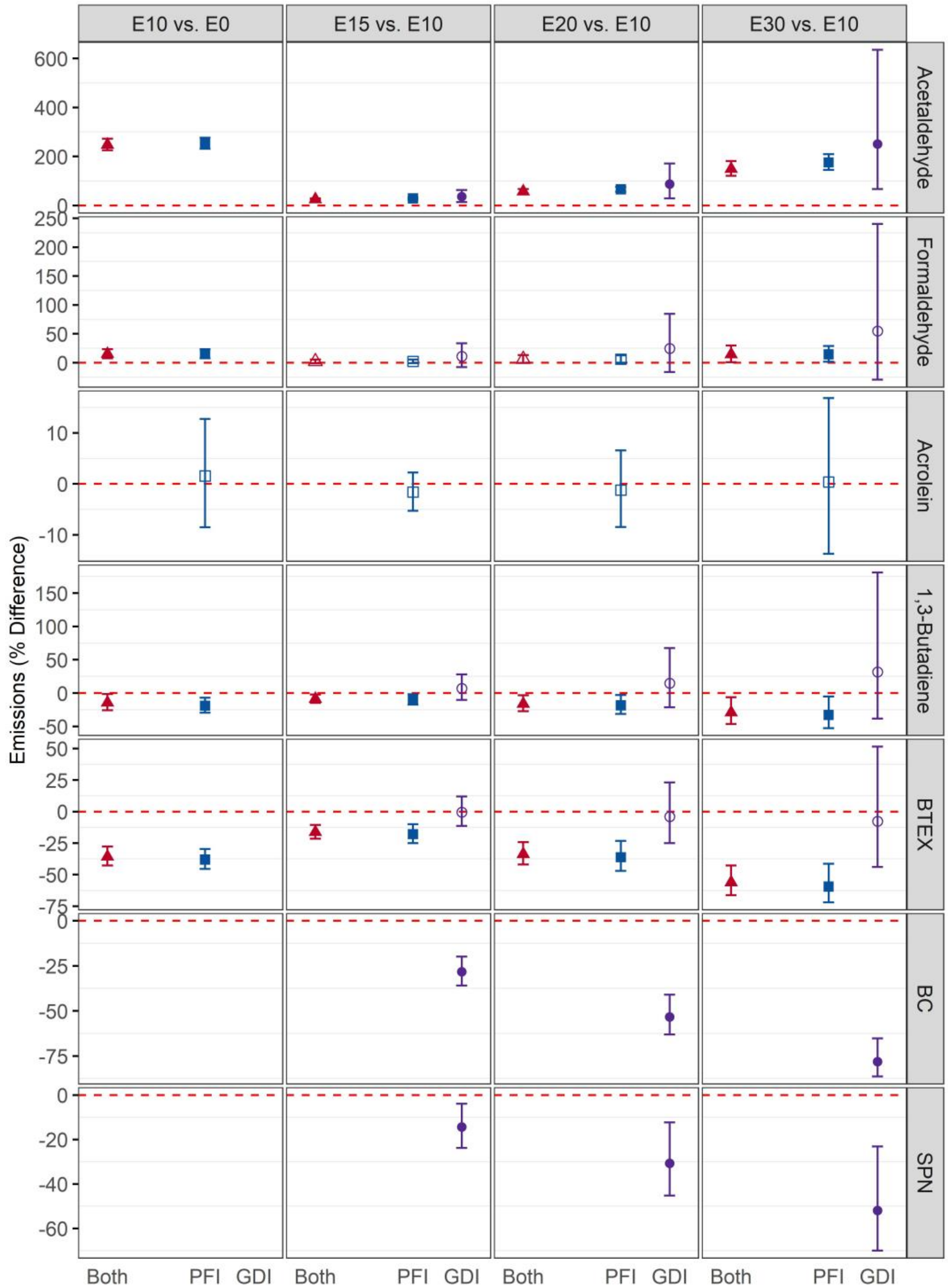


[a] Emissions were predicted from regression models that included ethanol and aromatics volume fraction, T90, and RVP as independent variables (Kazemiparkouhi et al., 2022a)

- ***Emissions of CO and THC generally decreased with increasing ethanol fuel content under cold running conditions, while NOx emissions did not change*** **(**Figure 1). The magnitude of the decrease in CO and THC emissions were comparable to those from the CARB-sponsored Karavalakis et al. (2022) study, which also found significant reductions in cold start THC and CO emissions for splash blended E15, with reductions of 6.1% and 12.1%, respectively. Under hot running conditions, CO, THC and NOx emissions were comparable for each of the examined ethanol fuels. Together, these findings add to the scientific evidence demonstrating emission reduction benefits of ethanol fuels for PM that are achieved with no concomitant increase in emissions for CO, THC, and NOx.

- ***Air toxic emissions showed lower BTEX, 1-3 butadiene, black carbon, and particle number emissions with increasing ethanol content*** in summer market fuels (Figure 2). Acrolein emissions did not vary with ethanol fuel content, while formaldehyde emissions showed little to no significant change with increasing ethanol fuel content. As expected, emissions of acetaldehyde, produced directly from ethanol combustion, increases with ethanol content. Notably, our findings are similar to those from the CARB study of splash-blended fuels (Karavalakis et al., 2022), for which ethylbenzene and xylene were significantly reduced by ~10% for splash-blended E15 (No significant change for Benzene and Toluene).

Figure 2. Change (%) in cumulative run toxics emissions for comparisons of different ethanol-content market fuels[a]



[a] Emissions were predicted from regression models that included ethanol and aromatics volume fraction, T90, and RVP as independent variables (Kazemiparkouhi et al., 2022a)
SPN = Solid Particle Number

Implications for Public Health and Environmental Justice Communities

The estimated reductions in air pollutant emissions, particularly of PM, indicate that increasing ethanol content offers opportunities to improve air quality and public health. As has been shown in numerous studies, lower PM emissions result in lower ambient PM concentrations and exposures (Kheirbek et al., 2016, Pan et al., 2019), which, in turn, are causally associated with lower risks of total mortality and cardiovascular effects (Laden et al., 2006, Pun et al., 2017, US EPA, 2019, Wang et al., 2020).

The above benefits to air quality and public health associated with higher ethanol fuels may be particularly great for environmental justice (EJ) communities. EJ communities are predominantly located in urban neighborhoods with high traffic density and congestion and are thus exposed to disproportionately higher concentrations of PM emitted from motor vehicle tailpipes (Bell and Ebisu, 2012, Clark et al., 2014, Tian et al., 2013). Further, vehicle trips within urban EJ communities tend to be short in duration and distance, with approximately 50% of all trips in dense urban communities under three miles long (de Nazelle et al., 2010, Reiter and Kockelman, 2016, US DOT, 2010). As a result, a large proportion of urban vehicle operation occurs under cold start conditions (de Nazelle et al., 2010), when PM emissions are highest. Given the evidence that ethanol-blended fuels during cold-start conditions substantially reduce PM, CO, and THC emissions while keeping NOx emissions constant, it follows that ethanol-blended fuels may represent an effective method to reduce PM health risks for EJ communities.

Summary

Findings from Kazemiparkouhi et al. (2022a, 2022b) provide important, new evidence of ethanol-related reductions in vehicular emissions of PM, CO, and THC based on real-world fuels and cold-start conditions. Recent experimental data from CARB studies reinforce this evidence. Given the substantial magnitude of the emission reductions and their potential to improve air quality and through this public health, our findings demonstrate the potential for policies that encourage higher concentrations of ethanol in gasoline to improve public health. These improvements are especially needed to protect the health of EJ communities, who experience higher exposures to motor vehicle pollution and are at greatest risk from their effects.

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APPENDIX B

Department of Civil and Environmental Engineering

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We are writing to comment on issues raised by the proposed RFS annual rule, the Draft Regulatory Impact Analysis (December 2021; EPA-420-D-21-002), and the supporting Health Effects Docket Memo (September 21, 2021; EPA-HQ-OAR-2021-0324-0124), specifically regarding the impact of ethanol-blended fuels on air quality and public health. We provide evidence of the air quality and public health benefits provided by higher ethanol blends, as shown in our recently published study[1] by Kazemiparkouhi et al. (2021), which characterized emissions from light duty vehicles for market-based fuels. Findings from our study demonstrate ethanol-associated reductions in emissions of primary particulate matter (PM), nitrogen oxides (NOx), carbon monoxide (CO), and to a lesser extent total hydrocarbons (THC). Our results provide further evidence of the potential for ethanol-blended fuels to improve air quality and public health, particularly for environmental justice communities. Below we present RFS-pertinent findings from Kazemiparkouhi et al. (2021), followed by their implications for air quality, health, and environmental justice.

Summary of Kazemiparkouhi et al. (2021)

Our paper is the first large-scale analysis of data from light-duty vehicle emissions studies to examine real-world impacts of ethanol-blended fuels on regulated air pollutant emissions, including PM, NOx, CO, and THC. To do so, we extracted data from a comprehensive set of emissions and market fuel studies conducted in the US. Using these data, we (1) estimated composition of market fuels for different ethanol volumes and (2) developed regression models to estimate the impact of changes in ethanol volumes in market fuels on air pollutant emissions for different engine types and operating conditions. Importantly, our models estimated these changes accounting for not only ethanol volume fraction, but also aromatics volume fraction, 90% volume distillation temperature (T90) and Reid Vapor Pressure (RVP). Further, they did so

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under both cold start and hot stabilized running conditions and for gasoline-direct injection engines (GDI) and port-fuel injection (PFI) engine types. Key highlights from our paper include:

- ***Aromatic levels in market fuels decreased by approximately 7% by volume for each 10% by volume increase in ethanol content*** (Table 1)**.** Our findings of lower aromatic content with increasing ethanol content is consistent with market fuel studies by EPA and others (Eastern Research Group, 2017, Eastern Research Group, 2020, US EPA, 2017). As discussed in EPA's Fuel Trends Report, for example, ethanol volume in market fuels increased by approximately 9.4% between 2006 and 2016, while aromatics over the same time period were found to drop by 5.7% (US EPA, 2017).

  We note that our estimated market fuel properties differ from those used in the recent US EPA Anti-Backsliding Study (ABS), which examined the impacts of changes in vehicle and engine emissions from ethanol-blended fuels on air quality (US EPA, 2020). Contrary to our study, ABS was based on hypothetical fuels that were intended to satisfy experimental considerations rather than mimic real-world fuels. It did not consider published fuel trends; rather, the ABS used inaccurate fuel property adjustment factors in its modeling, reducing aromatics by only 2% (Table 5.3 of ABS 2020), substantially lower than the reductions found in our paper and in fuel survey data (Kazemiparkouhi et al., 2021, US EPA, 2017). As a result, the ABS's findings and their extension to public health impacts are not generalizable to real world conditions.

Table 1. Estimated market fuel properties

Fuel ID	EtOH Vol (%)	T50 (^oF)	T90 (^oF)	Aromatics Vol (%)	AKI	RVP (psi)
E0	0	219	325	30	87	8.6
E10	10	192	320	22	87	8.6
E15	15	162	316	19	87	8.6
E20	20	165	314	15	87	8.6
E30	30	167	310	8	87	8.6

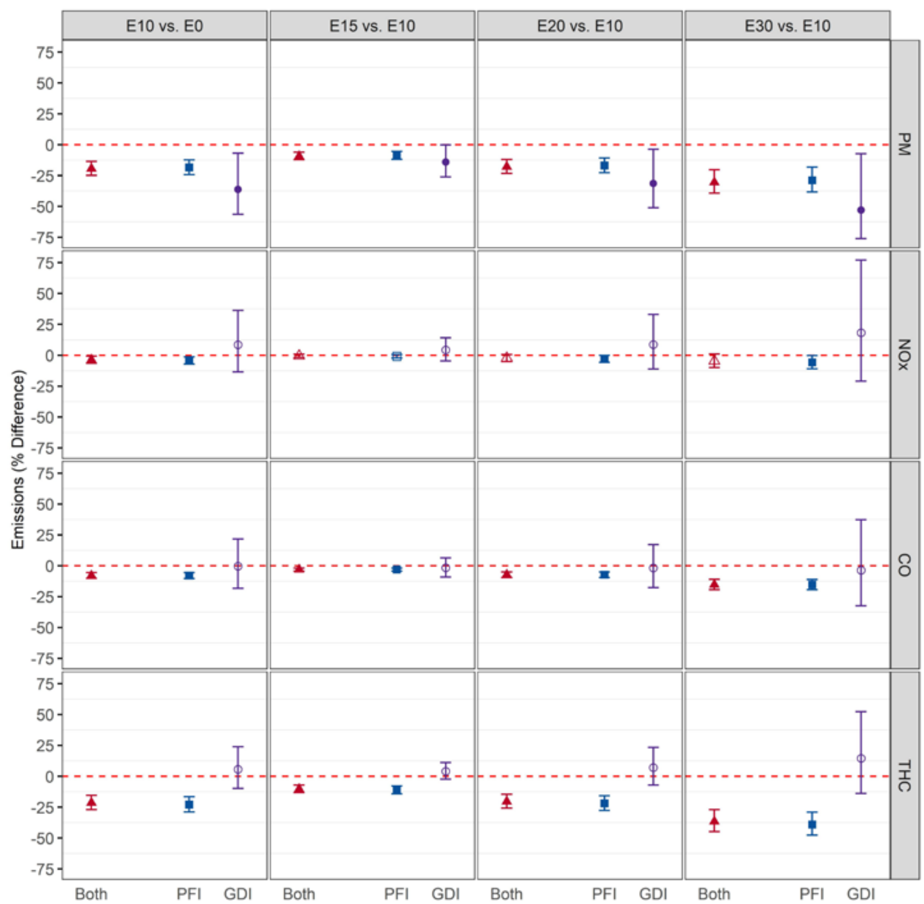
Abbreviations: EtOH = ethanol volume; T50 = 50% volume distillation temperature; T90 = 90% volume distillation temperature; Aromatics=aromatic volume; AKI = Anti-knock Index; RVP = Reid Vapor Pressure.

- ***PM emissions decreased with increasing ethanol content under cold-start conditions.*** Primary PM emissions decreased by 15-19% on average for each 10% increase in ethanol content under cold-start conditions (Figure 1). While statistically significant for both engine types, PM emission reductions were larger for GDI as compared to PFI engines, with 53% and 29% lower PM emissions, respectively, when these engines burned E30 as compared to E10. In contrast, ethanol content in market fuels had no association with PM emissions during hot-running conditions.

  Importantly, our findings are consistent with recent studies that examined the effect of ethanol blending on light duty vehicle PM emissions. Karavalakis et al. (2014), (2015), Yang et al. (2019a), (2019b), Schuchmann and Crawford (2019), for example, assessed the influence of different mid-level ethanol blends – with proper adjustment for aromatics – on the PM emissions from GDI engines and Jimenez and Buckingham (2014) from PFI engines. As in our study, which also adjusted for aromatics, each of these recent studies found higher ethanol blends to emit lower PM as compared to lower or zero ethanol fuels.

Together with these previous studies, our findings support the ability of ethanol-blended fuels to offer important PM emission reduction opportunities. **Cold start PM emissions have consistently been shown to account for a substantial portion of all direct tailpipe PM emissions from motor vehicles**, with data from the EPAct study estimating this portion to equal 42% (Darlington et al., 2016, US EPA, 2013). The cold start contribution to total PM vehicle emissions, together with our findings of emission reductions during cold starts, suggest that a **10% increase in ethanol fuel content from E10 to E20 would reduce total tailpipe PM emissions from motor vehicles by 6-8%.**

Figure 1. Change (%) in cold-start emissions for comparisons of different ethanol-content market fuels[a]



[a] Emissions were predicted from regression models that included ethanol and aromatics volume fraction, T90, and RVP as independent variables

- **NOx, CO and THC emissions were significantly lower for higher ethanol fuels for PFI engines under cold-start conditions**, but showed no association for GDI engines (Figure 1). CO and THC emissions also decreased under hot running conditions for PFI and for CO also for GDI engines (results not shown). [Note that NOx emissions for both PFI and GDI engines were statistically similar for comparisons of all ethanol fuels, as were THC emissions for GDI engines.] These findings add to the scientific evidence demonstrating emission reduction benefits of ethanol fuels for PM and other key motor vehicle-related gaseous pollutants.

Implications for Public Health and Environmental Justice Communities

The estimated reductions in air pollutant emissions, particularly of PM and NOx, indicate that increasing ethanol content offers opportunities to improve air quality and public health. As has been shown in numerous studies, lower PM emissions result in lower ambient PM concentrations and exposures (Kheirbek et al., 2016, Pan et al., 2019), which, in turn, are causally associated with lower risks of total mortality and cardiovascular effects (Laden et al., 2006, Pun et al., 2017, US EPA, 2019, Wang et al., 2020).

The above benefits to air quality and public health associated with higher ethanol fuels may be particularly great for environmental justice (EJ) communities. EJ communities are predominantly located in urban neighborhoods with high traffic density and congestion and are thus exposed to disproportionately higher concentrations of PM emitted from motor vehicle tailpipes (Bell and Ebisu, 2012, Clark et al., 2014, Tian et al., 2013). Further, vehicle trips within urban EJ communities tend to be short in duration and distance, with approximately 50% of all trips in dense urban communities under three miles long (de Nazelle et al., 2010, Reiter and Kockelman, 2016, US DOT, 2010). As a result, a large proportion of urban vehicle trips occur under cold start conditions (de Nazelle et al., 2010), when PM emissions are highest. Given the evidence that ethanol-blended fuels substantially reduce PM, NOx, CO, and THC emissions during cold-start conditions, it follows that ethanol-blended fuels may represent an effective method to reduce PM health risks for EJ communities.

Summary

Findings from Kazemiparkouhi et al. (2021) provide important, new evidence of ethanol-related reductions in vehicular emissions of PM, NOx, CO, and THC based on real-world fuels and cold-start conditions. Given the substantial magnitude of these reductions and their potential to improve air quality and through this public health, our findings warrant careful consideration. Policies that encourage higher concentrations of ethanol in gasoline would provide this additional benefit. These policies are especially needed to protect the health of EJ communities, who experience higher exposures to motor vehicle pollution, likely including emissions from cold starts in particular, and are at greatest risk from their effects.

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