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This chapter addresses environmental impacts of the LCFS, one of the topics of review required by the LCFS regulation. There are several sections that are still under review by ARB staff with assistance from interested Panelists. After this draft is completed, the Panel will have another opportunity to comment. This review will happen when this section is consolidated into a draft report that is expected to be released to the Panel in October.

When drafting this chapter, staff used the workplan as guidance; however, since there are similar and overlapping topics among the areas of review called out in the regulation, this chapter represents a grouping of such similar topics. This chapter specifically attempts to answer the questions related to environmental impacts since the last staff report in 2009.

VIII. Environmental Impacts

This chapter begins with a summary of the analysis that staff performed in 2009, which included an evaluation of the potential environmental impacts of the LCFS. We also discuss whether there is significant change from the data used in the original analysis; if the fuel pool in California has fundamentally changed; and if the existing permitting process is sufficient to prevent any adverse impacts on local, state, and federal levels. Additionally, we cover potential mitigation measures that can be used to minimize local impacts. We discuss the protocol that staff has developed for identifying proposed projects potentially related to the LCFS and the biorefinery siting guidance document, which was developed as a guide for local air districts. Lastly, we discuss how sustainability will be addressed, and whether we are collecting the necessary data to continue to monitor potential environmental impacts of the LCFS as the program moves forward.

This chapter addresses topics 9, 10 and 12 from the regulation that require consideration of the following areas:

- (9) An analysis of the public health impacts of the LCFS at the state and local level, including the impacts of local infrastructure or fuel production facilities in place or under development to deliver low carbon fuels, using an ARB-approved method of analysis developed in consultation with public health experts from academia and other government agencies;
- (10) An assessment of the air quality impacts on California associated with the implementation of the LCFS; whether the use of the fuel in the state will affect progress towards achieving state or federal air quality standards, or results in any significant changes in toxic air contaminant emissions; and recommendations for mitigation to address adverse air quality impacts identified; and
- (12) Significant economic issues; fuel adequacy, reliability, and supply issues; and environmental issues that have arisen.

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Through this review process, staff has determined that the public health and air quality impacts estimated in 2009 have not changed significantly throughout the first implementation year of the LCFS. This is due to many factors, including only slight changes in California's transportation fuel consumption, which cannot be solely attributed to the LCFS; no new fuel facilities being built in the state since the 2009 environmental impacts analysis; and no new fuels that could potentially be used in the State completing the multimedia process. As suggested, because 2011 is the first implementation year, the program is still in its infancy. The changes expected in the early years will be relatively minor.

That being said, as the LCFS annual carbon-intensity (CI) standards get more stringent, additional fuels will undergo the multimedia process, and investment will begin to flow more freely to ultra-low carbon fuel producers, so there will be impacts associated with the LCFS program—potentially positive or negative. Staff has developed two methods to help ensure the preservation of air quality due to changes in the transportation fuel sector. This includes drafting the biorefinery siting guidance document for local air districts, other agencies, and community members to use to minimize air pollution from biorefineries, and fulfilling the directive from the Board to participate in the environmental review of proposed projects, working with local air districts and others. We will also continue monitoring the state of transportation fuels within California as well as the accompanying infrastructure and vehicles associated with these transportation fuels.

A. *Summary of the 2009 Environmental Analysis*

The original environmental analysis focused on the significant GHG reductions that the regulation would provide due to the production and use of lower-CI transportation fuels. It also included the potential reductions due to changes in the vehicle fleet composition that would be available to use these lower-CI transportation fuels. Staff estimated that a reduction of about 16 million metric tons of CO₂-equivalent (MMTCO₂e) would come solely from the combustion of transportation fuels in California in 2020. If the full-fuel-lifecycle is included in the GHG benefits of the LCFS—taking into account GHG reductions outside of California—there would be an estimated reduction of about 23 MMTCO₂e.

As part of the analysis, staff estimated the number of potential new transportation fuel facilities that could be built in California. This estimate relied on the volume of biomass available in the state, projects that were undergoing the permitting process at the time of the analysis, and the projected demands of both the LCFS and RFS2 in 2009. It was estimated that a potential six ethanol facilities, 18 cellulosic ethanol facilities, and six biodiesel facilities could be operational in the State by 2020. In the 2009 analysis, staff did not anticipate any changes in the emissions from petroleum refineries, power plants, or existing corn facilities over the baseline projections. This was because we assumed that refining would not ramp up or slow down based solely on California consumption. We also assumed that any additional electricity use would be offset by the switch to a 33 percent renewable portfolio standard and off-peak charging. Lastly, at the time of

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writing the staff report, the California corn ethanol facilities were among the cleanest in the nation and we did not anticipate them needing to upgrade their facilities within the 2020 time frame. Therefore, any impacts above the baseline were attributed solely to potential new biorefinery facilities operating in the State.

In addition to the GHG benefits, staff also expected the LCFS to result in no additional adverse impacts to California's air quality due to criteria and toxic air pollutants. When calculating the emissions from potential new facilities, staff assumed the cleanest conversion and air pollution control technologies. This assumption was based on stringent New Source Review regulations affecting the permitting of these facilities. Staff recommended that any emissions from these facilities, if permitted, would be mitigated, consistent with local air district and CEQA requirements. Staff identified that the major source of criteria pollutant emissions were related to the number of truck trips associated with the delivery of feedstock and finished fuel. Staff proposed that these emissions could be offset by reduced motor vehicle emissions and by using newer trucks for the trips, as prescribed by other state and federal regulations (such as LEV and CAFE standards). Staff also recognized that there was still a potential for localized impacts, which prompted a further evaluation as described below.

Staff performed a health risk assessment to estimate the potential cancer risk from a biorefinery. To establish a plausible upper-bound, staff evaluated a scenario consisting of three co-located facilities. Details of this analysis can be found in Chapter VII of the 2009 ISOR. The highest potential cancer risk associated with on-site emission risk was estimated to be 0.4-out-of-a-million at the fence line of the facility. When including both on-site and off-site emissions in the risk analysis, it was estimated to be 5 out-of-a-million. In addition to the potential cancer risk, staff also analyzed the impacts related to PM_{2.5}. This analysis estimated an additional 20 premature deaths, 7 hospital admissions, and 314 cases of asthma, acute bronchitis, or lower respiratory symptoms.

When staff analyzed the ambient ozone impacts, it was determined that the air quality model could not reliably predict the impact because the concentrations of smog-forming pollutants associated with the LCFS were not statistically significant above the baseline.

Lastly, staff provided qualitative, and in a few cases quantitative, evaluations of impacts on other types of media. This included water use and water quality, agricultural resources, biological resources, geography and soils, hazardous materials, mineral resources, solid waste, and others. There was also a brief discussion on the commitment to develop a plan to address sustainability components related to the production of feedstock and transportation fuels.

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B. Tools and Methods for Assessing the Environmental Impacts in the 2009 Staff Report

1. Greenhouse Gas Emission Benefits

In the GHG analysis, staff evaluated the benefits of the LCFS in two ways. In the first analysis, staff evaluated the fuel energy required to meet the LCFS standard in each year using only the “tank-to-wheel” carbon intensity. In a “tank-to-wheel” analysis, only the emission reductions seen at the tailpipe of the vehicles combusting low carbon fuels are considered. This analysis reasonably represents the emissions that would occur in California and is similar to the analysis used in the Scoping Plan. In the second analysis, staff used the full lifecycle carbon intensity to estimate the overall CO₂ emission reductions associated with the LCFS.

One of the key parameters underlying the LCFS is estimating the volumes of fuels needed to propel California’s vehicle fleet each year. Staff estimated projections from 2010 to 2020 using a business-as-usual scenario for both gasoline and diesel fuel. The fuel use is expressed in terms of gasoline gallon equivalent (gge) to account for the different types of fuel used. By estimating the emissions associated with these petroleum-based fuels, and the alternative fuels used to displace a portion of them, staff can calculate the GHG emission reduction benefits of the LCFS.

2. Health Risk Assessment

Staff conducted a health risk assessment (HRA) study to evaluate the potential health impacts associated with toxic air contaminants emitted from typical biofuel facilities within California. The HRA focused on the potential cancer risk associated with diesel PM emissions associated with biofuel facilities. Specifically, the analysis focused on the diesel PM emissions from vehicles expected to deliver feedstocks to biofuel facilities.

The HRA follows *The Air Toxics Hot Spots Program Risk Assessment Guidelines* (OEHHA, 2003) published by the California Office of Environmental Health Hazard Assessment (OEHHA). The HRA is based on the facility specific emission inventory and air dispersion modeling predictions.

3. Ambient Ozone Impacts

National ambient ozone levels are regulated under the U.S. EPA national ambient air quality standards (NAAQS). To ensure attainment of the national standards in each state within specified time frames, U.S. EPA requires states to submit State Implementation Plans (SIPs) that show how each air basin within a state plans to meet the ozone NAAQS.

The SIP air quality modeling process begins with replicating field measurements of hourly ozone concentrations for a period of days using a modeling system that is

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comprised of: (1) an EPA-approved photochemical model; (2) representative meteorological- and boundary-condition inputs; and (3) a base case emissions inventory. After the modeling system has demonstrated the ability to reasonably replicate measured concentrations (i.e., based on regulatory model performance guidelines), it can be used to assess potential SIP control strategies for attaining or maintaining ambient ozone levels prescribed in the NAAQS. In general, this attainment demonstration step is accomplished through a process of applying control strategy emission reductions to the baseline emissions inventory, then determining whether the corresponding model response at ozone field-monitoring locations would yield the needed percentage reduction in measured ozone at the same locations to achieve attainment.

4. *Health Impacts*

A substantial number of epidemiologic studies have found a strong association between exposure to ambient PM_{2.5} and a number of adverse health effects. For the 2009 staff report, ARB staff quantified seven non-cancer health impacts associated with the change in exposure to NOx and PM_{2.5} emissions from increased transportation associated with new biorefineries and transporting imported ethanol within California. This analysis has been updated since the March 2009 ISOR was published to include: 1) updated emissions factors, 2) potential emissions benefits of advanced vehicles and 3) recognition of the potential programmatic overlap with the federal RFS2 program.

5. *Multimedia Evaluation*

Senate Bill 529, enacted in 1999 and set forth in Health and Safety Code (H&S) section 43830.8, generally prohibits ARB from adopting a regulation establishing a specification for motor vehicle fuel unless the fuel undergoes a multimedia evaluation. Since the LCFS is not a fuel specification, it does not trigger additional multimedia evaluations, although any new fuel introduced into California would be subjected to this analysis.

“Multimedia evaluation” means “the identification and evaluation of any significant adverse impact on public health or the environment, including air, water, or soil, that may result from the production, use, or disposal of the motor vehicle fuel that may be used to meet the state board’s motor vehicle fuel specifications.”

To oversee the multimedia evaluation process, the California Environmental Protection Agency formed the multimedia working group (MMWG), which makes recommendations to the California Environmental Policy Council (EPC) regarding the acceptability of the fuel and any significant adverse impacts on public health or the environment.

Proposed future rulemakings that may establish motor vehicle fuel specifications are subject to H&S §43830.8 and include biodiesel, compressed natural gas, E85, and biobutanol.

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C. *New Tool and Methods Developed to Aid in the LCFS Reviews Moving Forward*

1. *Proposed Review Protocol for CEQA Documents*

a. *Introduction*

Resolution 09-31 for the Low Carbon Fuel Standard (LCFS) directs Air Resources Board (ARB) staff to participate in the environmental review of projects in California directly related to the production, storage, and distribution of transportation fuel subject to the LCFS program. ARB staff has two primary opportunities to participate in the review of the air quality impacts of proposed new and expanding biorefinery projects through our role in (1) the California Environmental Quality Act (CEQA) process, and (2) the local air district permitting process. Flow charts illustrating the CEQA process and general district permitting process are attached, as Figures 1 and 2.

b. *CEQA Process [UNDER REVIEW BY ARB CEQA GROUP]*

A CEQA review usually requires the participation of local planning agencies, local air districts, and state agencies. Under CEQA, these agencies serve as lead agencies¹, responsible agencies², or interested agencies.³ For biorefinery projects in California, it is expected that the city or county planning department will serve as the lead agency, the district will serve as a responsible agency, and the ARB will participate as an interested agency.

ARB staff does not expect biorefinery projects to be exempt from CEQA review nor to qualify for a negative declaration under CEQA, and therefore expects that the CEQA lead agency will be required to prepare a detailed environmental impact report (EIR).⁴ The CEQA review is separate from the local air district's normal New Source Review permit process, although the two reviews may have some common considerations and requirements. The local air district (district) would assist the lead agency in specifying and reviewing information needed for evaluation of the project pertaining to air quality. When participating as a responsible agency, the district's decision-making must consider the lead agency's findings regarding air quality impacts.

The scope of the CEQA review for air quality could be substantially greater than that for district permit issuances. A CEQA review must include the effect of suspected toxic

¹ The CEQA lead agency is the public agency that has the principal responsibility for carrying out or approving a project and is responsible for determining whether the project will have a significant effect on the environment. The lead agency is normally the agency with general governmental powers, such as a city or county, rather than an agency with a single or limited purpose such as an air district.

² An agency with discretionary permitting authority, besides the lead agency, is the responsible agency.

³ Regulatory agencies with no permitting authority for a biorefinery project may still act as interested agencies and may participate in the evaluation of the environmental impacts of a project through the normal public review period built into the CEQA process.

⁴ The purpose of the EIR is to assess any significant effect on the environmental by the project and to evaluate potential mitigation measures.

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emissions and non-criteria emissions for which there are limited or no regulatory requirements yet developed, an analysis of cumulative air quality impacts, an analysis of project alternatives, and the analysis of source-related emissions (such as from motor vehicles associated with the project).

An EIR is usually produced in draft or initial versions that are followed by a final product. In accordance with the CEQA process, the draft EIR will be available for review by responsible agencies, interested agencies, and the public during the public review period, which is generally 30 days. The State Clearinghouse of the Governor's Office of Planning and Research coordinates the distribution of environmental documents prepared under CEQA to state agencies for their review and comment.

c. Local Air District Permitting Process

In addition to the environmental review process that takes place under CEQA, a project that is a direct source of emissions will also need a permit from the local air district. The permitting process starts with the submission of an application. The application will contain pertinent information such as equipment to be installed and processes that may emit air pollutants. After the district deems an application complete, the district normally has up to six months to process the application. During the application review period, most districts will prepare an engineering analysis that documents emission calculations, satisfaction of applicable district and state air quality regulations, assumptions used to evaluate the acceptability of the project, and required conditions of design and operation to achieve and maintain compliance. Many districts will also generate proposed permits (authorities to construct) that detail the specific air quality related operational and administrative requirements with which the facility must comply. If the project is large enough, a 30-day public review and comment period is required before a final district decision on the project. If public review and comment is required, the engineering analysis and proposed permits are made available to Region 9 of the United States Environmental Protection Agency, ARB, and the public.

d. ARB Participation in CEQA and District Permitting

The Project Assessment Branch within the ARB's Stationary Source Division receives CEQA documents that are filed with the State Clearinghouse, as well as district proposed authority-to-construct permits that trigger a public notice.

ARB staff will review all CEQA documents received for biorefinery projects submitted via the State Clearinghouse and all authority-to-construct permits submitted by the districts. ARB staff's role will be to provide comments to ensure that the proposed CEQA conditions of certification and district permit conditions will comply with all applicable orders, rules, and regulations of the district and the ARB, and are consistent with the recommendations outlined in ARB's *Air Quality Guidance for Siting Biorefineries in California* (October 2010). If deficiencies are noted, ARB staff will submit comments on the environmental documents prior to the end of the public review period.

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ARB staff is confident that it will receive adequate notice of new and expanding biorefinery projects via the established CEQA review and district permit review mechanisms described above, as well as through staff's regular interaction with the California Air Pollution Control Officers Association on district permitting issues.

2. *Air Quality Guidance for Siting Biorefineries in California*

a. *Introduction*

Implementation of the LCFS is expected to result in the installation of new biofuel production facilities (herein referred to as biorefineries) and expansion of existing facilities in California. In the LCFS rulemaking documents, ARB staff recommended that the emissions associated with biorefineries be fully mitigated consistent with local air pollution control and air quality management district (district) and California Environmental Quality Act (CEQA) requirements. To assist with this process, ARB staff has developed the *Air Quality Guidance for Siting Biorefineries in California* (guidance or report) to help stakeholders in assessing and mitigating air emissions associated with biorefinery activities in California.

The guidance addresses both stationary-source and mobile-source emissions associated with biorefinery operation. The primary purpose of this guidance is to: (1) identify the most stringent permitted emission limits from individual pieces of process equipment currently used or expected to be used at biorefineries, and (2) identify available options for mitigating air emissions from mobile sources at biorefineries.

This guidance is intended to provide districts, regulated parties, and other stakeholders with information that can be used to ensure that new or expanding biorefineries are constructed and operated in a way that eliminates or minimizes adverse air quality impacts. While this guidance is intended to promote general consistency in local permitting decisions, ARB recommends interested parties consult their local air district for specific requirements.

b. *Background*

This section briefly discusses the content of the guidance. Stakeholders should consult the actual guidance report for additional details and complete information regarding the recommendations made in this report.

i. *Purpose of Guidance*

The purpose of this report is to provide guidance to assist districts, local land use planners, environmental and public health groups, project proponents, and other stakeholders in site selection, air quality permitting considerations, and identification of potential CEQA mitigation measures. The guidance can assist stakeholders in evaluating the relative air quality impacts of various conversion technology options that

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are available for biofuels. Proponents of biorefinery projects may use the guidance to inform environmental and public health groups and other interested stakeholders about the emissions levels of proposed stationary equipment at biorefineries and the range of options that could be used to mitigate mobile source emissions that are associated with the construction and operation of biorefineries. The guidance is not intended to substitute case-by-case permitting decisions conducted by local air quality, environmental, or planning agencies. In addition, this report is not intended to preempt, replace, or devalue the decision-making processes that are associated with the outcomes of transportation planning analyses, site specific air quality modeling, risk assessments, SIP modeling, or future rules and regulations adopted for the purpose of controlling emissions of criteria pollutants, toxic air contaminants (TAC), or greenhouse gases (GHG).

ii. Biofuel Processes Evaluated

The information in the guidance was compiled from ARB staff's evaluation of the types of biofuels that could potentially be produced at a California biorefinery, the commercially available conversion technologies used to produce these fuels, the process equipment and air pollutants associated with these technologies that would be subject to district permit requirements, and the most current stringent permitted emission levels for these processes. The biofuels evaluated include: ethanol from grains, sugarcane, and cellulose; biodiesel; renewable diesel; biogas; hydrogen; and biogasoline. The conversion technologies evaluated include: fermentation, hydrolysis, gasification, transesterification, anaerobic digestion, reformation, and acid fermentation. Staff also evaluated motor vehicles and mobile equipment that would typically be associated with biorefineries. These could include trucks used to deliver raw material to a facility, excavators used to maintain the facility infrastructure, and chippers used to process raw material.

iii. Air Pollutants Addressed

The air pollutants evaluated include: oxides of nitrogen (NO_x), particulate matter (PM), volatile organic compounds (VOC), oxides of sulfur (SO_x), carbon monoxide (CO), and toxic air contaminants (TACs). Corresponding ammonia (NH₃) slip emission limits for stationary sources equipped with control technologies that use ammonia for the reduction of NO_x are identified in the report for informational purposes.

Strategies to specifically mitigate GHG emissions from biorefineries were not evaluated, and ARB staff has deferred to the work being undertaken to satisfy the requirements in the California Global Warming Solutions Act of 2006, also known as Assembly Bill 32 (AB 32). However, many of the mitigation strategies identified in the guidance will provide GHG reductions by promoting overall efficiency in energy conversion technologies and encouraging the recovery of energy and other marketable products from biomass feedstocks.

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iv. Topics Covered

The guidance addresses the following areas:

- California’s air regulatory structure and regulation of stationary sources – provides a broad overview of the air regulatory structure in California, major provisions for permitting stationary equipment at new or expanding biorefineries, and CEQA requirements that apply to proposed projects in the State;
- Biofuel production conversion technologies and stationary source emissions – describes commercially available biofuel pathways and conversion technologies, identifies stationary process equipment associated with each biofuel pathway, and identifies the air pollutants associated with each process;
- Most stringent emission limits for stationary source equipment at biorefineries – discusses the emissions data evaluated by ARB staff and staff’s rationale in identifying the most stringent permitted emission limits for stationary equipment at biorefineries;
- Mitigation of mobile source emissions associated with biorefineries – identifies vehicle and mobile equipment associated with new or expanding biorefineries, ARB mobile source regulations, and options to mitigate emissions from mobile sources at biorefineries; and
- Other considerations and future updates – identifies other factors to consider when evaluating the impacts of a new or expanded biorefinery, such as the location of low income communities that are highly impacted by air pollution, and outlines the update process for the guidance.

v. Development of Guidance Report

ARB staff solicited volunteers from interested stakeholders and formed a working group with representation from the districts, biorefinery and waste management industries, and environmental and public health groups. Beginning in August 2009, the working group met by teleconference 11 times to discuss the drafting of the guidance. In addition, ARB staff held two public workshops (August 2009 and January 2010) that included an update on progress and discussion of the report. Staff posted a draft version of the guidance report and notified interested parties on ARB’s LCFS listserve and the Bioenergy listserve at the California Energy Commission (CEC) on October 11, 2010, for a public review period ending on December 1, 2010. ARB staff also conducted a publicly-noticed meeting on October 14, 2010, on the draft report. After considering the comments, ARB is finalizing the document and expects to post it shortly. .

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c. Recommendations

The basis for the recommendations in the guidance are the result of ARB staff's compilation of the most current stringent emission limits for process equipment used at biorefineries and options available to mitigate mobile source emissions associated with biorefineries, through review of:

- Adopted and proposed district rules;
- Control techniques required as Best Available Control Technology (BACT) or Lowest Achievable Emission Rate (LAER);
- Emission levels achieved in practice, as verified by test results;
- More stringent control techniques which are technologically and economically feasible, but are not yet achieved in practice;
- Business, Transportation, and Housing and the California Environmental Protection Agency's Goods Movement Action Plan (2007);
- California Air Pollution Control Officers Association's Health Risk Assessment for Proposed Land Use Projects (2009);
- California Air Resources Board's Air Quality and Land Use Handbook: A Community Health Perspective (2005);
- State and local CEQA guidelines; and
- Draft and final Environmental Impact Reports (EIR) for various industrial facilities.

i. Stationary Source Emission Limits from Biorefineries

Tables 1, 2, and 3 in Appendix IX-1 summarize the most stringent emission limits for stationary process equipment that might be used at biorefineries. The tables are classified by equipment type—evaporative loss sources, combustion sources, and miscellaneous sources. ARB staff will continue to evaluate new emissions data and periodically provide updates using the process described later in this chapter.

ii. Mitigating Mobile Source Emissions from Biorefineries

On-road vehicles, off-road vehicles, and portable equipment used at biorefineries are a source of criteria pollutants, TACs, and GHGs. ARB staff recommends that on-road trucks serving biorefineries should have at a minimum 2007 model year or better engines, especially in areas where residents and sensitive receptors are present. To put this into context, an average on-road diesel truck equipped with a 2003 model year engine operating for an 8-hour day emits approximately 21 pounds per day NO_x and 0.5 pounds per day PM. Whereas, that same truck equipped with a 2007 model year engine emits 6 pounds per day NO_x (71 percent reduction) and 0.05 pounds per day PM (90 percent reduction). In addition, if that truck was equipped with a 2010 model year engine, the NO_x emissions would be even less at about 1 pound per day (a 95 percent reduction compared to 2003 model year). Other options to mitigate mobile source emissions associated with biorefineries include repower, retrofit, new purchases, replacement, or use of alternative fuels to achieve earlier, more aggressive, or more

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comprehensive (e.g., including exempt equipment) emission reductions that go beyond regulatory requirements for in-use diesel-fueled mobile sources. Additional mitigation options are detailed in the full guidance report.

iii. Considerations for Highly Impacted Communities

Some communities in California are disproportionately impacted by air pollution from multiple sources. Any environmental analysis for a new or expanding biorefinery project should include consideration of these cumulative impacts, public vetting of those impacts, and recommendations for mitigation of any significant impacts. The guidance provides various tools for stakeholders to use during the project-specific analyses for new or expanding biorefinery projects that pertain to community impacts in areas that are already disproportionately affected by air pollution. These tools will be available on ARB's Biorefinery Guidance website before the end of August 2011.

iv. Additional Strategies

In addition to the guidance provided for stationary-source process equipment and mitigation of mobile-source emissions, the report contains broader strategies that could be used to mitigate emissions from biorefineries. Some of these strategies include: use of onsite distributed generation (DG) and combined heat and power (CHP) systems in the form of fuel cells, microturbines, and other ultra-clean technologies; and the use of pipeline injection of biogas, rather than on-site combustion of biogas as a strategy to reduce emissions of NO_x in areas that do not achieve the federal or State Ambient Air Quality Standards for ozone.

d. Updates to the Guidance

ARB staff's near-term update activities will focus on the distribution of new and updated BACT determinations, new source test results, new technologies, newly approved regulations (including test methods), and an updated list of existing biorefineries in California. This information will be posted to ARB's Biorefinery Guidance website at <http://www.arb.ca.gov/fuels/LCFS/bioguidance/bioguidance.htm>. ARB staff will send e-mail notifications to the LCFS listserv at ARB and the Bioenergy listserv at CEC when new information is posted to this website. ARB staff plans to provide these updates on a periodic basis or as biorefinery project activity dictates.

In addition, to ensure the information provided in this report stays current, ARB staff will perform periodic updates at intervals that correspond to the review periods set forth in the LCFS regulation. As part of these updates, staff will assess the geographic distribution of biorefineries in the state, and where appropriate, integrate additional mitigation measures for the purpose of protecting against disproportionate air quality impacts that arise from the concentration or co-location of multiple biorefineries.

D. *Sustainability and the LCFS*

1. *Introduction*

When the Board approved the LCFS on April 23, 2009, it directed staff in Resolution 09-31 to work with the Interagency Forest Work Group (IFWG), appropriate state agencies, environmental advocates, regulated parties, and other interested stakeholders to present a workplan to the Board by December 2009 for developing sustainability provisions to be used in implementing the LCFS regulation. Furthermore, the Board stated that the workplan should provide a framework for how sustainability provisions could be incorporated and enforced in the LCFS program, and it should include a schedule for finalizing feasible and appropriate sustainability provisions by no later than December 2011.

Sustainability is generally considered to be the ability to meet the needs of the present without compromising the ability of future generations to meet their own needs. A more scientific definition would be: the long term viability of natural resource consumption in balance with the supporting ecosystem. The three major components of sustainability are environmental, social, and economic sustainability.

2. *Key Elements for Addressing Sustainability within the LCFS*

A report⁵ published by researchers at the University of California at Davis (UC Davis) examined a range of sustainability requirements for biofuels and considered a possible framework for LCFS sustainability provisions. This section briefly discusses some of the key elements of the proposed sustainability framework.

The study reviewed sustainability requirements and criteria being implemented or proposed by governments promoting biofuel programs—particularly the United Kingdom and the European Union. The study also reviewed the sustainability principles and criteria proposed by the Roundtable on Sustainable Biofuels (RSB). RSB is an international initiative involving stakeholders across the entire biofuel supply chain, nongovernmental organizations, experts, governments, and inter-governmental agencies.

Some of the key elements identified in the study for a sustainability provision include:

- Principles and criteria
- Benchmarking and/or third-party certification requirements

⁵ Yeh, S.; Summer, D.; Kaffka, S.; Ogden, J.; Jenkins, B. *Implementing Performance-Based Sustainability Requirements for the Low Carbon Fuel Standard – Key Design Elements and Policy Considerations*; Research Report UCD-ITS-RR-09-05; Institute of Transportation Studies, University of California, Davis: Davis, CA, 2009.

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- Supply chain and reporting requirements
- Legality

The California Energy Commission (CEC), in response to recent legislation⁶, has developed sustainability principles and criteria for its Alternative and Renewable Fuel and Technology Program. The intent of the program is “to develop and deploy alternative and renewable fuel and advanced transportation technologies to achieve the State’s climate change policies, reduce petroleum use, increase the use of alternative fuels and spur the development of in-state bioenergy sources.”⁷ Since the program awards public funds for projects that meet these objectives, CEC staff has had to develop sustainability metrics through which funding priorities are determined. ARB staff commends the CEC accomplishments and will continue to work closely with CEC staff on sustainability issues common to both agencies.

3. ARB Process for Addressing Sustainability Provisions for LCFS

In developing sustainability provisions for the Low Carbon Fuel Standard, ARB staff has been meeting on almost a monthly basis to talk about the details and challenges of constructing sustainability provisions. We have been working with the Interagency Forest Work Group (IFWG), appropriate state agencies, environmental advocates, regulated parties, and other interested stakeholders, as well as with national and international partners to address potential sustainability issues arising from the worldwide demand of biofuels.

Staff is also assessing how existing laws and regulations address sustainability for the management and harvest of biofuel feedstocks. Also, because several other countries have initiatives that are farther along than the LCFS, staff is following the development of certification and benchmark systems developed by other countries, organizations, or industry groups that can serve as models for California.

We will continue, with the help of the workgroup, to identify policies that can incent the adoption of sustainability provisions and the production of sustainable fuels. While doing so, we will comply with Health and Safety Code section 38562(b), enacted by AB 32, that requires the ARB, to the extent feasible, to ensure that activities undertaken do not disproportionately impact low-income communities and to consider overall societal benefits, including reductions in other air pollutants, diversification of energy sources, and other benefits to the economy, environment, and public health. We will also prioritize efforts to regionalize national and international sustainability provisions for the California context (natural resources, social and economic circumstances).

⁶ Assembly Bill 118 (Núñez, Chapter 750, Statutes of 2007) and Assembly Bill 109 (Núñez, Chapter 351, Statutes of 2008).

⁷ CEC. *Investment Plan for the Alternative and Renewable Fuel and Vehicle Technology Program*; CEC-600-2009-008-CMF; California Energy Commission: Sacramento, CA, 2009

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E. Environmental Impact Analysis for the 2011 Program Review

1. Changes in the California Transportation Fuel Pool

In Chapter VI of this review, staff presented the past consumption and future demand of transportation fuels. It was apparent from the data that in 2008 there was a decrease in the volume of major transportation fuels, with the exception of increased volumes of ethanol. This increase in ethanol consumption is due to the fact that California has moved from E6 to E10 by 2010. This increase was anticipated in the original analysis and therefore included in the 2009 baseline environmental impacts. Staff does not believe that these slight variations are caused by the LCFS and any small fluctuations can be attributed to factors outside of the LCFS, such as the economy. These small fluctuations do not lead to a significant change in the impacts from the 2009 impact assessment.

2. Changes to the Data Used to do the 2009 Impact Analysis

At this time, there have been no significant changes in the transportation fuel production capacity in California. No additional production facilities have been added since the baseline and impacts were calculated in 2009. Additionally, there have been no significant updates to the emission factors used in the 2009 analysis. In relation to additions in infrastructure, there has been an increase in E85 and biodiesel stations; however, past consumption data does not show an increase in consumption since the original environmental impacts analysis. Additionally, the increase in these stations cannot, with certainty, be associated with the LCFS. This increase can also be related to the federal RFS2, as it plays a role in the consumption of ethanol and biodiesel.

That being said, there are several multimedia evaluation updates that are being conducted that potentially impact the environmental analysis. These updates would most likely have a positive impact on the environment with relation to the LCFS. This includes biodiesel, E85, CNG, and biobutanol. Once these evaluations are complete and updates are proposed to the fuel specifications, staff intends to update the impacts analysis. This will potentially happen for the 2015 mandatory review that staff is required to perform.

In addition to the multimedia process, staff intends to use data found in the LCFS reporting tool to estimate the GHG benefits. At this stage, there is only one quarter of data in the system, which is not enough to make any accurate projections. From the first quarter data we can see that **~75,000 MTCO₂e** has been generated thus far.

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3. *Anticipated Environmental Impacts for 2011*

Based on the current data available compared to the data of 2009, staff does not believe that there is a significant difference in the transportation fuels used in the State to warrant a new environmental impacts analysis. Staff will prepare another quantitative review of the impacts once more data is collected through the multimedia process.

Nevertheless, there are several potential new aspects to the LCFS that may have either positive or negative environmental impacts, such as the sustainability provisions, adjusted land use values, and amendments to the high carbon intensity crude oil provisions in the LCFS. At this time, staff is developing the regulatory language for these amendments. When proposing amendments, staff is required to do an environmental and economic impact assessment of those proposed amendments. These analyses will be included in the staff report associated with the proposed regulatory amendments.

F. Summary and Conclusions

Since the initial staff report in 2009, staff has been continuing to monitor the potential environmental impacts of the LCFS. From monitoring the changes in the transportation fuel pool, the production facilities, and the permitting processes, there are no significant changes to the environmental impacts analysis originally conducted in 2009. In addition to this monitoring, we have been progressing on several key elements that will continue to support ARB's healthy air quality mission. These include: developing sustainability provisions; implementing a review process for CEQA documents related to transportation fuel projects; and developing a guidance document for the air quality districts related to siting practices. Although two years has passed since the adoption of the LCFS, 2010 was a reporting year and 2011 was the first implementation year for which a reduction in the carbon intensity of transportation fuels is required. Because this review is occurring early on in the program, there are not enough data to suggest that there are environmental impacts associated with the LCFS. Staff will continue to monitor the progress of the program and will revisit the environmental impact analysis again for the 2015 review.

APPENDIX IX-1

Table 1. Most Stringent Emission Limits Identified for Process Equipment at Biorefineries – Evaporative Loss Sources

Class/Category of Source	NOx	CO	VOC	SOx	PM10
Methanol / Sodium Methoxide receiving and storage			Emission limit corresponding to use of a VOC control system capable of 99.5% or better control efficiency		
Fermentation process: yeast, liquefaction, beerwell, and process condensate tanks			Emission limit corresponding to use of a VOC control system capable of 99.5% or better control efficiency		
Distillation and wet cake processes			Emission limit corresponding to use of a VOC control system (wet scrubber or equivalent) capable of 95% or better control efficiency		
Pumps and compressor seals			No leak of methane greater than 100 ppm above background and inspection and maintenance program		
Valves, flanges, and other types of connectors			No leak of methane greater than 100 ppm above background		

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Table 1. Most Stringent Emission Limits Identified for Process Equipment at Biorefineries – Evaporative Loss Sources

Class/Category of Source	NOx	CO	VOC	SOx	PM10
			and inspection and maintenance program		
Storage tank (fixed roof)			Emission limit corresponding to use of a VOC control system capable of 99.5% or better control efficiency		
Storage tank (floating roof)			Emission limit corresponding to use of a VOC control system capable of 98% or better control efficiency		
Liquid fuel loading operations			Emission limit corresponding to use of a VOC control system capable of 98% or better control efficiency		
Liquid fuel transfer and dispensing operations			Emission limit corresponding to use of an ARB certified Phase I vapor recovery system		

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Table 2. Most Stringent Emission Limits Identified for Process Equipment at Biorefineries – Combustion Sources

Class/Category of Source	NOx	CO	VOC	SOx	PM10
Natural gas-fired boiler, ≥2 to <5 MMBtu/hr	Non-atmospheric units: 9 ppmvd @ 3% O ₂ (0.011 lb/MMBtu) Atmospheric units: 12 ppmvd @ 3% O ₂ (0.015 lb/MMBtu)	Firetube type: 50 ppmvd @ 3% O ₂ Watertube type: 100 ppmvd @ 3% O ₂	Emission limit corresponding to use of natural gas with fuel sulfur content of no more than 1 gr/100 scf	Emission limit corresponding to use of natural gas with fuel sulfur content of no more than 1 gr/100 scf	Emission limit corresponding to use of natural gas with fuel sulfur content of no more than 1 gr/100 scf
Natural gas-fired boiler, ≥5 to <20 MMBtu/hr	6 ppmvd @ 3% O ₂ (0.007 lb/MMBtu)	Firetube type: ≤50 ppmvd @ 3% O ₂ Watertube type: ≤100 ppmvd @ 3% O ₂	Emission limit corresponding to use of natural gas with fuel sulfur content of no more than 1 gr/100 scf	Emission limit corresponding to use of natural gas with fuel sulfur content of no more than 1 gr/100 scf	Emission limit corresponding to use of natural gas with fuel sulfur content of no more than 1 gr/100 scf
Natural gas-fired boiler, ≥20 MMBtu/hr	5 ppmvd @ 3% O ₂ (0.0062 lb/MMBtu)	Firetube type: ≤50 ppmvd @ 3% O ₂ Watertube type: ≤100 ppmvd @ 3% O ₂ <u>For units ≥250 MMBtu/hr⁸:</u> 10 ppmvd @ 3% O ₂	Emission limit corresponding to use of natural gas with fuel sulfur content of no more than 1 gr/100 scf	Emission limit corresponding to use of natural gas with fuel sulfur content of no more than 1 gr/100 scf	Emission limit corresponding to use of natural gas with fuel sulfur content of no more than 1 gr/100 scf
Natural gas-fired dryer	0.018 lb/MMBtu (15 ppmv @ 3% O ₂)	0.07 lb/MMBtu	Emission limit corresponding to use of a VOC capture and control with thermal or catalytic incineration (98% control)	Emission limit corresponding to use of a wet scrubber (95% control)	Emission limit corresponding to use of high efficiency (1D-3D) cyclones and thermal incinerator in series

⁸ This CO limit may be required for boilers rated at <250 MMBtu/hr if an oxidation catalyst is found to be cost effective, is necessary to meet toxic best available control technology, or for VOC emission control.
S:\FUELS\Low_Carbon_Fuel_Standard\AdvisoryPanel (Deliberative & Confidential)\Report\8. Environmental\VIII-EnviroChapter-v4.docx
8/18/2011, MWB

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Table 2. Most Stringent Emission Limits Identified for Process Equipment at Biorefineries – Combustion Sources

Class/Category of Source	NOx	CO	VOC	SOx	PM10
			or equivalent		(98.5% control) or equivalent
Flare (ethanol production)	0.05 lb/MMBtu	0.37 lb/MMBtu	0.063 lb/MMBtu	0.00285 lb/MMBtu	0.008 lb/MMBtu
Biomass-fired boiler	0.012 lb/MMBtu (9 ppmvd @ 3% O ₂)	0.046 lb/MMBtu (59 ppmvd @ 3% O ₂) Alternate Limit: 0.01 lb/MMBtu (22 ppmvd @ 3% O ₂)	0.005 lb/MMBtu (11 ppmvd @ 3% O ₂)	0.012 lb/MMBtu (7 ppmvd @ 3% O ₂)	0.024 lb/MMBtu (0.01 gr/scf @ 12% CO ₂)
Landfill gas-fired flare	0.025 lb/MMBtu	0.06 lb/MMBtu	Emission limit corresponding to 98% VOC destruction efficiency or 20 ppmv @ 3% O ₂	Emission limit corresponding to use of a wet scrubber with 98% control efficiency	Emission limit corresponding to use of steam injection and/or knockout vessel
Manure digester and co-digester gas-fired flare	0.03 lb/MMBtu (25 ppmvd @ 3% O ₂)	Operate per manufacturer specifications to minimize CO	0.03 lb/MMBtu	Emission limit corresponding to use of a H ₂ S removal system (dry or wet scrubber or equivalent)	Emission limit corresponding to use of smokeless combustion and LPG or natural gas-fired pilot
Biogas-fired microturbine	0.5 lb/MWh As of 1/1/2013: 0.07 lb/MWh	6.0 lb/MWh As of 1/1/2013: 0.10 lb/MWh	1.0 lb/MWh As of 1/1/2013: 0.02 lb/MWh	N/A	N/A
Biogas-fired reciprocating internal combustion engine	11 ppmvd @ 15% O ₂ (or 0.15 g/bhp-hr) in conjunction with an effective and efficient biogas treatment system Alternate Limit for dairy	250 ppmvd @ 15% O ₂	20 ppmvd @ 15% O ₂	Emission limit corresponding to use of a fuel gas pretreatment system for sulfur removal along with maximum fuel sulfur content limit	0.1 g/bhp-hr

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Table 2. Most Stringent Emission Limits Identified for Process Equipment at Biorefineries – Combustion Sources

Class/Category of Source	NOx	CO	VOC	SOx	PM10
	digester gas-fired rich-burn engines: 9 ppmvd @ 15% O ₂ (or 0.15 g/bhp-hr)				
Biogas-fired turbine, <3 MW	9 ppmvd @ 15% O ₂	60 ppmvd @ 15% O ₂	3.5 ppmvd @ 15% O ₂ ⁹	Landfill gas: Emission limit corresponding to use of landfill gas with sulfur content of no more than 150 ppmv as H ₂ S	Emission limit corresponding to use of a fuel gas pretreatment system for particulate removal
Biogas-fired turbine, ≥3 MW	5 ppmvd @ 15% O ₂			Digester gas: Emission limit corresponding to use of digester gas with sulfur content of no more than 40 ppmv as H ₂ S	
Biomass syngas-fueled ¹⁰ reciprocating internal combustion engine	5 ppmvd @ 15% O ₂	N/A	25 ppmvd @ 15% O ₂	N/A	N/A
Diesel-fueled emergency engine generator	Engine meeting emission standards of ARB's Airborne Toxic Control Measure for Stationary Compression	Engine meeting emission standards of ARB's Airborne Toxic Control Measure for	Engine meeting emission standards of ARB's Airborne Toxic Control Measure for	Emission limit corresponding to use of CARB, or very low sulfur, diesel fuel (15 ppm sulfur by	Engine meeting emission standards of ARB's Airborne Toxic Control Measure for

⁹ Due to limited data set available for this Report on achievable VOC emission levels for landfill and digester gas-fired turbines, ARB staff recommends that regulatory agencies consult with the manufacturers on guaranteed emission levels, as well as, evaluate additional source tests to determine the appropriate VOC limit for a turbine.

¹⁰ BACT guideline that is the basis of these emission limits defines syngas, or synthetic gas, to be “derived from biomass (agricultural waste) by gasification or similar processes. Syngas is distinguished from waste gases by its low methane content (<5%) and comparatively high hydrogen gas content (15% or greater), although frequently over half of the syngas composition is non-combustible gases such as nitrogen and carbon dioxide.”

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Table 2. Most Stringent Emission Limits Identified for Process Equipment at Biorefineries – Combustion Sources

Class/Category of Source	NOx	CO	VOC	SOx	PM10
	Ignition Engines for applicable horsepower range ¹¹	Stationary Compression Ignition Engines for applicable horsepower range	Stationary Compression Ignition Engines for applicable horsepower range	weight)	Stationary Compression Ignition Engines for applicable horsepower range

Table 3. Most Stringent Emission Limits Identified for Process Equipment at Biorefineries – Miscellaneous Sources

Class/Category of Source	NOx	CO	VOC	SOx	PM10
Grain receiving, conveying, and grinding operations					Emission limit corresponding to use of a baghouse with 99% control, or equivalent
Wet cooling tower					Emission limit corresponding to use of a drift eliminator with 0.0005% drift loss
Compressed gas dispensing operations	No emissions – use of closed loop system with all vent and excess process gas directed to an on site treatment system, used in vehicles, or directed to another combustion or processing facility that can process the biogas and which has been issued a valid air permit				

¹¹ Refer to ARB regulations and/or Appendix D Table D-29 of the guidance for the applicable emission standard.

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Table 3. Most Stringent Emission Limits Identified for Process Equipment at Biorefineries – Miscellaneous Sources

Class/Category of Source	NOx	CO	VOC	SOx	PM10
Biogas-fueled fuel cell ¹²	0.5 lb/MWh Alternate Limit: 0.07 lb/MWh	6.0 lb/MWh Alternate Limit: 0.10 lb/MWh	1.0 lb/MWh Alternate Limit: 0.02 lb/MWh	N/A	N/A
Composting			Emission limit corresponding to use of a VOC control system (enclosure with biofilter or equivalent) capable of 80% or better control efficiency Ammonia: Emission limit corresponding to use of an NH3 control system capable of 80% or better control efficiency		Emission limit corresponding to use of a PM10 control system capable of 99% or better control efficiency

¹² Emission limits are the 2008 standards for waste gas required by the ARB's Distribution Generation (DG) Certification Regulation. Alternate limits represent the 2013 standards for waste gas required by the DG Certification Regulation.