Proposed Regulation on the Commercialization of Alternative Diesel Fuels

Staff Report: Initial Statement of Reasons




Industrial Strategies Division

Oil and Gas and GHG Mitigation Branch & Transportation Fuels Branch

Release Date: January 2, 2015

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State of California
Air Resources Board

Staff Report: Initial Statement of Reasons for Proposed Rulemaking

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Air Resources Board

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EXECUTIVE SUMMARY

The staff of the Air Resources Board (ARB or Board) is proposing a regulation to govern the commercialization of motor vehicle alternative diesel fuels (ADF) in California. Through California's fuel policies, consumers are beginning to see increasingly cleaner fuels as well as more options for fueling their motor vehicles. The ADF regulation is intended to create a framework for these low carbon diesel fuel substitutes to enter the commercial market in California, while mitigating any potential environmental or public health impacts. ADFs are those alternative diesel fuels that do not have an established ARB fuel specification in effect prior to January 1, 2016. The proposed regulation consists of two major parts:

1) A three stage process for ADFs to be introduced into the California market including, if necessary, a determination of mitigation measures to ensure no degradation in air quality.
2) In-use requirements for biodiesel as the first ADF

Although this will be a new regulation, the proposal consolidates many current administrative and regulatory practices into one regulation that provides a clear framework for commercialization of ADFs. The formal framework is necessary for two primary reasons. First, programs such as California's Low Carbon Fuel Standard (LCFS) and the federal Renewable Fuels Standard (RFS) are expected to incentivize the rapid development of ADFs. Many of these fuels provide criteria pollutant and toxic air contaminant emission reductions in addition to their greenhouse gas (GHG) benefit. Second, some ADFs may have adverse effects under certain circumstances. For these reasons, ARB is proposing the regulation to ensure that ADFs are commercialized in California under specific requirements and conditions that avoid potential adverse impacts while realizing the benefits that ADFs can provide.

The first ADF that will be subject to in-use requirements under this framework is biodiesel. Fuel specifications and other requirements for future ADFs will be incorporated into this regulation through additional rulemakings. Biodiesel has particulate matter (PM) and GHG benefits, however testing by ARB and others show that biodiesel can increase oxides of nitrogen (or NOx) under certain circumstances and without considering offsetting factors. These effects are only observed in older (pre-2010) vehicles. As new technology diesel engines are phased in through other ARB programs such as the Truck and Bus Regulation, the NOx impacts will be reduced until they are negligible. ARB expects the in-use specifications to sunset around 2023. Until that time, the in-use specifications will reduce NOx from current levels and Californians will continue to experience the PM and GHG benefits.

There has been confusion between biodiesel and renewable diesel; however, these are two distinct fuels. Renewable diesel and biodiesel are both biomass based diesel fuel replacements and can be confused with each other, but the distinctions are important. Although the two fuels use the same feedstocks (e.g. animal tallow, used cooking oil, soybean oil), they are produced using different production processes with resulting

products having different chemical properties and environmental attributes. Renewable diesel is not considered an ADF as it consists solely of hydrocarbons and is chemically indistinguishable from conventional diesel. Renewable diesel has been shown to decrease emissions of GHGs, PM, hydrocarbons, and carbon monoxide and, in contrast to biodiesel, renewable diesel has also been shown to reduce NOx. Because renewable diesel is not an ADF, it would not be subject to in-use requirements and is expected to increase significantly over time, with associated co-benefits of reduced air pollutants.

The availability of both renewable diesel and biodiesel will help fulfill our climate goals, provide fuel diversity, contribute PM emission reduction benefits, and, with the implementation of this regulation, have no degradation of air quality from current levels.

What are we proposing?

The proposed regulation would require an ADF to proceed through a three-stage process that evaluates the fuel for environmental impacts prior to use above a minimum threshold amount in California. As part of that evaluation process, the regulation establishes measures that apply to maintain current air quality protections. Many of the provisions in this regulation are already required under existing State law. The three stages of this process are described below.

Stage 1: Pilot Program. In this stage, an ADF applicant(s) would apply to ARB for a pilot program under which no more than 1 million gallons total of the ADF could be used in the State in well-defined fleets within a year. During that time, the applicant would conduct required testing and emissions evaluations. The application process includes disclosure of the chemical composition of the ADF, as well as other important information, which would enable staff to conduct a screening analysis. This screening analysis is intended to help staff determine whether use of the ADF presents a potential adverse impact to the public health or environment. Advancement to Stage 2 requires the ADF applicant to fulfill the Stage 1 requirements and enter into an agreement with the Executive Officer (EO) to complete and satisfy specified terms and conditions, such as additional emissions testing, which will apply during the second stage.

Stage 2: Fuel Specification Development. In this stage, an ADF proponent(s) would apply for a broader, but still limited, agreement allowing use of up to 30 million gallons of that ADF per year in a larger fleet. The larger volume and sample fleet would allow for more comprehensive testing and analyses that would inform a multimedia evaluation; help develop consensus standards for the ADF; identify what circumstances, if any, could result in an adverse impact on public health or the environment; and, if necessary, determine appropriate mitigation options. During this stage, ARB staff would determine, if necessary, a pollutant control level for a particular pollutant of concern.

Stage 3: Commercial Sales. This stage is split into Stage 3A and Stage 3B. Stage 3A is applicable to ADFs for which ARB staff has identified a pollutant control level. An ADF sold in California under this stage would be subject to potential sales conditions and mitigation measures that are based on the pollutant control level(s) determined in

Stage 2. By contrast, Stage 3B is applicable to ADFs for which no pollutant control level is necessary. Accordingly, ADFs in Stage 3B can be used at any blend level and without any conditions of use or mitigation measures.

An ADF subject to Stage 3A is subject to enhanced monitoring and recordkeeping. The ARB staff would use such monitoring and records, along with other market and fleet data, to determine whether the pollutant control level has been reached.

Staff has determined that certain blends of biodiesel, the first ADF to be subject to the proposed regulation, can increase NOx under certain circumstances and in the absence of offsetting factors. However, ARB staff has also determined that NOx associated with these biodiesel blends are offset by a number of factors. Accordingly, ARB staff has designed the proposed regulation to ensure that biodiesel can be commercialized without an increase in NOx. The proposed regulation provides for a proper accounting of offsetting factors already occurring in the California market and the appropriate application of in-use requirements.

Accounting for feedstock saturation and offsetting factors such as renewable diesel usage and fuel use by newer heavy duty trucks, biodiesel can be used in lower blends levels without triggering in-use specifications. In-use specifications are necessary above a five percent blend level (B5) for low saturation biodiesel and a B10 level for high saturation biodiesel during ozone season and above B10 for all biodiesel in low ozone season.

Why are we taking this action?

Consumption of ADFs, such as biodiesel, is expected to increase in the coming years due to a variety of policy incentives including the RFS, LCFS, and potentially the continuance of federal blending tax credits. These fuels will help California meet its climate and petroleum reduction goals, provide fuel diversity, and contribute PM benefits. As such, it is important to ensure that the full commercialization of these fuels do not increase air pollution or cause other environmental concerns. The proposed regulation will ensure this by subjecting new ADFs to a rigorous, phased environmental review with specific terms and conditions. As part of the environmental review, staff will determine whether the ADF has a “pollutant control level” for the pollutant of concern, which is defined to be that level of ADF use which could lead to an increase in the pollutant of concern. In that case, staff will identify the terms of the pollutant control level and define the specific in-use requirements, when conditions warrant mitigation. This regulation will ensure that ADFs avoid potential adverse impacts while realizing the benefits that ADFs can provide in terms of reductions in GHGs and PM and increase in fuel diversity in the state.

Who is affected by this proposed regulation?

The regulation applies primarily to producers and importers of alternative diesel fuels. If necessary, the applicant producer or importer would be responsible for applying any mitigation measures that may be required under a Stage 3A scenario. Retail marketers and distributors of alternative diesel fuels are generally not affected by the in-use requirements unless they are also conducting fuel blending. Retailers and distributors may be required to do some of the required recordkeeping and monitoring, but these generally would apply to the higher blends of an ADF (e.g., for marketers of biodiesel in blends above B10).

What are the costs of this proposed regulation?

Staff expects the costs directly attributable to this proposed regulation to be minimal. Regulatory costs are primarily due to some increases in reporting, recordkeeping and testing of ADFs, as well as costs for in-use requirements affecting some biodiesel blends. Many of the requirements of this regulation already exist under other State law, and, as such, are not an additional cost of this regulation. For example, much of the reporting associated with this regulation is already required to comply with the LCFS regulation or other State or federal programs. The requirement for a multimedia evaluation of new ADFs is already required by ARB pursuant to Health and Safety Code (H&SC) section 43830.8, and development of consensus standards is already required by existing regulations implemented by the California Department of Food and Agriculture. The differences between existing law and this proposed regulation is primarily the enhanced monitoring required and a more streamlined route to the commercial market.

Staff also estimated potential costs of in-use control for biodiesel use. Staff's analysis shows that with full implementation of the in-use requirements in 2018, biodiesel used in B5 blends incur no in-use requirement costs, only minimal recordkeeping costs. Higher blends above B5 may have a small cost per gallon. For 2018, the projected costs for complying with the in-use requirements are about $3 million on 180 million gallons of biodiesel, or less than two cents per gallon. Beyond 2018, the cost for biodiesel blends above B5 is projected to decrease to zero because the in-use requirement will sunset upon near full fleet penetration of new technology diesel engines in California.

CHAPTER 1. INTRODUCTION

A. Air Quality

Due to its unique geography, California has unique air pollution challenges. Ambient air quality standards designed to protect public health have been established for several pollutants in the State. Although California has made substantial progress, in many parts of the State air pollution exceeds these ambient air quality standards. To attain the ambient air quality standards, the California Air Resources Board (ARB or Board) has designed a multi-faceted strategy, including emission reductions from mobile sources and motor vehicle fuels. The ARB uses its legal authority to regulate emissions from motor vehicle fuels in the State when appropriate to reduce air pollution. To date, ARB has developed fuel quality standards for gasoline, diesel and several alternative motor vehicle fuels.

In anticipation of increasing biodiesel use and additional alternative motor vehicle fuels in California, ARB staff recognizes the need for a new regulation to maintain air quality benefits for future commercial substitute diesel fuels.

B. Alternative Motor Vehicle Fuels

There is a trend in California toward increasing consumption of alternative motor vehicle fuels in place of conventional petroleum-based gasoline and diesel fuels. This trend is primarily due to economic incentives and policies at the State and national level that incent the use of lower polluting, less toxic, and lower carbon intensity fuels in the commercial market. A more detailed discussion of these new fuels is presented in Chapters 2 through 4. As a result of this diversification, some diesel fuel substitutes have started to enter commerce in California without clear regulatory requirements to ensure there are no detrimental impacts to air pollution as a result of their use. In response to this, ARB staff is proposing a new Alternative Diesel Fuel (ADF) regulation that will put the proper regulatory structure into place to ensure no detrimental impacts to air quality as California moves toward increased alternative motor vehicle fuels consumption.

C. Alternative Diesel Fuels Overview

In general, alternative diesel fuels are a category of motor vehicle fuels that are not conventional diesel and do not solely consist of hydrocarbons. While there are a few alternative diesel fuels in existence today, biodiesel is by far the most prevalent. While renewable diesel is also an innovative diesel fuel replacement, it consists solely of hydrocarbons and is virtually indistinguishable from conventional diesel; therefore, renewable diesel is not considered an alternative diesel fuel under this proposed regulation.

Biodiesel and renewable diesel are both low carbon fuels that can be produced domestically. Using conventional feed stocks, these fuels provide carbon intensities

about 25 percent lower than petroleum diesel fuel. Using waste feedstocks, the carbon intensity can be as much as 80 percent lower than petroleum diesel fuel. Biodiesel and renewable diesel also decrease emissions of harmful air pollutants. Blends of biodiesel and renewable diesel have been shown to decrease the emission rates of particulate matter, hydrocarbons and carbon monoxide. Renewable diesel has also been shown to reduce NOx.

1. Biodiesel

Biodiesel has already been in use in California for several decades. Waste restaurant grease is frequently confused with biodiesel. Grease is referred to as straight vegetable oil (SVO), which has a long history of use in diesel engines. Peanut oil, a type of SVO, was the fuel that powered Rudolph Diesel's original compression ignition engine at the 1911 World Fair.

Although SVO can be used in most diesel engines, its use leads to durability issues, such as clogging of fuel injectors and fatty engine deposits. To create a fuel that is more appropriate for the modern diesel engine, SVO must be chemically converted to a form that has improved combustion properties through a process called transesterifcation. In order to accomplish this conversion, the SVO, or other feed stock, is chemically converted to fatty acid methyl esters (FAME) by reacting the SVO with methanol and a catalyst. The resulting FAME biodiesel is much cleaner burning and less viscous, reducing or eliminating many of the problems caused by SVO.

Biodiesel feed stocks such as animal tallow and waste vegetable oil contain high concentrations of triglycerides, which is the main component of fats and oils. These feed stocks can be processed into biodiesel and depending upon the specific feed stock, there may be a range of emissions effects. For example, soybean oils tend to produce higher NOx emitting biodiesel than animal tallow.

2. Renewable Diesel

In addition to biodiesel, ARB considered renewable diesel during this rulemaking. Renewable diesel uses essentially the same feed stocks that are used to make biodiesel, but instead of the transesterification reaction, renewable diesel is produced by hydroprocessing, which results in a fuel containing pure hydrocarbons, paraffinic compounds and nearly no aromatics. Renewable diesel has few of the disadvantages normally associated with biodiesel such as poor cold weather performance, biological degradation or oxidation stability. However, renewable diesel exhibits poor lubricity and generally must be used in a lubricated mixture or have a lubricity additive incorporated in the fuel. Finally, renewable diesel is generally more homogeneous and does not exhibit the chemical variability of biodiesel made from different production feedstocks.

D. Low Carbon Fuel Standard Litigation

On July 15, 2013, the State of California Court of Appeal, Fifth Appellate District (Court) issued its opinion in POET, LLC versus California Air Resources Board (2013) 218 Cal.App.4th 681. Among the issues in the lawsuit was the treatment of biodiesel in the original LCFS regulation. The judge's opinion was that ARB did not adequately address biodiesel NOx emissions that could potentially result from implementation of the LCFS. The Court held that the LCFS would remain in effect and that ARB can continue to implement and enforce the 2013 regulatory standards while it takes steps to cure California Environmental Quality Act and Administrative Procedure Act issues associated with the original adoption of the regulation. In addition to the general impetus of this regulation to protect air quality, it is also designed to fulfill the court's requirements and to remedy issues with NOx emissions from biodiesel. Implementation of this regulation will ensure that the use of biodiesel due to LCFS will not result in increases in NOx emissions in California.

E. Development Process for the Proposed Regulation

Staff evaluation of ADFs and biodiesel began in the early 2000s. During the informal rulemaking process, ARB staff conducted numerous meetings of the Multimedia Working Group (MMWG), multiple public workshops, and numerous meetings with individual stakeholders to discuss a proposed regulation. The MMWG is an inter-agency group responsible for oversight of multimedia evaluations. Below is a timeline of the public actions taken leading up to this proposal, each of the meetings below included opportunities for public comment, which were considered when developing the proposed ADF regulation.

Table 1.1: ADF Regulatory Development Timeline

Date	**Meeting**
2004-2005	Two Biodiesel Work Group Meetings
2006-2007	Five Meetings of the Biodiesel Work Group
2008-2009	Six Meetings of the Biodiesel Work Group
2010	Two Biodiesel Rulemaking Workshops
December 8, 2010	Multimedia Evaluation Meeting
October 4, 2011	Released Biodiesel Guidance Document
February 15, 2013	ADF Concept Paper
April 23, 2013	ADF Rulemaking Workshop
June 13, 2013	ADF Rulemaking Workshop
September 5, 2013	ADF Rulemaking Workshop
February 13, 2014	ADF Rulemaking Workshop
April 17, 2014	ADF Rulemaking Workshop
July 1, 2014	Webinar/Biodiesel Emissions Characteristic Study
October 20, 2014	ADF Rulemaking Workshop
November 21, 2014	Final ADF Rulemaking Workshop and Proposed Draft Regulatory Language

For each of the rulemaking meetings above, over 7,000 individuals or companies were notified and invited to participate. Each of these meetings was well attended by a variety of stakeholders including refiners, oil marketers, alternative fuel producers, non-governmental organizations, academia, and other State agencies. Notices for the workshops, and associated materials, were posted to ARB's biodiesel and renewable diesel webpage at: http://www.arb.ca.gov/fuels/diesel/altdiesel/biodiesel.htm, and emailed to subscribers of our "altdiesel" listserve. Rulemaking workshops were made available to remote attendees by either webcast or webinar in all cases.

In addition to the public meetings, staff had many meetings with stakeholders, attended trade meetings, and exchanged technical information on a regular basis with staff from other State agencies, academia, industry groups, and non-governmental organizations. As a result of this extensive communication with the affected entities, the proposal contained herein is based upon feedback from nearly every corner of the regulated industry as well as other impacted organizations and individuals that are affected by actions concerning or regulate the fuels industry.

Staff also conducted a Standardized Regulatory Impact Assessment (SRIA) in combination with the LCFS. As required by Senate Bill 617 (Chapter 496, Status of 2011), ARB conducted a SRIA and received public feedback and comments from the Department of Finance.

As part of the SRIA process, ARB solicited public input on alternative ADF approaches, including any approach that may yield the same or greater benefits than those associated with the proposed regulation, or that may achieve the goals at lower cost. Alternative approaches submitted to ARB were considered as staff prepared a SRIA. The combined SRIA of Low Carbon Fuel Standard and ADF summary is posted at: http://www.dof.ca.gov/research/economic_research_unit/SB617_regulation/2014_Major_Regulations/documents/ADF_DF_131_SUMMARY.PDF

F. Organization of This Report

This report is organized into twelve chapters with five appendices. We start with four chapters of background and introduction followed by chapters for description of the proposed regulation, alternatives considered, technology assessment, environmental assessment, multimedia assessment, economic impacts analysis of this proposed regulation and concluding with a summary and rationale for the regulation as well as a references chapter. The five appendices include Proposed Regulation Order, Technology Assessment, Economic Assessment, Standardized Regulatory Impact Assessment and California Environmental Quality analysis.

CHAPTER 2. CALIFORNIA MANDATES ON AIR QUALITY

A. Ambient Air Quality Standards

Ambient air quality standards (AAQS) are established to protect even the most sensitive individuals in our communities. An air quality standard defines the maximum amount of a pollutant that can be present in outdoor air without harm to the public's health. Both the ARB and the U.S. Environmental Protection Agency (U.S. EPA) are authorized to and have set ambient air quality standards. California has established AAQS standards for certain pollutants such as fine particulate matter (PM_{10}), ozone, carbon monoxide and sulfur dioxide, which are more protective of public health than federal ambient air quality standards. California has also set standards for some pollutants that are not addressed by federal standards in addition to six criteria pollutants that are on National AAQS list.

Air pollution harms the health of California residents, damages agricultural crops, forests and other plants, and creates the haze that reduces visibility. A large body of scientific evidence associates air pollution exposure with a variety of harmful health effects. To address air pollution, both the California ARB and the U.S. EPA have adopted ambient (outdoor) air quality standards. These legal limits on outdoor air pollution are designed to protect the health and welfare of Californians.

B. Greenhouse Gases and Climate Change

California Global Warming Solutions Act of 2006 (AB 32) outlined the process by which the Board would reduce GHG emissions in California to 1990 levels by 2020 - a reduction of approximately 30 percent by 2020, and then an 80 percent reduction below 1990 levels by 2050. Required actions are codified in H&SC section 38500 through 38599, and Executive Orders S-3-05 and B-16-2012. Some specific provisions of AB 32 included the following responsibilities of ARB:

- Prepare and approve a scoping plan for achieving the maximum technologically feasible and cost-effective reductions in GHG emissions from sources or categories of sources of GHG by 2020 (H&SC §38561); and
- Identify the statewide level of GHG emissions in 1990 to serve as the emissions limit to be achieved by 2020 (H&SC §38550); and
- Adopt a regulation requiring the mandatory reporting of GHG emissions (H&SC §38530); and
- Identify and adopt regulations for discrete early actions that could be enforceable on or before January 1, 2010 (H&SC §38560.5).

AB 32 also requires ARB to develop a Scoping Plan (H&SC §38561) which lays out California's strategy for meeting the GHG reduction goals. The Scoping Plan must be updated every five years and in December 2008, the Board approved the initial Scoping Plan, which included a suite of measures to sharply cut GHG emissions. In May 2014, ARB approved the First Update to the Climate Change Scoping Plan (Update), which

builds upon the initial Scoping Plan with new strategies and recommendations. The Update highlights California's progress toward meeting the near-term 2020 GHG emission reduction goals, highlights the latest climate change science and provides direction on how to achieve long-term emission reduction goal described in Executive Order S-3-05. Low Carbon Fuel Standard Program was one of the discrete early actions identified by ARB pursuant to AB 32.

CHAPTER 3. CALIFORNIA MOTOR VEHICLE DIESEL FUEL POLICIES

This chapter provides a summary of various State policies that affect motor vehicle diesel fuel and specifically the development of the ADF regulation. These policies broadly include statutes, regulations, or initiatives that impact the development of the ADF regulation.

A. California Health and Safety Code

California Senate and Assembly bills pertinent to motor vehicle diesel fuels are codified in the California Health and Safety Code (H&SC). These statutes are then administered as rules and regulations in the California Code of Regulations (CCR). The relevant statutes and regulations are provided below but are primarily contained in H&SC Division 26, Parts 1, 2, and 5; and CCR Division 3, Titles 13 and 17.

1. Development of Diesel Fuel Regulations

H&SC Sections 39600, 39601, 43013, 43018, 43101, and 43833 authorize the Board to adopt motor vehicle diesel fuel regulations. Section 43013 is the primary source of ARB's legal authority to adopt and implement motor vehicle fuel specifications, motor vehicle emission standards, and in-use performance standards for the control of air contaminants and sources of air pollution which the Board has found to be necessary, cost effective, and technologically feasible.

Section 43018 expands ARB's authority to adopt whatever control measures pertaining to fuels that are technologically feasible, cost-effective, and necessary to attain the state AAQS by the earliest practicable date.

2. Fuels Multimedia Evaluation

H&SC section 43830.8 requires the state Board to conduct a multimedia evaluation before adopting any regulation that establishes motor vehicle fuel specifications. Section 43830.8(b) defines "multimedia evaluation" as "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 specification."

Section 43830.8 also requires the California Environmental Policy Council (CEPC or Council) to review the multimedia evaluation and determine if any significant adverse impact on public health or the environment may result from a proposed regulation. If the Council determines that the proposed regulation will cause a significant adverse impact on public health or the environment, or that alternatives exist that would be less adverse, the Council shall recommend alternative or mitigating measures to reduce the adverse impact on public health and the environment.

B. Low Carbon Fuel Standard

In January 2007, Executive Order S-01-07 called for a low carbon fuel standard for transportation fuels to be established for California. The Executive Order specifies a reduction of at least 10 percent in the average carbon intensity of the State's transportation fuels by 2020.

The Executive Order instructed the California Environmental Protection Agency to coordinate activities between the University of California (UC), the California Energy Commission (CEC), and other state agencies to develop and propose a draft compliance schedule to meet the 2020 target. Furthermore, it directed ARB to consider initiating regulatory proceedings to establish and implement the LCFS. The ARB identified the LCFS as a discrete early action measure and approved it on April 23, 2009. The LCFS regulation reduces the carbon intensity of transportation fuels used in the State by an average of 10 percent by the year 2020 to be in line with Executive Order S-01-07.

California's LCFS is expected to reduce GHG emissions from the transportation sector in California by about 16 million metric tons (MMT) in 2020. These reductions account for almost 20 percent of the total GHG emission reductions needed to achieve the State's mandate of reducing GHG emissions to 1990 levels by 2020. In addition, the LCFS is designed to reduce California's dependence on petroleum, create a lasting market for clean transportation technology, and stimulate the production and use of alternative, low carbon fuels in California.

The LCFS is designed to provide a framework that uses market mechanisms, based on carbon intensity – a full lifecycle accounting of a fuel's carbon emissions relative to its energy potential, to spur the steady introduction of lower carbon fuels. The framework establishes performance standards that fuel producers and importers must meet each year beginning in 2011. Since the regulation went into effect, regulated parties have operated under the LCFS program with no significant compliance issues.

To date, the LCFS is working as designed and intended. Fuel producers are innovating and achieving reductions in their fuel pathway carbon intensities, an effect the LCFS regulation is expressly designed to encourage.

The LCFS, as well as other policies and incentives, are prompting the development and use of new ADFs in the State. As such, it is important to ensure that the full commercialization of these fuels do not adversely affect air quality or cause other environmental concerns. The proposed ADF regulation helps ensure this by subjecting new ADFs to rigorous environmental review and a comprehensive multimedia evaluation. In response to the LCFS, biodiesel production is projected to increase. As the LCFS and other policies continue to incentivize the use of ADFs, the proposed regulation will maintain air quality protections and address potential environmental and public health impacts.

Under the LCFS, biodiesel and emerging ADFs represent an important strategy for meeting annual compliance standards and will continue to be an essential part of California's fuel pool. The ADF regulation not only provides regulatory certainty for biodiesel and biodiesel blends, but also provides a clear pathway to streamline the commercialization of new ADFs in the future.

1. ADF Role within the Low Carbon Fuel Standard Program

The proposed ADF regulation is separate and not a part of the LCFS regulation, however the two are interconnected. The LCFS (among other policies and regulations) is expected to drive demand for biodiesel, renewable diesel, and other low carbon fuels. As a result of the increased use of biodiesel in recent years, interest has developed on the impacts of these fuels, especially as it relates to NOx emissions which had been identified as a potential concern. As such the proposed ADF regulation is a response in part to the LCFS and increased demand for biodiesel, as well as potential future demand for other ADFs.

2. Low Carbon Fuel Standard Litigation

Since the initial adoption of the LCFS in 2009, ARB has been involved with two separate lawsuits. The first, Rocky Mountain Farmers Union vs. Corey, relates to a federal lawsuit that challenges the LCFS on the grounds that the regulations were preempted by the federal Clean Air Act and the federal Energy Independence and Security Act and violated the dormant Commerce Clause. On December 29, 2011, the District Court granted Rocky Mountain Farmers Union's request for a preliminary injunction and American Fuels & Petrochemical Manufacturers Association's partial motion for summary judgment, concluding that the LCFS violated the dormant Commerce Clause of the U.S. Constitution. On September 18, 2013, the Ninth Court of Appeals reversed the District Court's opinion that held that the LCFS violated the dormant Commerce Clause and remanded the case for trial. The Ninth Circuit reversed on all but the Clean Air Act preemption claims and remanded for entry of partial summary judgment in favor of ARB.

A second lawsuit, POET, LLC vs. CARB was initiated on December 23, 2009, on the grounds that ARB violated the Administrative Procedure Act (APA) and California Environmental Quality Act (CEQA) during the adoption process. On July 15, 2013, the State of California Court of Appeal, Fifth Appellate District (Court) issued its opinion in POET, LLC v. California Air Resources Board (2013) 218 Cal.App.4th 681. The Court held that the LCFS would remain in effect and that ARB can continue to implement and enforce the 2013 regulatory standards while it takes steps to comply with APA and CEQA statutes.

Among the issues in the POET, LLC vs. CARB lawsuit was the treatment of biodiesel in the original LCFS regulation. The Court concluded that ARB violated CEQA by deferring the formulation of mitigation measures for NOx emissions from biodiesel without committing to specific performance criteria for judging the efficacy of the future

mitigation measures. In addition to the general impetus of this ADF regulation to protect air quality, it is also designed to fulfill the court's requirements and to address issues with NOx emissions from biodiesel. Implementation of this proposed regulation will ensure that the use of biodiesel subject to LCFS will not result in increases in NOx emissions in California relative to current conditions.

Also, in response to the Court's directive, ARB staff will propose re-adoption of the LCFS regulation in 2015. This will allow ARB to comply with all procedural requirements imposed by CEQA and the APA. As stated earlier, the Court held the 2013 regulatory standards in place until the LCFS regulation can be re-adopted. Since the LCFS is scheduled to be presented to the Board in early 2015, the new LCFS requirements are schedule to go into effect January 1, 2016. As part of the LCFS re-adoption effort, new elements and amendments are also being considered.

C. California Diesel Fuel Programs

Diesel and biodiesel are regulated by multiple state agencies in California. This section gives an overview of major state regulations affecting ADF use in California.

1. ARB Regulations

As the state air pollution agency, ARB is authorized to adopt standards, rules, and regulations to achieve the maximum degree of emission reduction possible from vehicular and other mobile sources in order to accomplish the attainment of the State ambient air quality standards at the earliest practicable date. ARB regulations can be found under California Code of Regulations (CCR) Division 3, Titles 13 and 17.

a. California Reformulated Diesel Fuel

In November 1988, the Board approved regulations limiting the aromatic hydrocarbon content to 10 percent by volume with a 20 percent limit for small refiners. These diesel fuel regulations, which became effective in 1993, are a necessary part of the State's strategy to reduce air pollution through the use of clean fuels, lower-emitting motor vehicles, and off-road equipment. The regulation includes provisions that enable diesel fuel producers and importers to comply through alternative diesel formulations that may cost less. The alternative specifications must result in the same emission benefits as the 10 percent aromatic standard (or in the case of small refiners, the 20 percent standard).

On July 24, 2003, the Board approved amendments to the California diesel fuel regulations. The amendments reduced the sulfur content limit from 500 ppmw to 15 ppmw for diesel fuel sold for use in California in on-road and off-road motor vehicles starting in mid-2006. The lower sulfur limit aligned the California requirement with the on-road diesel sulfur limit adopted by the U.S. EPA, but expanded the limit to include

off-road motor vehicle diesel fuel. The new sulfur standard enabled the use of the emissions control technology, such as particulate filters, used for 2007 and subsequent model-year heavy-duty engines and vehicles.

In 2005, the Board also adopted a measure that applied the diesel fuel standards to harborcraft and intrastate locomotives.

b. Alternative Fuels

"Alternative fuel" generally means any motor vehicle transportation fuel that is not gasoline or diesel fuel. This includes, but is not limited to, those fuels that are commonly or commercially known or sold as one of the following: M-100 fuel methanol, M-85 fuel methanol, E-100 fuel ethanol, E-85 fuel ethanol, biodiesel, compressed natural gas (CNG), liquefied natural gas (LNG), liquefied petroleum gas (LPG), or hydrogen.

The quality of alternative motor vehicle fuels is subject to ARB-approved composition specifications under Title 13, California Code of Regulations, Sections 2292.1 through 2292.6, as follows:

- M-100 fuel methanol (13 CCR §2292.1),
- M-85 fuel methanol (13 CCR §2292.2),
- E-100 fuel ethanol (13 CCR §2292.3),
- E-85 fuel ethanol (13 CCR §2292.4),
- compressed natural gas (13 CCR §2292.5), and
- liquefied petroleum gas (13 CCR §2292.6).

Biodiesel is considered to be an alternative diesel fuel, but there are currently no ARB standards for biodiesel fuel.

2. SWRCB Regulations

The California State Water Resources Control Board (SWRCB) regulates the storage of diesel and biodiesel in Underground Storage Tanks (UST). These tanks must undergo compatibility testing by an independent certification lab, such as Underwriters Laboratory, for any new fuel that may be stored in them. B5 has undergone such a certification. Fuels above B6 have not undergone independent certification and there is no current activity to obtain certification, as such B6-B20 blends of biodiesel are generally stored above ground.

3. CDFA Regulations

The Division of Measurement Standards (DMS) of the California Department of Food and Agriculture (CDFA) regulates diesel and biodiesel for compliance with California specifications and measurement. DMS is statutorily obligated to adopt specifications for

new fuels when an independent specification organization, such as ASTM, sets specifications for that fuel.

In 2008, ASTM international developed three biodiesel specifications. First, ASTM updated its specifications for B-100 blendstock, D6751-08, "Standard Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels." Second, ASTM approved revisions to D975-08, "Standard Specification for Diesel Fuel Oils," which would subject biodiesel blends from B1 to B5 to the same specification as regulation diesel fuel. Finally, ASTM adopted new fuel specifications for B-6 to B-20 in D7467-08, "Standard Specification for Diesel Fuel Oil Biodiesel Blend (B6 to B20)."

DMS conducted a rulemaking to adopt ASTM D6751 Standard Specification for Biodiesel fuel Blend Stock (B100) for use in Middle Distillate Fuels. DMS has also adopted ASTM D7467 Standard Specification for Diesel Fuel Oil, Biodiesel Blends (B6-B20). ASTM D975, Standard Specification for Diesel Fuel Oils, allows up to B5 to be used and has also been adopted by ASTM.

4. OSFM Regulations

The Office of the State Fire Marshal regulates diesel and biodiesel storage, dispensing, and vapor recovery. All diesel and biodiesel facilities must follow California building and fire code and adhere to the specific provisions regarding diesel and biodiesel.

5. Air Quality Improvement Program (AB 118)

The *California Alternative and Renewable Fuel, Vehicle Technology, Clean Air, and Carbon Reduction Act of 2007* (Assembly Bill (AB) 118) establishes two funding programs for alternative fuels and vehicle technologies.[1] The Air Quality Improvement Program (AQIP) is a voluntary incentive program administered by the ARB. Through AQIP, ARB invests in clean vehicle and equipment projects that reduce criteria pollutant and air toxic emissions, often with concurrent climate change benefits. For current information on annual funding plans and guidelines, please visit ARB's Air Quality Improvement Program website at http://www.arb.ca.gov/msprog/aqip/aqip.htm.
The Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP), administered by the CEC, is a competitive grant program that provides as much as $100 million annually towards innovative transportation and fuel technologies. The CEC's program is governed by its AB 118 Investment Plan, through which the CEC has provided nearly $415 million to date in funding for production and infrastructure projects involving diesel substitutes, including biodiesel and renewable diesel.[2] For more information on total funding amounts and clean transportation projects to date, please visit the CEC's ARFVTP website at http://www.energy.ca.gov/drive/index.html.

[1] Assembly Bill 118; Núñez, Chapter 750, Statutes of 2007
[2] California Energy Commission, *2014-2015 Investment Plan Update for the Alternative and Renewable Fuel and Vehicle Technology Program*, p. 1, April 2014

CHAPTER 4. FEDERAL POLICIES AFFECTING MOTOR VEHICLE DIESEL FUEL

This chapter summarizes various Federal policies that affect motor vehicle diesel fuel and may specifically impact the ADF regulation. The policies covered in this chapter include pertinent federal fuel regulations, standards, and requirements.

A. Federal Fuel Registration

U.S. EPA regulations establish fuel registration and formulation requirements. U.S. EPA requires that all diesel fuels and fuel additives for on-road motor vehicle use be registered in accordance with 40 Code of Federal Regulation (CFR) Part 79. To become registered, a new fuel must apply for registration and meet "substantially similar" requirements as either conventional gasoline or diesel fuel. The "substantially similar" requirement means that the fuel must be of mostly the same composition as the fuel it is displacing, which in the cases depicted under this regulatory proposal would be diesel fuel. Any biodiesel used in California must also be registered as a fuel with U.S. EPA.

The registration requirements for diesel fuels apply to fuels composed of more than 50 percent diesel fuel by volume, and their associated fuel additives. Manufacturers may enroll a fuel or fuel additive in a group of similar fuels and fuel additives through submission of jointly-sponsored testing and analysis conducted on a specific product, for which additives would be measured in parts per million (ppm). In addition, the regulation requires a cetane index of at least 40 or an aromatic hydrocarbon content of no greater than 35 volume percent. All on-road motor vehicle diesel fuel sold or supplied in the United States, except in Alaska, must comply with representative specifications for all products in that group.

B. Federal Regulations Affecting Diesel Fuel Quality

U.S. EPA motor vehicle diesel fuel standards, contained in 40 CFR Part 80 Subpart I, requires on-road motor vehicles diesel fuel to have a sulfur content of no greater than 15 ppmv.

The diesel fuel sulfur regulations require refiners, importers, distributors, and retailers who produce, import, sell, store, or transport diesel fuel to meet the standards specified in the diesel regulations. Sulfur standards were phased in from 2006 to 2010, and were designed to ensure widespread availability of highway diesel fuel containing 15 ppm sulfur or less.

C. Federal Renewable Fuels Standard

Congress adopted the Renewable Fuels Standard (RFS) in 2005 and strengthened it (RFS2) in December 2007 as part of the Energy Independence and Security Act of 2007 (EISA). The RFS2 contains, among other provisions, requirements for increasing

volumes of biofuels every year, up to a required volume of 36 billion gallons by 2022. New categories of renewable fuel were also established with separate volume requirements for each category.

Successful implementation of the RFS2 will result in significant quantities of low carbon intensity biofuels that could be used toward compliance with California's LCFS. In addition, successful implementation would also signal that the necessary technological breakthroughs to produce second and third generation biofuels have occurred.

1. Renewable Fuel Volume Requirements

The RFS2 requires fuel producers to use a progressively increasing amount of biofuel, culminating in at least 36 billion gallons of biofuel by 2022[3]. The U.S. EPA must establish regulations to ensure that the transportation fuel sold in, or imported into, the United States contains a minimum volume of renewable fuels as required under the EISA of 2007. Responsible parties under the U.S. EPA regulations relating to biofuels include refiners, blenders, and importers of transportation fuels.[4] RFS2 differentiates between "conventional biofuel" (corn-based ethanol) and "advanced biofuel." Advanced biofuel is renewable fuel, other than corn-based ethanol, with lifecycle greenhouse gas emissions that are at least 50 percent less than greenhouse gas emissions produced by gasoline or diesel. Starting in 2009, a progressively increasing portion of renewable fuels must be advanced biofuels, such as cellulosic ethanol.

2. Renewable Fuels GHG Requirements

The RFS2 requires GHG reductions for the various categories of renewable fuels, but only in discrete "bins" (e.g., both advanced biofuel and biomass-based diesel must achieve a life-cycle GHG emission-reduction threshold of 50 percent).[5] This federal program does not use a carbon intensity standard like the LCFS. As noted, there are specific requirements for the different classifications of renewable fuels. In general, these specifications are set relative to the baseline lifecycle GHG emissions for gasoline and diesel fuel sold or distributed in 2005. The lifecycle GHG emissions are specifically defined as:

> *"The term 'lifecycle greenhouse gas emissions' means the aggregate quantity of greenhouse gas emissions (including direct emissions and significant indirect emissions such as significant emissions from land use changes), as determined by the Administrator, related to the full fuel lifecycle, including all stages of fuel and feedstock production and distribution, from feedstock generation or extraction through the distribution and delivery and use of the finished fuel to the ultimate*

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[3] *Energy Independence and Security Act of 2007,* section 202 (a)(2)(B)(i)(I)

[4] U.S. Environmental Protection Agency, Office of Transportation and Quality. *EPA Finalizes Regulations for the National Renewable Fuel Standard Program for 2010 and Beyond,* EPA-420-F-10-007. February 2010

[5] U.S. Environmental Protection Agency, Office of Transportation and Quality. *EPA Lifecycle Analysis of Greenhouse Gas Emissions from Renewable Fuels,* EPA-420-F-10-006. February 2010

consumer, where the mass values for all greenhouse gases are adjusted to account for their relative global warming potential."[6]

There are four general classifications of renewable fuels defined in RFS2: renewable fuels, advanced biofuels, cellulosic biofuels, and biomass-based diesel.

3. Renewable Biomass Definition

The RFS2 defines renewable fuel as fuel that is produced from renewable biomass. Renewable biomass is then defined as each of the following[7]:

- Planted crops and crop residue harvested from agricultural land cleared or cultivated at any time prior to the enactment of this sentence that is either actively managed or fallow, and nonforested.
- Planted trees and tree residue from actively managed tree plantations on non-federal land cleared at any time prior to enactment of this sentence, including land belonging to an Indian tribe or an Indian individual, that is held in trust by the United States or subject to a restriction against alienation imposed by the United States.
- Animal waste material and animal byproducts.
- Slash and pre-commercial thinnings that are from non-federal forestlands, including forestlands belonging to an Indian tribe or an Indian individual, that are held in trust by the United States or subject to a restriction against alienation imposed by the United States, but not forests or forestlands that are ecological communities with a global or State ranking of critically imperiled, imperiled, or rare pursuant to a State Natural Heritage Program, old growth forest, or late successional forest.
- Biomass obtained from the immediate vicinity of buildings and other areas regularly occupied by people, or of public infrastructure, at risk from wildfire.
- Algae.
- Separated yard waste or food waste, including recycled cooking and trap grease

One aspect of the definition of renewable biomass is that there are significant federal incentive funds for producing advanced biofuels. To qualify for these incentives, the renewable fuels must be produced from renewable biomass.

4. U.S. EPA Rulemakings Implementing the RFS2

U.S. EPA is responsible for implementing the volume requirements in the RFS2. Section 211(o) of the Clean Air Act (CAA or the Act), as amended, requires the

[6] *Energy Independence and Security Act of 2007*, Title II-Energy Security Through Increased Production of Biofuels; Subtitle A Section 201 (1)(H).
[7] *Energy Independence and Security Act of 2007*, Title II-Energy Security Through Increased Production of Biofuels; Subtitle A Section 201 (1)(I).

U.S. EPA Administrator to annually determine a renewable fuel standard and publish the standard in the Federal Register. Based on this standard, each obligated party determines the volume of renewable fuel that it must ensure is consumed as motor vehicle fuel. This standard is calculated as a percentage, by dividing the amount of renewable fuel that the Act requires to be blended into gasoline for a given year by the amount of gasoline expected to be used during that year, including certain adjustments specified by the Act.

a. RFS2 Volume Requirement - 2013

In August 2013, U.S. EPA finalized the 2013 renewable fuel standards which established the 2013 annual percentage standards for cellulosic biofuel, biomass-based diesel, advanced biofuel, and total renewable fuel. [8]: Note that the 16.55 billion gallons of renewable fuel required in 2013 was projected to include approximately 1.7 billion gallons of biodiesel and renewable diesel. In April 2014, U.S. EPA took direct final action to revise the 2013 cellulosic biofuel standard. The final 2013 volumes are shown in Table 4.1 below.

Table 4.1: Volumes Used to Determine the Final 2013 Percentage Standards

Category	Volume*
Cellulosic Biofuel	810,185 gal
Biomass-based Diesel	1.28 billion gal
Advanced Biofuel	2.75 billion gal
Renewable Fuel	16.55 billion gal

*All volumes are ethanol-equivalent, except for biomass-based diesel which is actual.

The U.S. EPA also used the applicable volumes that are specified in the statute to set the percentage standards for advanced biofuel and total renewable fuel for 2013.[9] The percentage standards required under the RFS program represent the ratio of renewable fuel volume to non-renewable gasoline and diesel volume. The 2013 standards are shown in Table 4.2 below.

Table 4.2: Final Percentage Standards for 2013

Category	Percent
Cellulosic Biofuel	0.0005%
Biomass-based Diesel	1.13%
Advanced Biofuel	1.62%
Renewable Fuel	9.74%

b. RFS2 Volume Requirements - 2014

[8] U.S. Environmental Protection Agency, Office of Transportation and Quality. *EPA Finalizes 2013 Renewable Fuel Standards,* EPA-420-F-13-042. August 2013

[9] U.S. Environmental Protection Agency, Office of Transportation and Quality. *EPA Issues Direct Final Rule for 2013 Cellulosic Standard,* EPA-420-F-14-018. April 2014

In November 2013, U.S. EPA proposed 2014 percentage standards for cellulosic biofuel, biomass-based diesel, advanced biofuel, and renewable fuels.[10] The projected 2014 volumes used to determine the proposed percentage standards are shown in Table 4.5 below:

Table 4.3: Volumes Used to Determine the Proposed 2014 Percentage Standards

Category	Proposed Volume*	Projected Range
Cellulosic Biofuel	17 million gal	8-30 million gallons
Biomass-based Diesel	1.28 billion gal	1.28 billion gallons**
Advanced Biofuel	2.20 billion gal	2.0-2.51 billion gallons
Renewable Fuel	15.21 billion gal	15.00-15.52 billion gallons

* All volumes are ethanol-equivalent, except for biomass-based diesel which is actual
** U.S. EPA is requesting comment on alternative approaches and higher volumes

The percentage standards represent the ratio of renewable fuel volume to non-renewable gasoline and diesel volume. The proposed 2014 standards are shown in Table 4.6 below.

Table 4.4: Proposed Percentage Standards for 2014

Category	Percent
Cellulosic Biofuel	0.010%
Biomass-based Diesel	1.16%
Advanced Biofuel	1.33%
Renewable Fuel	9.20%

The proposed 2014 standards were submitted to the Office of Management and Budget of interagency review in August 2014. However, in November 2014, the U.S. EPA announced that it will not be finalizing the 2014 standards until 2015.

D. Federal Trade Commission Labeling Requirements

The EISA of 2007 required Federal Trade Commission (FTC) to adopt regulations pertaining to the labeling of biodiesel and biomass-based diesel at retail dispensing outlets. This regulation was enacted under Title 16, Code of Federal Regulations, Part 306.12. The regulation requires labeling of biodiesel and biomass-based diesel if the blend level is above 5 percent. Specifically it requires labeling of blend B6 to B20 and blends above B20 are required to be labeled by the exact amount of biodiesel for example B63. Biomass-based diesel labeling requirements are parallel but independent of biodiesel volume.

[10] U.S. Environmental Protection Agency. *2014 Standards for the Renewable Fuel Standard Program; Proposed Rule.* Federal Register. Volume 78, No. 230. Part II. 40 CFR 80. November 29, 2013

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CHAPTER 5. DESCRIPTION OF PROPOSED REGULATION

A. Overview of Proposed Regulation

The primary purpose of the proposed regulation is to create a framework that allows for innovation and diversity in the California diesel fuel pool while ensuring the introduction of ADFs is managed responsibly by setting up a three stage process to evaluate environmental impacts of ADFs. Additionally, this rulemaking will establish in-use specifications for biodiesel as part of Stage 3A requirements of the proposed regulation.

B. Applicability

The proposed regulation will apply to all producers, importers, blenders and distributors of ADFs in the State of California. Fuel that meets a specification under the alternative fuels regulation 13 CCR 2292 are not considered ADFs and are thus not subject to this regulation. It is ARB's intention that this proposed regulation be in effect at all points of sale, offer, or supply in the California fuel distribution infrastructure.

C. Definitions

For the purposes of sections 2293 through 2293.9, the definitions in H&SC sections 39010 through 39060 shall apply, except as otherwise specified in subarticle 1:

Section (a) covers the definitions in the proposed regulation.

Section (b) is a glossary of acronyms used in the proposed regulation.

D. Applicable Requirements for Alternative Diesel Fuels

It is the goal of this proposed regulation to ensure that there are no adverse environmental impacts of ADFs as they are introduced into California. This proposed regulation relies on a three-stage introduction of ADFs, through which the environmental impacts will be determined and, if necessary, any adverse impacts minimized.

1. Stage 1 (Pilot Program)

The first stage of this proposed regulation is referred to as a pilot program. Any new ADF proponent may apply to setup a pilot program in order to begin testing of their fuel in California. The pilot program will limit the amount of a new ADF, not to exceed the energy equivalent of one million gallons of diesel fuel, used in well-defined fleets. The pilot program will last for one year, with three opportunities to renew for six months each. The application for a pilot program includes public disclosure of many properties of the fuel that may affect its impact to the environment (e.g., density, distillation curve, and water-octanol partition coefficient). The EO will use this information to conduct a preliminary review of the fuel to determine whether it is appropriate for use in California and if any potential risks resulting from the use of the fuel in a pilot program are

outweighed by any potential benefits of the fuel. The EO will issue an Executive Order if the pilot program application is approved. The Executive Order will contain the necessary terms and conditions of additional testing based on the properties of the fuel. Completion of the terms of the Executive Order will be required prior to advancing to Stage 2. Applicants under a Stage 1 Executive Order will also be required to submit quarterly reports on how much fuel is being used.

2. Stage 2 (Fuel Specification Development)

Once an ADF applicant completes the terms of a Stage 1 Executive Order, they may apply for an updated Executive Order to move to Stage 2. The Stage 2 Executive Order will include a limit on the amount of that fuel that may be sold in California, to be determined by the EO but not to exceed the energy equivalent of 30 million gallons of diesel.

During Stage 2, an ADF applicant would be required to: (1) complete a multimedia evaluation, (2) achieve adoption of consensus standards, (3) obtain approval for use from 75 percent of engine manufacturers who produce engines in which the ADF is expected to be used, and (4) identify appropriate specifications for the fuel.

During Stage 2, ARB would make a determination of potential adverse emissions impacts from use of the ADF in question, using emissions data assembled during a multimedia evaluation. If it is determined that an ADF has been shown to have no potential adverse emissions impacts, the ADF would then be eligible to apply to advance to Stage 3B. If, however, it has determined there are potential adverse emissions impacts for the ADF or ADF blends, the ADF would be eligible to apply to advance to Stage 3A.

3. Stage 3 (Commercial Sales)

After completing the requirements of Stage 2, an ADF proponent may apply to the EO to move their fuel to Stage 3. If a determination of potential adverse emissions impacts was made under Stage 2, the EO may declare intent to advance the fuel to Stage 3A where an evaluation to determine whether there are adverse emissions impacts considering the effects of offsetting factors will commence. If the EO determines there are adverse emissions impacts the appropriate specifications and/or in-use requirements will be established by rulemaking. Throughout the course of a Stage 3A rulemaking, the volume limits from Stage 2 shall apply. In a Stage 3A rulemaking the EO shall consider, at a minimum, the offsetting effects of feedstocks, other fuel use, and vehicle effects when determining the appropriateness of establishing specifications and/or in-use requirements.

If the ADF was found to have no potential adverse emissions impacts, the EO may advance the ADF to Stage 3B by issuing an Executive Order with the specific provisions of the no potential adverse impacts determination. In Stage 3B, there are no limits on

the fuel volume a proponent may sell or supply for use in California. Stage 3B consists of reporting and recordkeeping for an ADF.

E. Biodiesel as an Alternative Diesel Fuel

Biodiesel will have completed all of the relevant steps that are outlined in Stage 2 of the proposed regulation by the time this proposed regulation is in full effect. Potential adverse impacts have been identified. As such, ARB is proposing to regulate biodiesel at stage 3A. Because of the potential adverse emissions impacts identified for NOx emissions, ARB is proposing to establish specifications and in-use requirements for biodiesel and its blends.

ARB is also proposing the in-use requirements come into effect on January 1, 2018, as time is needed to overcome logistical and other issues in implementation of in-use requirements. For example, use of the additive Di-tert-butyl peroxide (DTBP) will require replacement of steel tanks with stainless steel tanks, permitting of hazardous substance storage, approval by local fire agencies, additional additization infrastructure, and logistical business changes to acquire the additive. All of this is expected to take around 2 years to complete. Another method of compliance is re-routing higher blends to NTDEs. Research shows that the use of biodiesel in blends up to B20 in NTDEs results in no detrimental NOx impacts. This and other methods of complying with the in-use requirements, such as certification of additional options are also expected to take 2 years or more. Because compliance with the in-use options would be infeasible during initial implementation on January 1, 2016, only recordkeeping and reporting provisions will be implemented initially. The in-use requirements are proposed to come into effect on January 1, 2018.

Staff's statistical analysis found that for certain vehicles biodiesel has potential adverse emissions impacts on NOx in any blends of low saturation biodiesel (un-additized CN <56) but not in blends of high saturation biodiesel (un-additized CN ≥56) up to B10. Staff has also found that there exist offsetting factors, in the form of renewable diesel and NTDEs that are expected to reduce and eventually eliminate any NOx increase from low level blends (B5 or less) of low saturation biodiesel. In order to ensure that the use of higher blends of biodiesel do not increase NOx emissions, staff is proposing NOx control levels above which per gallon in-use requirements would be instituted. Table 5.1 below shows the proposed NOx control levels based on feedstock and time of year.

Table 5.1: NOx Control Levels

	Control Level (April 1 to October 31)	Control Level (November 1 to March 31)
Low Saturation BD	B5	B10
High Saturation BD	B10	B10

In the period between November 1 and March 31, NOx control for reduction of ozone is less necessary. In order to maximize the PM reductions from biodiesel and allow

increased flexibility for the biodiesel industry, ARB is proposing a control level of B10 for all biodiesel during this period.

Staff expects increasing use of NTDEs to eliminate biodiesel's NOx impact over time, thus the proposed biodiesel provisions include a sunset provision. ARB is proposing that the NOx control levels would sunset when EMFAC 2011 (ARB's model for estimating emissions from California on-road vehicles) shows more than 90 percent of Vehicle Miles Travelled (VMT) by NTDEs. The sunset provision is expected to trigger in 2023. However, staff has also proposed a review to be completed by December 31, 2019 in order to make sure that the offsetting factors are on track and that the in-use requirements for biodiesel are operating as expected.

Research indicates that the use of biodiesel in light- or medium-duty vehicles results in no detrimental NOx impacts. Research also indicates that the use of biodiesel up to blends of B20 in NTDEs results in no detrimental NOx impacts. Therefore, the proposed regulation also includes a process for fleets and fueling stations to become exempted from the in-use requirements for biodiesel blends up to B20 as long as they can demonstrate to the satisfaction of the Executive Officer that they are fueling at least 90 percent light or medium duty vehicles, or NTDEs.

CHAPTER 6. TECHNOLOGY ASSESSMENT

A. Introduction

This chapter summarizes the process by which ARB developed the conclusions on the NOx impacts of the use of biodiesel. This process includes the studies that ARB has sponsored, the additional studies upon which we based our analysis, as well as the statistical methods and study selection criteria that we used.

B. Emissions Studies Literature Review

Multiple studies have looked at the impact of biodiesel on heavy-duty diesel vehicle NOx emissions. The National Renewable Energy Lab (NREL) and the U.S. EPA have both examined the literature to determine these effects. Neither of these databases focused primarily on the effects of using CARB diesel as the base fuel. To fill this knowledge gap, ARB staff conducted a literature search that addresses the impacts of biodiesel use on NOx emissions in heavy duty engines using California diesel as the base fuel. It is important to focus on studies which use CARB diesel as the baseline, since multiple studies, such as the NREL and EPA studies referenced above, have found that base fuel impacts the presence and magnitude of a biodiesel NOx impact.

1. Criteria for Choosing Relevant Studies

The literature search focused on biodiesel blends B20 and below and characterized studies by their baseline fuel properties. Studies looking at B20 and below were chosen as the focus, since these are the fuels which are currently legal commercially. Studies that used either explicitly CARB diesel or a diesel fuel that was tested to have a cetane number of at least 49 were included in the analysis. Non-CARB diesel that had a cetane number of at least 49 was determined by staff to be similar enough to CARB diesel in NOx emissions to treat as CARB diesel for the purposes of this analysis, including showing similar emissions result when testing biodiesel blends derived from these fuels.

The studies included in this analysis were all performed using an engine dynamometer with commercially available engines, and no engine modifications. Engine dynamometer data were chosen over chassis dynamometer data because they eliminate some variability and as such are able to get a more accurate representation of true fuel to fuel variances. For example, since chassis dynamometer requires a person driving who would attempt to match an acceleration curve and engine dynamometer curves are performed by a computer, driver to driver variability is eliminated. Studies using test cycles based on a single speed and mode were excluded from this analysis because their results do not transfer well to real world emissions. Instead studies that used test cycles such as the Federal Test Procedure (FTP) or Urban Dynamometer Drive Schedule (UDDS) were selected because these cycles vary load and engine speed over the cycle in order to approximate real world operation.

2. Major Studies

Below is a list of the studies that met the stated criteria for inclusion in this analysis from our literature search.

Table 6.1: Major Studies from Literature Search

Author	Title	Publication	Year
Clark	Transient Emissions Comparisons of Alternative Compression Ignition Fuels	SAE 1999-01-1117	1999
Durbin	Biodiesel Characterization and NOx Mitigation Study	UC Riverside, prepared for CARB	2011
Durbin	CARB B5 Biodiesel Preliminary and Certification Testing	UC Riverside, prepared for CARB	2013
Durbin	CARB B20 Biodiesel Preliminary and Certification Testing	UC Riverside, prepared for CARB	2013
Eckerle	Effects of Methyl Ester Biodiesel Blends on NOx Emissions	SAE 2008-01-0078	2008
Karavalakis	CARB B5 Biodiesel Characterization Study	UC Riverside, prepared for CARB	2014
McCormick	Fuel Additive and Blending Approaches to Reducing NOx Emissions from Biodiesel	SAE 2002-01-1658	2002
McCormick	Regulated Emissions from Biodiesel Tested in Heavy-Duty Engines Meeting 2004 Emissions	SAE 2005-01-2200	2005
Nikanjam	Performance and Emissions of Diesel and Alternative Diesel Fuels in a Heavy-duty Industry-Standard Older Engine	SAE 2010-01-2281	2010
Nuzkowski	Evaluation of the NOx Emissions from Heavy Duty Diesel Engines with the Addition of Cetane Improvers	Proc. I Mech E Vol. 223 Part D: J. Automobile Engineering: 1049-1060	2009
Thompson	Neat Fuel Influence on Biodiesel Blend Emissions	Int J Engine Res Vol. 11: 61-77	2010

In order to better understand emissions from biodiesel, ARB considered NOx data from literature studies as well as ARB studies from a wide range of vehicles feedstocks and test cycles. Table 6.2 below summarizes the testing matrix that was completed in studies included in the literature search.

Table 6.2: Summary of Testing Included in Literature Search

Application	Engine	Feedstocks	Test Cycles
On-road chassis	Caterpillar C15 Cummins ISM DDC MBE4000 Cummins ISX	Animal Soy Renewable diesel GTL	UDDS FTP 40mph Cruise 50mph Cruise
On-road HD engine	Cummins ISM DDC MBE4000 DDC Series 60	Animal Soy	UDDS FTP SET
Non-road engine	John Deere 4084 Kubota TRU	Animal Soy	ISO 8178-4

These studies found that most of the emissions from biodiesel are reduced from the CARB diesel baseline, including PM, CO, HC, and most toxic species. However, NOx was found to increase for certain biodiesel blend levels and feedstocks. Generally, it was found that soy based biodiesel blends had greater NOx emissions than those derived from animal based biodiesel. The results of these studies apply specifically to heavy-duty vehicles that do not use post-exhaust NOx emissions control, therefore the results of this study should not be extended to NTDEs or Light-duty and Medium-duty vehicles.

3. Effect of Base Fuel on Emissions

EPA 2002[11] examined the effect that base fuel has on the emissions results of biodiesel blends and found that using clean base diesel, such as CARB diesel, may impact the results in NOx emissions from biodiesel. As a result of this conclusion, ARB staff began looking into the effect that biodiesel might have on blends used within the State of California specifically. California's diesel fuel tends to be lower in aromatic hydrocarbon content and higher in cetane number than federal diesel. These two properties are important in the formation of NOx. After extensive testing and review, staff confirms EPA's original analysis and finds that the effects of biodiesel on NOx with CARB diesel as a base fuel are greater than the effects using federal diesel as a base fuel. As an example, EPA 2002 found NOx increases of about two percent in B20 derived from soy when federal diesel is the base fuel, whereas ARB's literature review finds NOx increases of about four percent in B20 derived from soy when CARB diesel is the base fuel. These results are discussed more in section C of this chapter.

C. NOx Emissions Data Analysis

ARB staff re-analyzed original data from three engine dynamometer studies that look at B5 to examine whether biodiesel blends yield different NOx emissions from conventional diesel fuel.[12,13,14] Staff chose to focus on engine studies because the

[11] U.S. Environmental Protection Agency, *A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions*, 2002

[12] Durbin et al., *Biodiesel Characterization and NOx Mitigation Study,* October 2011

variability in emission measurements is smaller than for vehicles. A small change in emissions due to biodiesel would require a larger sample size to detect if vehicle data were used.

Our analysis focused primarily on soy B5, since soy is expected to be the dominant feed stock, and the existence of a significant effect at the 5% blend level would imply the existence of an effect at higher blend levels. Staff analyzed each blend level separately, and did not make any assumptions about whether the relationship between blend level and NOx emissions is linear or not.

Engine type and drive cycle have a significant impact on NOx emissions, and differences from one study to another can lead to large variations in emissions. We therefore controlled for these three variables in the statistical model. Out of several possible ways to reflect this in the model, we chose a simple approach: we treated the combination of engine type, drive cycle and study as a single categorical variable which we called the "experiment", and considered each experiment as yielding an independent estimate of the difference in NOx emissions between soy B5 and conventional diesel.

Past experience with emissions data suggests that transforming emissions by taking logarithms (or equivalently, working with percent differences instead of absolute differences) is appropriate. Staff confirmed this with model diagnostics.

Staff used a linear mixed effects model, with experiment as a random effect, fuel type as a fixed effect, and the natural logarithm of NOx emissions as the response, to estimate the difference in NOx emissions from soy B5 relative to CARB diesel.[15,16] Staff used R statistical software, specifically the `lmer` model fitting routine from R's `lme4` package.[17,18] The result: B5 yields approximately 1% higher NOx emissions than CARB diesel, and the increase is highly statistically significant (confidence level > 99.9999%).

Staff performed numerous sensitivity checks on the results. Staff tried several different formulations of the mixed model, as well as other statistical models. Staff also experimented with including other data sets that were not used for the final analysis. In each case soy B5 yielded around 1% higher NOx emissions than CARB diesel, and in each case the result was statistically significant.

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[13] Durbin et al., *CARB B5 Biodiesel Preliminary and Certification Testing*, April 2013

[14] Karavalakis et al., *CARB Comprehensive B5/B10 Biodiesel Blends Heavy-Duty Engine Dynamometer Testing*, June 2014

[15] Nester et al.,(1996). *Applied Linear Statistical Models*, Fourth Edition, Irwin. US

[16] Draper N, Smith H (1998). *Applied Regression Analysis*. Third Edition, Wiley Interscience. US

[17] R Core Team (2013). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0. http://www.R-project.org/

[18] Bates et al., (2014). lme4: Linear mixed-effects models using Eigen and S4. R package version 1.1-7 http://CRAN.R-project.org/package=lme4

As a further check against ARB staff's results, ARB contracted with Prof. David Rocke of U.C.Davis to analyze the same data set and derive independent conclusions. Prof. Rocke's analysis is attached as Appendix F. His results matched ARB staff's: soy B5 yielded approximately 1% higher NOx emissions than CARB diesel. The increase was highly statistically significant (confidence level > 99.9999%).

Further analysis of other biodiesel blends yielded the following results:

Soy B10	approximately 2% higher than CARB diesel
Animal B5	no statistical difference
Animal B10	no statistical difference

These results are consistent with a linear relationship between blend level and NOx emissions for soy blends in the 5-10% range. However, no data were available for blend levels below 5%, and it is not possible to establish whether the relationship is linear in the 0-5% range.

It should be noted that this testing demonstrates the results of a specific fuel formulation on specific engines in controlled laboratory conditions. To translate this to any potential real-world emission impact requires consideration of many factors (e.g., number of NTDE engines, amount of renewable and other low-NOx diesel, amount of low saturation vs high saturation biodiesel, and any NOx-reducing additives).

The complex mechanisms creating NOx increases at different biodiesel levels are not completely understood. The NOx emissions appear to be affected primarily through thermodynamic interactions, yet other factors have also been proposed. For example, Bunce et. al.,[19] looked at engine factors such as air to fuel ratio, EGR fraction, rail pressure and start of injection, as well as cetane number, soot radiation, bulk modulus, Engine Control Module feedback, and adiabatic flame temperature as factors that could serve to control engine NOx emissions. The complex interactions created by the fuel and engine system demonstrate the uncertainty inherent in translating the results of laboratory testing to real world emissions effects. The consistent and highly significant findings for NOx give certainty that there is an effect compared to CARB diesel.

D. Biodiesel Emissions in Heavy-Duty Diesel Engines

Below staff presents emissions effects of biodiesel based on the literature search described in section B of this chapter. The average data below are based on averages of the data found in the literature search and are not weighted as they were in the statistical analysis above. These results should thus be used as estimates of the effect of biodiesel as no attempt was made to weight them according to representativeness of the engines tested in the California Heavy duty vehicle fleet. For the rest of this chapter staff refers to soy biodiesel as low saturation biodiesel, and animal biodiesel as high saturation biodiesel. This is explained more fully in section 4.

[19] Bunce et al, *Stock and Optimized Performance and Emissions with 5% and 20% Soy Biodiesel Blends in a Modern Common Rail Turbo-Diesel Engine,* Energy Fuels*,* 2010**,** *24* (2), pp 928–939

1. NOx Emissions

Biodiesel blend level was found to be directly related to NOx emissions level. Additionally, the NOx emissions from biodiesel were found to be dependent upon the saturation level of the biodiesel feedstock: high saturation feedstocks (animal in the studies) had less NOx emissions than low saturation feedstocks (soy and other lower cetane number feedstocks). Engine and duty cycle did not have substantial impacts on the NOx emissions. Table 6.3 below shows NOx emissions based on biodiesel blend levels and feedstock saturation.

Table 6.3: Biodiesel NOx Emissions by Blend Level and Feedstock Saturation

(∆NOx Emissions)	**B5**	**B10**	**B20**
Low Saturation	1.1%	1.8%	4.0%
High Saturation	-0.2%	0.1%	1.5%

2. PM Emissions

Biodiesel blend level was found to be inversely correlated to PM emissions. Biodiesel feedstock or test method did not seem to substantively affect PM emissions. In 2007 and later engines equipped with PM filters, it was difficult to identify any meaningful differences in PM emissions between CARB diesel and biodiesel. Table 6.4 below shows PM emissions results by blend level.

Table 6.4: PM Reductions by Biodiesel Blend Level in pre-2007 Engines

(∆PM Emissions)	**B5**	**B10**	**B20**
Pre-2007 Engines	-4.7%	-8.9%	-19.0%

3. VOC Emissions

Biodiesel blends generally had lower VOC emissions than CARB diesel, however in 2007 and later engines with PM filters it was difficult to identify any trends, likely because PM filters generally also include diesel oxidation catalysts which are designed to reduce VOCs. Effects of feedstocks and test cycles were not clear. Table 6.5 below shows VOC emissions in pre-2007 engines.

Table 6.5: VOC Emissions by Biodiesel Blend Level in pre-2007 Engines

(∆VOC Emissions)	**B5**	**B10**	**B20**
Pre-2007 Engines	-2.2%	-3.1%	-10.1%

4. Effect of Biodiesel Properties on Emissions

NOx emissions from biodiesel are influenced by the feedstock from which the biodiesel is produced. Chemically the main properties of the biodiesel that are related to NOx

appear to be the level of saturation and the chain length. Biodiesel is produced in such a way that several properties of the feedstock (e.g., saturation level, chain length) are retained in the biodiesel product. These chemical properties influence physical properties in fuel delivery and combustion that are important to the way the engine operates and thus relate to NOx emissions. The physical properties of interest include modulus of incompressibility, fuel atomization, and ignition delay; these properties are intercorrelated.

Rather than specifying feedstocks and their specific relationship with NOx emissions, which can pose technical and logistical difficulties for determination and tracking, it is preferable to separate biodiesel feedstocks and their NOx emissions potential using performance based properties. Staff is aware of two performance properties that have been shown to be reasonably well correlated to NOx emissions differences between feedstocks: Cetane number and iodine value. Neither of these properties are direct indicators of NOx emissions, but are surrogate values for predicting the chemical and physical properties which are related to NOx emissions. Cetane number has been shown to be a better indicator of NOx emissions differences than iodine number, but has problems when the fuels are additized with cetane enhancing additives.

Durbin 2011 showed that use of the cetane enhancing additive DTBP mitigated the NOx increases from a soy biodiesel. That same study showed that another cetane enhancing additive, 2-ethylhexyl nitrate (2-EHN), did not mitigate the NOx increases from a soy biodiesel. In fact, there were no differences between unnaditized biodiesel blends and additized biodiesel blends using 2-EHN. This result shows that the difference in NOx emissions from biodiesel is not based solely on cetane number of the mixture but on the properties of the biodiesel. Therefore, if cetane is used as an indicator of the NOx differences between biodiesel feedstocks, it should be measured prior to addition of cetane enhancing additives.

Alternatively, iodine number may be used to predict NOx differences between biodiesel feedstocks since it is not sensitive to cetane enhancing additives and is a measure of saturation of a fuel. Iodine number also has potential issues since it only addresses biodiesel saturation, and does not include the important effects of biodiesel chain length. However, this may not be an issue as the currently most frequently used feedstocks are very similar in chain length (primarily C16 and C18), and is not likely to become a problem unless more exotic feedstocks such as coconut oil (primarily C12) become popular. Staff proposes to use unadditized cetane number as the determinant of saturation level, since it is more frequently tested for by biodiesel producers and is more closely correlated to NOx emissions than iodine number.

5. Comparison of Vehicle Chassis to Engine Data

Vehicle chassis dynamometer and engine dynamometer are two popular methods of measuring the work exerted during emissions testing. In both cases, the goal is to relate the amount of emissions to some relevant value, generally grams/mile for chassis dynamometer and gram/brake horsepower hour for engine dynamometer. While

chassis dynamometer certainly has its place and is able to better distinguish vehicle to vehicle differences, due to the use of the whole vehicle in testing, it adds greatly to the variability of testing, due to the driver, transmission and other sources of variability not present in engine testing. Therefore, when testing for fuel specific effects it is most appropriate to use engine dynamometer testing. As such, staff's analysis of specific numeric quantification of biodiesel emissions testing relies upon engine dynamometer studies.

It should be noted that although chassis dynamometer studies were not relied upon for quantification of emissions effects of biodiesel, staff examined several studies that included results using chassis dynamometer and they were directionally similar to the results staff got using engine data.

6. Emissions in New Technology Diesel Engines

Engines that meet the latest emission standards through the use of Selective Catalytic Reduction (SCR) have been shown to have no significant difference in NOx emissions based on the fuel used. A study conducted by the NREL looked at two Cummins ISL engines that were equipped with SCR, and found that NOx emissions control eliminates fuel effects on NOx, even for B100 and even in fuels compared against a CARB diesel baseline.[20] However, a recent study at UC Riverside tested B50 blends and found a NOx increase with a 2010 Cummins ISX.[21] The UC Riverside study did not look at blends below B50. Staff proposes to take a precautionary approach and in the light of data showing there may be a NOx impact at higher biodiesel blends but not at lower biodiesel blends, staff is limiting the conclusion of no detrimental NOx impacts in NTDEs to blends of B20 and below. Additional studies on NTDEs have been completed, however since they included either retrofit engines or non-commercial engines staff did not include their results in this analysis.[22,23,24]

7. Renewable Diesel NOx Emissions

Renewable diesel (as well as Gas-to-liquid diesel) has been found to decrease NOx emissions relative to CARB diesel. Durbin 2011 found that use of pure renewable diesel or GTL fuel reduced NOx emissions by about 10 percent relative to CARB diesel, and was found to be fairly linear according to blend level. Additionally as part of the

[20] Lammert et al., *Effect of B20 and Low Aromatic Diesel on Transit Bus NOx emissions Over Driving Cycles with a Range of Kinetic Intensity*, SAE Int. J Fuels Lubr., 5(3):2012
[21] Gysel et al., *Emissions and Redox Activity of Biodiesel Blends Obtained from Different Feedstocks from a Heavy-Duty Vehicle Equipped with DPF/SCR Aftertreatment and a Heavy-Duty Vehicle without Control Aftertreatment,* SAE 2014-01-1400 Published 04/01/2014
[22] McWilliam et al., Emission and Performance Implications of Biodiesel Use in an SCR-equipped Caterpillar C6.6 2010-012157 Published 10/25/2010
[23] Mizushima et al., *Effect of Biodiesel on NOx Reduction Performance of Urea-SCR System* 2010-01-2278 Published 10/25/2010
[24] Walkowicz et al., *On-Road and In-Laboratory Testing to Demonstrate Effects of ULSD, B20, and B99 on a Retrofit Urea-SCR Aftertreatment System*, SAE Int. 2009-01-2733

mitigation testing in that study, it was found that blends containing at least 2.75 gallons of renewable diesel per gallon of biodiesel were NOx neutral compared to CARB diesel.

E. Biodiesel Effects in Light and Medium Duty Vehicles

Light-duty and medium-duty vehicles have been found not to experience increases in NOx due to the use of biodiesel. For example, a study performed on three light-duty vehicles using different biodiesel blends found no significant and consistent pattern in NOx emissions based on blend levels across the different engines, blends and cycles.[25,26]

F. Biodiesel Effects in Non-road and Stationary Engines

1. Emissions from Non-road Engines

Durbin 2011 included two non-road engines in its test matrix, a John Deere 4084 and a Kubota TRU engine. Generally, the trends and magnitude of emissions for these engines were similar to those for the study as a whole. In general, NOx emissions increased, PM and HC emissions decreased with increasing biodiesel blend levels. The table below shows selected emissions for the John Deere and Kubota TRU engines, from a soy feedstock.

Table 6.6. Emissions from non-road engines on soy biodiesel

Engine	Blend Level	NOx	p-value	PM	p-value	HC	p-value
John Deere	B20	2.82%	0.021	-23.25%	0.028	-5.22%	0.498
	B50	7.63%	0.000	-31.75%	0.013	-15.12%	0.104
	B100	13.76%	0.000	-55.93%	0.000	-27.54%	0.001
Kubota TRU	B20	2.25%	0.086	-6.91%	0.011	-5.68%	0.153
	B100	18.89%	0.000	-40.30	0.000	-58.53%	0.000

2. Emissions from Stationary Engines

Stationary engines were not tested as part of staff's studies on biodiesel and no data were found on them during the literature search. As a conservative measure staff assumes that biodiesel also increases NOx at similar rates in stationary engines as in on-road and non-road engines.

G. NOx Emission Control Techniques

As a result of the Mitigation Study completed by UC Riverside and ARB, several technically feasible options were identified that would ensure no NOx increase as a

[25] Nikanjam et al, *Performance and Emissions of Diesel and Alternative Diesel Fuels in Modern Light-Duty Vehicles*, SAE 2011-24-0198, 2011

[26] Durbin et al., *Regulated Emissions from Biodiesel Fuels from On/Off-road Applications*, Atmospheric Environment, Volume 41, p. 5647-5658, 2007

result of biodiesel use. The options that were identified reduce NOx to parity with conventional CARB diesel by using additives or altering the baseline fuel.

The Mitigation study found that a blend of 1 percent di-tert butyl peroxide in B20 yielded NOx emissions that were equivalent to the CARB diesel baseline. Additionally, the Mitigation Study found that a blend of 55 percent renewable diesel, 25 percent CARB diesel and 20 percent biodiesel was equivalent to the CARB diesel baseline. Additionally, 2-ethylhexyl nitrate (2-EHN) was tested to determine whether it would also be able to mitigate the NOx from biodiesel blends since it is also a cetane improver. However, the fuels containing 2-EHN had essentially the same NOx emissions as those without additives. The difference between the NOx emissions of these blends compared to baseline CARB diesel is shown in the Table 6.3 below.

Table 6.7: NOx Emissions of Mitigation Measures

Fuel Blend	NOx Diff % from CARB diesel	p-value
B20 1%DTBP	0.0 %	0.959
C25 R55 B20	-0.8 %	0.029
B20 1% 2-EHN	6.3 %	0.000

In addition to the use of additives, staff is including certification procedures to allow for innovation and to allow the market to determine the best option for mitigation while ensuring no increase in NOx from the use of biodiesel. The certification option is based on the CARB diesel certification procedures under title 13 CCR section 2282(g). The certification requires a minimum of 20 tests each on a CARB diesel reference fuel and a candidate fuel. This number of replicates ensures that any emissions differences between the candidate fuel and the reference diesel are detected if they exist.

H. Determination of NOx Control Level for Biodiesel

Staff considered several factors in the analysis of what level of NOx control would be appropriate for biodiesel, primarily:

- NOx increase associated with biodiesel,
- Effects of high vs low saturation feedstocks,
- NOx reducing impacts of renewable diesel,
- Penetration rate of NTDEs,
- Reductions in emissions of pollutants other than NOx, and
- Feasibility of control methods.

When considering the impacts of biodiesel by feedstock, ARB determined that most of the biodiesel used in California would be low saturation biodiesel, which was found to have NOx increases at B5 with no clear point of NOx neutrality with CARB diesel. To be conservative, ARB has assumed that all blends containing low saturation biodiesel caused NOx increase.

ARB considered the range of factors which affect NOx emissions from diesel engines in the commercial market. NTDEs, which are increasing in number in California, do not show increased NOx from biodiesel use up to B20. Additionally, renewable diesel, which is increasing in California in response to the LCFS, reduces NOx. Given their impact on NOx emissions, renewable diesel and NTDEs are considered offsetting factors. Staff's analysis was designed to determine the appropriate blend level considering the Nox controls achieved by the above offsetting factors. Staff's analysis concluded that existing trends regarding use of NTDEs and renewable diesel as well as other factors supports a NOx control level of B5 for low saturation and B10 for high saturation biodiesel from April 1st to October 31st, and B10 for low and high saturation biodiesel from November 1st to March 31st.

For biodiesel blends below the NOx control level no in-use requirements are proposed because their use would not increase NOx emissions in the environment above current conditions after considering offsetting factors. In-use requirements will, under staff's proposal, be required for use of blends higher than NOx control level. These requirements could be met through the use of the additive DTBP, targeting exempt fleets, or certification of alternative options. The proposal addresses the seasonality of potential detrimental air quality impacts primarily related to summer-time ozone, and therefore allows a higher B10 blend for both low and high-saturation biodiesel during the low ozone season. Staff's analysis suggests that there will likely be no secondary PM detriment from the higher blends allowed in the low ozone season and may be benefits due to the direct PM reductions from biodiesel.

The net impacts of the proposal reduce NOx impacts from biodiesel, even assuming increased biodiesel volumes over the subsequent years. Estimated impacts under the proposal are less than the baseline (current year) and will continue to decrease as NTDE use increases in California. This proposal provides the maximum feasible level of mitigation while still achieving GHG and PM emission reductions.

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CHAPTER 7. AIR QUALITY AND ENVIRONMENTAL JUSTICE

A. Introduction

This chapter outlines the expected air quality impacts of the proposed regulation as well as an analysis of potential effects of the ADF regulation on environmental justice and local communities. The CEQA related requirements and findings are discussed in Chapter 8 as well as the attached Environmental Analysis document attached in Appendix D.

B. Air Quality

One of the primary goals of the ADF regulation is to ensure no significant environmental impacts as a result of the use of ADFs. As such ARB is proposing an environmental review process through the three stage evaluation of ADFs, as well as provisions for biodiesel as the first commercial ADF. Biodiesel provides important air quality benefits, primarily in the form of PM and GHG emissions reductions. Use of biodiesel is expected to contribute to ARB's short and long term air quality and climate goals.

Biodiesel has been found to increase NOx emissions in some circumstances, depending on feedstock, blend level, and vehicle technology. Staff anticipates that over the long term offsetting factors, such as NTDEs and renewable diesel, will grow as a result of other ARB regulations and will eliminate any adverse NOx impacts associated with the use of biodiesel. However, until the offsetting factors reach a critical point (90 percent of on-road heavy-duty VMTs operated by NTDE) there is a risk that use of higher blends of biodiesel (greater than B5) could result in NOx emissions higher than the current levels in 2014. In order to eliminate this risk, ARB is proposing a NOx control level that varies depending on the saturation level of the biodiesel feedstock and the time of year.

In 2014, staff estimates that approximately 72 million gallons of biodiesel and 120 million gallons of renewable diesel were consumed in California. These volumes combined with the use of NTDEs resulted in an increase in NOx of about 1.3 tons per day (TPD) and a decrease in PM of about 0.8 TPD statewide compared to use of CARB diesel alone. Once the proposed ADF and LCFS regulations are adopted staff anticipates that NOx emissions will decrease from current levels. As a result of the in-use requirements on biodiesel, staff expects that use of biodiesel above B5 will not result in NOx impacts. Table 7.1 shows the expected NOx impacts of biodiesel compared to 2014, including offsetting factors.

Table 7.1: Fuel Volumes and Resulting NOx emissions relative to 2014 levels

Million gallons	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Low Saturation B5	72	97	129	160	150	150	150	150	150
RD	120	180	250	300	320	360	400	500	550
NTDE VMT %	40%	51%	60%	66%	71%	75%	80%	85%	89%
Net NOx TPD	0.0	-0.06	-0.08	-0.09	-0.51	-0.75	-0.9	-1.17	-1.26

The result of staff's analysis concludes that the proposed LCFS and ADF regulations will have long term air quality benefits with reductions in NOx expected as well as reductions in PM and GHG emissions.

C. Environmental Justice and Local Communities

Government Code section 65040.12(e) defines environmental justice as the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies. ARB is committed to supporting the achievement of environmental justice. In 2001, the Board adopted a framework for incorporating environmental justice into the ARB's programs consistent with the directives of State law.[27] Although ARB's environmental justice policies apply to all communities in California, they recognize that environmental justice issues have been raised more often in the context of low-income and minority communities.

As a result of ARB's work with the public, the business sector, local government, and air districts, California's ambient air is the cleanest since air quality measurements have been recorded.[28] Whereas the Los Angeles area experienced 148 smog alerts in 1970, by the year 2000, there was not a single smog alert.[29] However, large numbers of Californians live in areas that continue to experience episodes of unhealthy concentrations of ozone and PM2.5.

For this analysis, we note as an initial matter that any community in proximity to operations involving diesel fueled vehicles is already experiencing incremental risks from exposure to diesel particulate matter (PM). In 1998, ARB identified diesel PM as a toxic air contaminant with no safe threshold of exposure, which means that any diesel PM exposure may increase lifetime cancer risk for affected communities. Consequently, ARB embarked on a comprehensive diesel risk reduction program in the

[27] California Air Resources Board, Report, *Policies and Actions for Environmental Justice*, 2001
[28] California Air Resources Board, *History of Air Resources Board*, Website, http://www.arb.ca.gov/knowzone/history.htm, November 16, 20120 (accessed October 4, 2013)
[29] California Air Resources Board, Video file, *Clearing California Skies Updated*, http://www.arb.ca.gov/videos/clskies.htm (accessed October 4, 2013)

early 2000s, implementing a number of stationary, mobile, and portable diesel engine standards; fleet emission controls; and diesel fuel requirements designed to address such risks.

This proposed rulemaking is designed to maintain the air quality protections already in place under ARB's existing diesel fuel regulations. This includes, but is not limited to, maintaining protections in the only two areas nationwide whose air quality nonattainment status has been classified as "extreme," the San Joaquin Valley Air Basin and the South Coast Air Basin. Both areas have active environmental justice groups that have lobbied ARB to take aggressive action in pursuit of reduced toxic emission releases and attainment of ambient standards to ease air quality-related health burdens on their communities.

The air quality impacts of this regulatory proposal promote environmental justice by maintaining current protections for California's air quality in areas that are simultaneously the most adversely affected with respect to ground level ozone and home to many minority and low-income groups. At the same time, the proposed rulemaking provides a clear legal pathway to the commercialization of innovative, lower carbon diesel fuel substitutes. These innovative substitutes will reduce GHG emissions, and many of them also provide benefits in the form of additional reductions in PM, CO, NOx, toxic air contaminants, and other air pollutants.

As noted in Chapter 6, ADFs have the potential to reduce exposure to pollutants when used as a replacement for conventional diesel. To the extent that the proposed regulation expedites the introduction of ADFs as replacements for conventional diesel, all communities will benefit from improved air quality. In general, staff anticipates that any impacts resulting from the proposed regulation will be beneficial in nature, as a result of introducing new, lower-emitting ADFs.

To further ensure maintenance of air quality protections at the community level, the proposed regulation contains provisions that require a new ADF proponent to disclose comprehensive information about the ADF and the proponent's plan for limited fleet testing of that fuel. This comprehensive and detailed level of information required to be submitted before testing begins will permit ARB staff to assess the potential impacts such vehicle fleet studies could have on the most sensitive communities. Pertinent to the sensitive communities is a provision in the proposal that requires disclosure, in the Stage 1 and Stage 2 phases, of the ZIP codes in which the applicant proposes to conduct the limited vehicle fleet testing. The ARB staff will consider the proposed ZIP codes, along with the feasibility of conducting the fleet tests in alternative locations, as part of the Stage 1 and Stage 2 approval process. Depending on a number of factors, including the nature of the candidate ADFs and the extent of the fleet test, ARB staff may suggest or require a different location for the study as appropriate and feasible.

Based on staff's assessment of current and future ADFs, such as biodiesel and dimethyl ether, it is likely that new ADFs will exhibit less PM emissions relative to conventional diesel. In such cases, communities will benefit from lower cancer risk associated with

the replacement of diesel fuel with ADFs. Likewise, communities will also benefit from any reductions in other criteria and toxic air pollutants associated with ADF use. The State mandated multimedia assessment will determine whether future ADFs will exhibit any increases in other toxic compounds, which may warrant additional controls. Moreover, since the proposed regulation provides for a more orderly process than currently exists towards commercialization, ARB would have more oversight over the approval of any ADF use in local communities and can ascertain whether additional requirements should apply to safeguard against any adverse impacts.

In addition to governing the approval and use of future ADFs, the proposed regulation would also explicitly identify biodiesel as the first ADF commercialized under this regulation. Biodiesel has an extensive history of environmental evaluation and consensus standard development. Indeed, much of the proposed regulation is modeled on ARB staff's experience in evaluating biodiesel over the years. As a result, the proposed regulation would explicitly identify biodiesel as a Stage 3A ADF, "Commercial Sales Subject to Mitigation," in recognition of the fact that biodiesel already has effectively undergone the requirements in Stage 1 and 2.

As discussed in Chapter 6 and the multimedia evaluation, biodiesel has been shown to reduce PM, HC, CO and greenhouse gases from diesel engines. Therefore, replacing diesel with biodiesel provides an immediate reduction in toxic cancer risk that is proportional to the percent reduction in PM emissions. Likewise, reductions in HC and CO also help communities by lowering near source and regional concentrations of ozone and CO.

Being the first commercially recognized ADF under the proposed regulation, biodiesel will have positive long term overall air quality impacts and benefits for all communities, and near term benefits to PM and GHG emissions. Staff expects that in the longer term (post 2022) no NOx mitigation will be necessary for biodiesel blends up to B20 due to the adoption of NTDEs.

In conclusion, the proposed ADF regulation is designed to ensure that the introduction and use of innovative ADFs in California, including biodiesel, will have no significant adverse environmental or public health impacts, as the heavy duty diesel fleet transitions to NTDEs. This conclusion applies at the State level as a whole, at the various air basin and regional levels, and at the local community level. As a result, the proposed regulation maintains the environmental and human health protections that are already provided under the existing diesel fuel regulations.

CHAPTER 8. ENVIRONMENTAL ANALYSIS

The Air Resources Board (ARB), as the lead agency for the proposed regulation, has prepared an environmental analysis under its certified regulatory program (17 CCR 60000 – 60008) to comply with the requirements of the California Environmental Quality Act (CEQA). ARB's regulatory program, which involves the adoption, approval, amendment, or repeal of standards, rules, regulations, or plans for the protection and enhancement of the State's ambient air quality has been certified by the California Secretary for Natural Resources under Public Resources Code section 21080.5 of CEQA (14 CCR 15251(d)). ARB, as a lead agency, prepares a substitute environmental document (referred to as an "Environmental Analysis" or "EA") as part of the Staff Report to comply with CEQA (17 CCR 60005).

The Draft Environmental Analysis (EA) for the proposed regulation is included in Appendix D to this Staff Report. The Draft EA provides a single coordinated programmatic environmental analysis of an illustrative, reasonably foreseeable compliance scenario that could result from implementation of the proposed Alternative Diesel Fuel (ADF) regulation and the proposed re-adoption of the Low Carbon Fuel Standard (LCFS) regulation. The proposed ADF and LCFS regulations have two separate regulatory notices and staff reports and will be considered by the Board in separate proceedings. This approach is consistent with CEQA's requirement that an agency consider the whole of an action when it assesses a project's environmental effects, even if the project consists of separate approvals (14 CCR 15378(a)).

The Draft EA states that implementation of the proposed regulations could result in beneficial impacts to GHGs through substantial reductions in emissions from transportation fuels in California from 2016 through 2020 and beyond, long-term beneficial impacts to air quality through reductions in criteria pollutants, and beneficial impacts to energy demand. The Draft EA also states the proposed regulations could result in less than significant or no impacts to mineral resources, population and housing, public services, and recreation; and potentially significant and unavoidable adverse impacts to aesthetics, agriculture resources, biological resources, cultural resources, geology and soils, hazards and hazardous materials, hydrology and water quality, land use and planning, noise, transportation and traffic, and utilities, and short-term construction-related air quality impacts primarily related to the construction projects and minor expansions to existing operations that are reasonably foreseeable as a result of the proposed regulations.

Written comments on the Draft EA will be accepted starting January 2, 2015 through 5 p.m. on February 17, 2015. The Board will consider the Final EA and responses to comments received on the Draft EA before taking action to adopt an ADF regulation.

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CHAPTER 9. MULTIMEDIA EVALUATION

H&SC section 43830.8 prohibits ARB from adopting any regulation that establishes motor vehicle fuel specifications unless that regulation is subject to a multimedia evaluation and reviewed by the CEPC. Pursuant to Public Resources Code section 71017(b), the CEPC was established as a seven-member body comprised of the Secretary for Environmental Protection; the Chairpersons of the ARB and SWRCB; and the Directors of the Office of Environmental Health Hazard Assessment (OEHHA), the Department of Toxic Substances Control (DTSC), the Department of Pesticide Regulation (DPR), and the Department of Resources Recycling and Recovery (CalRecycle). Key components of the evaluation process are the identification and evaluation of significant adverse impacts on public health or the environment and the use of best available scientific data.

A. General Overview

"Multimedia evaluation" means the identification and evaluation of any significant adverse impact in public health or the environment, including air, water, and soil, that may result from the production, use, and disposal of a motor vehicle fuel that may be used to meet the state board's motor vehicle fuel specifications (H&SC §43830.8(b)).

1. Multimedia Working Group

The California Environmental Protection Agency (Cal/EPA) formed the interagency multimedia working group (MMWG) to oversee the multimedia evaluation process. The MMWG includes representatives from the ARB, SWRCB, OEHHA, and DTSC. The MMWG also consults with other Cal/EPA agencies and experts as needed.

During a multimedia evaluation, ARB staff are responsible for the air quality impact assessment and overall coordination of the MMWG. SWRCB staff are responsible for the evaluation of surface water and groundwater quality and potential impacts. OEHHA staff are responsible for evaluating potential public health impacts. DTSC staff are responsible for evaluating potential hazardous waste and soil impacts.

2. California Environmental Policy Council

Before ARB adopts a regulation that establishes new fuel specifications, the CEPC must determine if the proposed fuel specification poses a significant adverse impact on public health or the environment. In making its determination, the CEPC must consider the following:

- emissions of air pollutants, including ozone-forming compounds, particulate matter, toxic air contaminants, and greenhouse gases,
- contamination of surface water, groundwater, and soil,
- disposal of waste materials, including agricultural residue, forest biomass, and municipal solid waste, and

- MMWG staff report and peer review comments.

The CEPC must complete its review of the evaluation within 90 calendar days following notice from ARB that it intends to adopt the regulation. If the CPEC determines that the proposed regulation will cause a significant adverse impact on public health or the environment, or that alternatives exist that would be less adverse, the CEPC shall recommend alternative measures to reduce the impact.

3. External Scientific Peer Review

H&SC section 43830.8(d) requires an external scientific peer review to be conducted on the multimedia evaluation in accordance with H&SC section 57004. The purpose of the peer review is to determine whether the scientific portions of the staff report are based upon "sound scientific knowledge, methods, and practices (HSC section 57004(d)(2))."

B. Summary of the Biodiesel and Renewable Diesel Multimedia Evaluation

As part of the ADF regulation, staff intends to establish fuel quality specifications for biodiesel. Therefore, a multimedia evaluation of biodiesel and renewable diesel fuel was conducted pursuant to H&SC section 43830.8 and the *Guidance Document and Recommendations on the Types of Scientific Information Submitted by Applicants for California Fuels Environmental Multimedia Evaluations,* ("Multimedia Evaluation Guidance Document").[30]

The MMWG prepared two staff reports entitled, "*Draft Staff Report: Multimedia Evaluation of Biodiesel*" (Biodiesel Staff Report)[31] and "*Draft Staff Report: Multimedia Evaluation of Renewable Diesel*" (Renewable Diesel Staff Report).[32] The draft staff reports consist of the MMWG's assessment of the biodiesel and renewable diesel multimedia evaluations conducted by the UC Berkeley and UC Davis, and the MMWG's analysis of potential significant adverse impacts on public health and the environment.

The MMWG's conclusions and recommendations are based on the results of the multimedia evaluation and the information provided in the UC final reports entitled, "*California Biodiesel Multimedia Evaluation Final Tier III Report*" (Biodiesel Final Report)[33] and "*California Renewable Diesel Multimedia Evaluation Final Tier III Report*" (Renewable Diesel Final Report).[34]

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[30] U.C. Berkeley, U.C. Davis, Lawrence Livermore National Laboratory, *Guidance Document and Recommendations on the Types of Scientific Information Submitted by Applicants for California Fuels Environmental Multimedia Evaluations*, June 2008

[31] Multimedia Working Group, California Environmental Protection Agency. *Staff Report: Multimedia Evaluation of Biodiesel"* November 2013

[32] Multimedia Working Group, California Environmental Protection Agency. *Staff Report: Multimedia Evaluation of Renewable Diesel"* November 2013

[33] U.C. Berkeley, U.C. Davis, *California Biodiesel Multimedia Evaluation Final Tier III Report*, May 2013

[34] U.C. Berkeley, U.C. Davis, *California Renewable Diesel Multimedia Evaluation Final Tier III Report*, April 2012

1. Biodiesel Multimedia Evaluation

The MMWG completed their assessment of the biodiesel multimedia evaluation and potential impacts on public health and the environment. The evaluation is a relative comparison between biodiesel and CARB diesel.

The MMWG concludes that the use of biodiesel fuel in California, as specified in the biodiesel multimedia evaluation, does not pose a significant adverse impact on public health or the environment relative to CARB diesel.

Each agency's individual assessments and conclusions are summarized below:

- Air Emissions Evaluation. ARB staff assessed potential air quality impacts and made conclusions based on their assessment of various emissions test results and air quality data, including criteria pollutants, toxic air contaminants, and greenhouse gas emissions data. ARB staff concludes that biodiesel reduces PM, CO, and HC emissions and may increase NOx emissions in some blends.

- Water Evaluation. SWRCB staff assessed potential surface water and groundwater impacts and made conclusions based on their assessment of potential water impacts and materials compatibility, functionality, and fate and transport information. SWRCB staff concludes that there are minimal additional risks to beneficial uses of California waters posed by biodiesel than that posed by CARB diesel.

- Public Health Evaluation. OEHHA staff assessed potential public health impacts and made conclusions based on their assessment of potential impacts on atmospheric carbon dioxide and combustion emissions results. OEHHA staff concludes that the substitution of biodiesel for CARB diesel reduces the rate of addition of carbon dioxide to the atmosphere and reduces the amount of PM, benzene, ethyl benzene, and polycyclic aromatic hydrocarbons (PAHs) released into the atmosphere, but may increase emissions of NOx for certain blends. Limited emission testing resulted in a non-statistical increase in acrolein for a higher B50 biodiesel blend level (i.e., confidence interval less than 95%). Furthermore, the statistical analysis for acrolein emission results was compared to only one data point for the control sample.

- Soil and Hazardous Waste Evaluation. DTSC staff assessed soil and hazardous waste impacts and made conclusions based on their evaluation of hazardous waste generation and potential impacts on the fate and transport of biodiesel fuel in the subsurface soil from unauthorized spills or releases. DTSC concludes that biodiesel aerobically biodegrades more readily than CARB diesel, has potentially higher aquatic toxicity for a small subset of tested species, and generally has no significant difference in vadose zone infiltration rates.

2. Renewable Diesel Multimedia Evaluation

The MMWG completed their assessment of the renewable diesel multimedia evaluation in support of low NOx standard. The evaluation is a relative comparison between renewable diesel and CARB diesel.

The MMWG concludes that the use of renewable diesel fuel in California, as specified in the renewable diesel multimedia evaluation, does not pose a significant adverse impact on public health or the environment relative to CARB diesel.

Each agency's individual assessments and conclusions are summarized below:

- Air Emissions Evaluation. ARB staff assessed potential air quality impacts and made conclusions based on their assessment of various emissions test results and air quality data, including criteria pollutants, toxic air contaminants, and greenhouse gas emissions data. ARB staff concludes that renewable diesel does not pose a significant adverse impact on public health or the environment from potential air quality impacts.

- Water Evaluation. SWRCB staff assessed potential surface water and groundwater impacts and made conclusions based on their assessment of potential water impacts and materials compatibility, functionality, and fate and transport information. SWRCB staff concludes that there are minimal additional risks to beneficial uses of California waters posed by renewable diesel than that posed by CARB diesel.

- Public Health Evaluation. OEHHA staff assessed potential public health impacts and made conclusions based on their analysis of toxicity testing data and combustion emissions results. OEHHA staff concludes that PM, benzene, ethyl benzene, and toluene in combustion emissions from diesel engines using hydrotreated vegetable oil renewable diesel are significantly lower than CARB diesel.

- Soil and Hazardous Waste Evaluation. DTSC staff assessed soil and hazardous waste impacts and made conclusions based on their evaluation of hazardous waste generation and potential impacts on the fate and transport of biodiesel fuel in the subsurface soil from unauthorized spills or releases. DTSC concludes that renewable diesel is free of ester compounds and has low aromatic content. The chemical compositions of renewable diesel are almost identical to that of CARB diesel. Therefore, the impacts on human health and the environment in case of a spill to soil, groundwater, and surface waters would be expected to be similar to those of CARB diesel.

C. Biodiesel and Renewable Diesel Peer Review

The peer review process was initiated by submittal of a request memorandum to the manager of the Cal/EPA Scientific Peer Review Program. The memorandum was prepared by ARB as the lead agency of the MMWG and included a summary of the nature and scope of the requested review, descriptions of the scientific issues to be addressed, and a list of recommended expertise. Upon approval, the University of California, through an interagency agreement with Cal/EPA, identified seven reviewers to complete the review of the biodiesel and renewable diesel multimedia evaluations.

The MMWG requested reviewers to address the Biodiesel and Renewable Diesel Staff Reports separately. Therefore, each reviewer completed two separate reviews, accordingly, for a total of 14 reviews.

In general, the peer reviewers determined that the conclusions and recommendations made by the MMWG were based upon sound scientific knowledge, methods, and practices, including the overall finding that the use of biodiesel and renewable diesel fuel in California, as specified in the biodiesel and renewable diesel multimedia evaluation, respectively, do not pose a significant adverse impact on public health or the environment relative to CARB diesel.

The complete set of peer review comments are posted on the *Fuels Multimedia Evaluation Meetings and Documents* webpage.[35] Individual peer review comments are categorized under the following general topics:

- Air quality
- Public health
- Water quality
- Soil and hazardous waste
- Multimedia evaluation
- Staff report
- Source reports
- Proposed regulation

The MMWG are preparing written responses to each of the comments. The complete set of peer review comments and MMWG responses will be included in the staff reports as new chapters, including any revisions to the staff reports that were made to address comments, where appropriate.

D. Current Status and Next Steps

The Biodiesel Staff Report is currently undergoing supplemental external peer review and internal MMWG analysis. Upon completion of the MMWG's review and

[35] Air Resources Board. *Fuels Multimedia Evaluation Meetings and Documents* webpage: http://www.arb.ca.gov/fuels/multimedia/meetings/meetings.htm

assessment of additional biodiesel studies and comments from the initial peer review, ARB intends to update and modify the Biodiesel Staff Report.

The supplemental external peer review of biodiesel will focus on the modifications to the MMWG's assessment of the biodiesel multimedia evaluation and the scientific basis for which the proposed modifications are based.

The supplemental peer review is currently scheduled from January to February 2015. Once all peer review comments are received, the MMWG will prepare written responses and make any revisions to the staff report, as needed. After all comments have been addressed, the MMWG will finalize the staff reports for submittal to the CEPC. The Cal/EPA will then convene a public meeting of the CEPC to consider the results of the peer reviews and the overall multimedia evaluation of biodiesel and renewable diesel fuel. Based on the evaluation and public comments, the CEPC will determine if the proposed regulation will cause a significant adverse impact on public health or the environment.

CHAPTER 10. ECONOMIC IMPACTS ASSESSMENT

A. Summary of Economic Impacts

In preparing this economic analysis, staff considered the costs of complying with the general provisions prescribed for Stage 1, Stage 2, and Stage 3 (as described in Chapter 5) of the proposed regulation. The compliance costs are determined on a fuel-by-fuel basis and will depend on whether a new ADF achieves full commercial development and successfully completes all three stages. Full commercialization of new ADFs in California will depend on successful resolution of a myriad of technical issues including, but not limited to, vehicle performance, fuel infrastructure compatibility, public health and environmental issues. If a new ADF completes all three prescribed stages, then only minimal recordkeeping and reporting above and beyond requirements that are already required under other State and Federal mandates will be the costs attributable to this regulation. These reporting requirements would be satisfied with reporting currently done through the Low Carbon Fuel Standard Reporting Tool (LRT) used to claim LCFS credits.

Because the majority of the provisions in all three stages are already required under existing State and Federal programs, staff estimates that the overall cost of the regulation to commercialize a future ADF will be minimal for the majority of ADF producers or distributors and would mainly account for additional, or "enhanced," recordkeeping. Other than biodiesel, no other ADF has undergone more than a preliminary analysis akin to Stage 1 of this proposal. The environmental impacts of those potential fuels are unknown, as that is determined in Stage 2 during the multimedia evaluation. For an ADF under Stage 3B, there will be minimal costs attributable to the proposed regulation because those ADFs would be subject to the same reporting requirements as all other commercial motor vehicle fuels, and no costs if reporting is done via the LRT. Without knowing the type of ADF and associated volumes that may come to market in the future, pollutant control costs cannot be estimated for those fuels commercialized under Stage 3A. Since biodiesel is the first commercialized ADF to be regulated under this proposal, the cost for biodiesel suppliers to comply with the regulation is addressed in this chapter as the costs of the regulation.

As noted, biodiesel has already undergone the equivalent of the proposal's Stages 1 and 2. Accordingly, biodiesel would be sold in the California market under Stage 3A upon this proposed regulation becoming effective. Staff propose to incorporate certain provisions in Stage 3A to ensure NOx emissions from biodiesel use do not cause any significant adverse impacts. These include per gallon NOx emission control requirements from April 1st through October 31st, for low saturation biodiesel blends above B5, as well as for blends above B10 for high saturation biodiesel. From November 1st through March 31st, the in-use requirements are relaxed and permit both low and high saturation biodiesel blends up to B10 for use without these in-use requirements. The current California biodiesel market currently uses and is projected to continue using the majority of the biodiesel produced in the state to create blends below B5, and therefore, we project limited costs due to NOx control requirements.

Biodiesel and biodiesel blends are being currently sold in California without regulatory oversight to safeguard against potential adverse emissions impacts, including NO_x. As such, the biodiesel industry has not invested in the additive blending infrastructure required for NO_x emissions controls, nor have they pursued certifications of low NO_x emissions biodiesel formulas. This absence of any NOx emissions controls infrastructure was brought up in the National Biodiesel Board's (NBB) submittal of an alternative to the proposed regulation, which also recommended a lead-in period. Given the current lack of NO_x emissions controls infrastructure, staff proposes that the in-use requirements not take effect until 2018, or two years after the implementation date of the regulation. Staff believes that two years is sufficient to provide the biodiesel industry with time to invest in the infrastructure necessary for additive handling and blending; to develop and pursue certifications for new NOx reduction options; and to adopt potential commercial changes such as focusing on exempted NTDE fleets. Also, this two year period is in keeping with established ARB policy, as many other ARB regulations have also provided similar grace periods to their affected industries; allowing them time to adjust their business practices and minimize adverse fiscal impacts, especially in cases where no regulatory oversight existed before.

The proposed regulation is not expected to have a significant adverse economic impact on California businesses or their competitiveness. However, the proposed ADF regulation will have some minimal economic costs to ADF fuel providers, including producers, distributors, and possibly retailers. In addition, consumers and government agencies that opt to fuel their fleets with biodiesel blends requiring NO_x emissions controls may experience an increase in fuel costs provided their fleets consist of heavy duty vehicles without NTDEs, though these costs are small. ARB determined that the regulation does not pose any requirements that will have an adverse economic impact. The highest cost year of the regulation is 2018 with a cost of $3,071,000 to produce both B10 and B20 blends. This represents less than one-one hundredth of the economic activity in California in 2018. Additionally, the direct costs to the industry are a small portion of the industry revenues and can likely be absorbed by either the ADF business or passed along to consumers. Finally, these additional costs will likely be offset by the revenue from credit generation in the LCFS program and therefore not impact the regulated entities significantly.

B. Major Regulations

ARB is subject to two separate major regulation requirements, identified below:

For a major regulation proposed on or after November 1, 2013, a standardized regulatory impact assessment (SRIA) is required. A major regulation is one "that will have an economic impact on California business enterprises and individuals in an amount exceeding fifty million dollars ($50,000,000) in any 12-month period between the date the major regulation is filed with the Secretary of State through 12 months after the major regulation is estimated to be fully implemented, as estimated by the agency." (Govt. Code Section 11342.548). This requirement is triggered if either the direct,

indirect and induced costs, or taken separately, the benefits exceed $50 million. The economic impacts of this regulation may exceed $50 million, and therefore the regulation is treated as major according to the Government Code. In response, ARB prepared and submitted a SRIA to the Department of Finance[36].

For purposes of Health and Safety Code Section 57005(b), "major regulation" means any regulation that will have an economic impact (compliance cost) on the state's business enterprises in an amount exceeding ten million dollars ($10,000,000), as estimated by the board, department, or office within the agency proposing to adopt the regulation in the assessment required by subdivision (a) of Section 11346.3 of the Govt. Code. This regulation may impose compliance costs that exceed $10 million and therefore the regulation is treated as major for the Health and Safety Code.

C. Economic Impacts Assessment

As discussed in Chapter 5, biodiesel is currently the only ADF identified as subject to the proposed regulation. Given the fact that biodiesel currently has consensus standards, is completing a multimedia assessment, and has an identified NOx emissions impact and in-use pollutant control strategies, staff proposes to recognize biodiesel as a Stage 3A commercial ADF subject to in-use requirements under specified conditions.

Therefore, only the cost of biodiesel compliance in Stage 3A would be attributable to the proposed regulation, and drives all the actual costs of the regulation. This means that the cost of biodiesel as the first commercial ADF will be primarily the cost of enhanced monitoring with minor costs due to in-use requirements. As staff discussed in Chapter 6, in-use requirements for NO_x control are unlikely to be utilized for most of the biodiesel sold in the state. In the unlikely scenario of blends requiring NO_x controls reaching wide scale market share in the future, the cost of these controls would also be attributable to the proposed regulation. NO_x control costs are presented in Appendix C.

Staff projects the same overall volumes of pure biodiesel (B100) will be produced as in business as usual. However, the blend levels will be adjusted downward to meet the provisions outlined in this regulation. Staff identified the following options that may occur in reaction to the ADF regulation:

Option 1: Businesses will use NO_x emissions controls and continue selling at the same level. Staff believes the majority of businesses will not opt to use NO_x emissions controls given that other options are less costly and therefore more feasible. These businesses will have an option to sell biodiesel blends up to B10 in the winter months.

Option 2: Businesses will continue selling blends with in-use requirements such as B20 at existing volumes by targeting NTDE fleets with exemptions from the in-use requirements. Many of the existing retailers (and therefore distributors), are already working with functionally exempt fleets. For example, staff discovered that many B20

[36] SRIA: http://www.dof.ca.gov/research/economic_research_unit/SB617_regulation/2014_Major_Regulations/

fueling pumps cannot accommodate HDVs because of low ceiling clearance and inaccessible facilities. As such, these retailers could seek exemptions that allow them to continue selling B20 to the medium and light duty vehicles, which these retail pumps are designed to accommodate. For the retailers that can accommodate HDVs, some change in their business practices will have to occur, such as establishing a dedicated lane for NTDEs that wish to use biodiesel blends such as B20. These business will also the option to sell biodiesel blends up to B10 in the winter months

Option 3: Businesses will stop selling B20 and only offer lower blends. For the retailers they may lose some business, which is likely negligible as the consumers of these fuels will likely transition from B20 to lower blends. The distributors will be able to stay in business, but have to change their business practices to accommodate a change to lower blends. For instance: they will likely have to distribute lower blends by truck, potentially leading to increased truckloads. These business also will have an option to sell biodiesel blends up to B10 in the winter months

Staff believes the reality will be a mix of these options. This chapter assumes the following scenario, which is evaluated in detail in this chapter:

Staff estimates that in 2018 the market share of biodiesel blends requiring NO_x controls will be around 17 percent (30 million gallons out of 180 of the total biodiesel volumes sold in the state), with volumes projected to remain steady until 2021 when total biodiesel volumes increase to 185 million gallons. These volumes then remain at 185 million gallons until 2023 when NTDE VMT exceeds 90 percent of total VMT in EmFAC 2011. At that point the in-use requirements will sunset and use of B20 will be allowed without in-use requirements.

- For all seasons, high saturation biodiesel has a NOx emissions control requirement at the level of B10. Staff assumes high saturation biodiesel will be sold at B10 with only the cost of testing to verify the high saturation exemption to the requirement for NOx emissions controls at the B5 level.
- The projection of VMT by NDTEs is 71 percent in 2018. Assuming some portion of these vehicles will be targeted by the B20 industry, coupled with additional B20 use in light and medium-duty vehicles, staff calculates 8 million gallons of B100 used in B20 will be exempted for all seasons in 2018. The VMT by NTDE's increases in the subsequent years from 75 percent in 2019 to 98 percent in 2023. As the VMT of the NTDE fleets increases, so will the proportion of biodiesel volumes with exemptions to the in-use requirements.
- The final 9 million gallons of low saturation biodiesel will be divided between winter and summer. Assuming slightly less biodiesel is used in the winter; staff assumes 4 million gallons in winter and 5 million in summer. The summer use will require a NOx emissions control of 5 percent DTBP per gallon of B100. The remaining 4 million will be used in winter as B10 without any in-use requirements.

This scenario is summarized in the table below, using volumes projected for 2018:

Table 10.1 Summary of Costs for 2018

Million Gallons of biodiesel blended above B5	Category of Use	Requirement	Cost in 2018
5	High-saturation use in summer as B10	Testing to verify high saturation*	$215,000
8	Low-saturation used in exempted fleets and vehicles in all seasons	Use in exempted fleets such as NTDEs, medium and light duty vehicles	Recordkeeping (included as part of $56,000.00)
5	Low-saturation use in summer as B20	5% DTBP per gallon of B100	$2,800,000
12	Low-saturation use in winter as B10	No NOx controls in winter for B10 and below (Nov 1-March 31)	Recordkeeping (included as part of $56,000.00)
Total: 30 million gallons			Total: $3,071,000**

* See Appendix C for testing costs methodology

** Includes reporting and recordkeeping costs for 150 million gallons of B100 used for blends below

As mentioned earlier, staff assumes the volumes of biodiesel with NO_x controls to decrease as the volumes of biodiesel used in exempted fleets such as NTDEs, medium and light duty vehicles increase each year. The table below reflects the changing scenario on increased NTDEs and the subsequent reduction in costs. Table 10.2 demonstrates how the volumes, and associated costs, of high saturation biodiesel for summer use and NO_x controls for low saturation biodiesel decreased while the volumes of low saturation biodiesel blends in exempted fleets increased; when compared to table 10.1. In 2023, only the cost of recordkeeping and reporting would apply due to the sunset provision.

In addition to the in-use requirement costs listed in Tables 10.1 and 10.2, the industry will face additional recordkeeping costs, which are outlined below. Following this discussion, this chapter will identify the costs as indicated in the table above.

Table 10.2 Summary of Costs for 2021

Million Gallons of biodiesel blended above B5	Category of Use	Requirement	Cost in 2021
2	High-saturation use in summer as B10	Testing to verify high saturation*	$86,000
14	Low-saturation used in exempted fleets and vehicles in all seasons	Use in exempted fleets such as NTDEs, medium and light duty vehicles	Recordkeeping (included as part of $56,000.00)
2	Low-saturation use in summer as B20	5% DTBP per gallon of B100	$1,120,000
12	Low-saturation use in winter as B10	No NOx controls in winter for B10 and below (Nov 1-March 31)	Recordkeeping (included as part of $56,000.00)
30			$1,262,000**

* See Appendix C for testing costs methodology

** Includes reporting and recordkeeping costs for 150 million gallons of B100 used for blends below

1. Cost of Enhanced Recordkeeping

Because staff is proposing to allow commercialization of biodiesel under Stage 3A with in-use requirements for low and high saturation biodiesel blends, detailed market sales and related information would be required from biodiesel producers to track blend levels and compliance with the in-use requirements. We anticipate similar compliance costs if pollutant controls are identified for future ADFs that are approved for commercialization under this regulation. For an ADF with no such controls identified, there will be no costs attributable to the proposed regulation because those ADFs would be subject to the same reporting requirements as all other commercial motor vehicle fuels. Biodiesel retailers will not experience any quantifiable costs for enhanced recordkeeping once a transition from Stage 3A to Stage 3B occurs.

As shown in Table 10.3, staff estimates that a typical cost for enhanced recordkeeping for each producer will be about $1,600 annually. For the 12 producers and 23 blender distributors we are aware of, we estimate the total cost for recordkeeping to be $56,000 per year. This number was reached using the prevailing wage for an environmental engineer of $40.00 an hour and an estimate of 40 hours needed to comply with the enhanced recordkeeping.

Table 10.3: Estimate of Annual Cost of Enhanced Recordkeeping*

Increased Annual Recordkeeping Hrs.	Cost per Hr**	Annual Cost per Producer and Blender/Distributor	Total Annual Cost for all Recordkeeping
40	$40.00	$1,600	$56,000

* Enhanced monitoring consists of: monthly biodiesel sales volumes by blend (B5, B10, B20, B100); geographic location of respective biodiesel blend sales; Sales of biodiesel produced from animal tallow feedstocks

** Prevailing wage for environmental engineer (source: http://www.bls.gov/ooh/architecture-and-engineering/environmental-engineers.htm)

2. Cost of NOx Emissions Controls for Biodiesel

a. High-saturation for use in all seasons

The 2018 projected biodiesel volumes of 180 million gallons consist of 150 million B100 gallons dedicated to biodiesel blends below the blend levels requiring NO_x emissions controls and 30 million B100 gallons used to create blends above that level. Of these 30 million gallons, 5 million gallons are potential high saturation biodiesel due to their marketability as B10 with only the cost of testing required (cost of testing is laid out in Appendix B). Staff expects most of this high saturation biodiesel to be sold as B10, which does not require more expensive NOx controls. So the resultant cost would be:

5 million gallons * $0.043/ gallon = $215,000

b. Low-Saturation Use in Summer

This will require DTBP additization at the cost of $0.112 per gallon of B20 (see Appendix C for the per gallon calculation). Staff assumes, that in 2018, 5 million gallons of low saturation B100 will be used in the summer and require NOx emissions controls. This means that 5 million gallons of B100, or 25 million gallons of B20 will cost the industry:

$0.112 per gallon. (B20 * 25 million gallons = $2,800,000)

Based on the analysis presented in Chapter 6, staff concludes that using additives such as DTBP is the least likely compliance option for blends with NOx emissions control requirements, due to the high cost of additives and infrastructure needed for additization blending. However, due to demand for these blends by certain government agencies and companies with policies that encourage “green” fuels, some additization will occur. A detailed cost analysis of the NOx control option using additive, as well as the certification option, can be found in Appendix C and is summarized in Table 10.4. The cost of ADF certification is not included as a direct cost because biodiesel producers are not required to pursue that option. It would be a producer’s decision to develop a

certified low-NOx formula under a research and development protocol, which can be viewed as the cost of doing business.

c. Low-Saturation Use in Winter

Because the requirement for the winter allows a higher blend, the producers would likely not use additives for NOx controls but instead sell at the B10 blend level. Therefore, no additional costs above the recordkeeping would be incurred in the winter. Due to cloud point issues with biodiesel in cold weather, business as usual is typically the use of blends with a lower percentage than 20 percent by volume. However, because California has a fairly mild climate, blends of B10 in areas such as Southern California and the San Francisco Bay Area would not be expected to decrease in the winter. These areas also happen to be where the majority of biodiesel is consumed.

3. Potential Adverse Economic Impacts Directly Affecting Business

Biodiesel industries downstream from the producers such as blenders or jobbers, distributors, and retailers, are not expected to experience any costs during the first two years of the regulation. However, in 2018, when in-use requirements for certain biodiesel blends take effect, businesses that did not modify their business practices or seek exemptions to in-use requirements for blends above B5 for low saturation biodiesel, or B10 for high saturation biodiesel, can be expected to incur costs and/or losses. These costs or losses may include: costs of additizing the blends they sell, the costs of adopting new business practices, and the loss of business from not offering B20.

In addition to the measures businesses can take to reduce any adverse economic impacts resulting from the 2018 requirements of the proposal, others may find increased opportunities. Staff does not expect total biodiesel volumes in the State to decrease as a result of the regulation, but rather to be diverted from blends with in-use requirements to blends below B5, or to exempt fleets.

4. Impacts on Small Business

Tables 10.4 and 10.5 on the next page list several businesses that support biodiesel use in California, including 12 biodiesel producers and 23 biodiesel distributor/blenders operating in the State. Twenty-two of these are small businesses, seven are not, and six are unknown, based on the definition for small businesses (GC 11342.610). The list of producers and distributors was derived from Biodiesel magazine[37] and National Biodiesel Board's lists of biodiesel producers[38] and distributors[39].

[37] Biodiesel Magazine, *USA Plants* http://www.biodieselmagazine.com/plants/listplants/USA/page:1/sort:state/direction:asc (accessed November 4, 2014)
[38] National Biodiesel Board, *Biodiesel Plants Listing*, http://www.biodiesel.org/production/plants/plants-listing (accessed November 4, 2014)

Table 10.4: Biodiesel Producers

Biodiesel Producers	**Small Business**
Baker Commodities, Inc.	No
Bay Biodiesel, LLC	Yes
Biodiesel Industries of Ventura, LLC	Yes
Community Fuels	unknown
Crimson Renewable Energy, L.P.	Yes
Geogreen Biofuels, Inc.	Yes
Imperial Western Products, Inc.,	Yes
New Leaf Biofuel, LLC	No
Noil Energy Group, Inc.	Yes
North Star Biofuels, LLC	unknown
Simple Fuels Biodiesel	Yes
Yokayo Biofuels	Yes

Table 10.5: List of Distributors

Biodiesel Distributors	**Small Business**
Argo Energy	Unknown
Beck Oil, Inc	Unknown
Downs Energy	Yes
Eel River Fuels, Inc.	Yes
General Petroleum Corporation	No
Goodspeed Auto-Fuel Systems, Inc.	No
Inter-State Oil Co.	No
Interstate Oil Company	Yes
Lee Escher Oil Co	Yes
NAPA Valley Petroleum, Inc.	No
New West Petroleum	Unknown
New West Petroleum	Yes
Pearson Fuels	Yes
Promethean Biofuels Cooperative Corporation	Unknown
Ramos Oil Company Inc.	Yes
Royal Petroleum Company	Yes
RTC Fuels, LLC (Pearson)	Yes
SC Fuels	Yes
Sirona Fuels	No
Southern Counties Oil Co.	Yes
Supreme Oil Co.	Yes
Tom Lopes Distributing, Inc.	Yes
W. H. Breshears, Inc.	No

[39] National Biodiesel Board, *Biodiesel Distributor Listings*, http://www.biodiesel.org/using-biodiesel/finding-biodiesel/locate-distributors-in-the-us/biodiesel-distributor-listings (accessed November 4 , 2014)

Many of the biodiesel fuel providers will take advantage of the two-year grace period to change business practices and thus incur minimal costs from recordkeeping. For instance, retail fuel providers that sell B20 at fueling stations that only accommodate light duty vehicles could work with a biodiesel producer to target customers of light duty vehicle fleets. This would allow the fuel producers and fuel providers to continue selling blends up to B20 at said stations.

5. Total Cost of Biodiesel Under Proposed Regulation

The total cost of the biodiesel regulation is identified for two time periods. The first time period addresses costs in 2016 and 2017 which are the years before the in-use requirement provisions take effect. The second time period is from 2018 through 2023 when provisions for in-use requirements, including NOx emissions controls, take effect until the sun setting of the regulation.

Based on the estimates above, we expect the total cost of biodiesel as the first commercial ADF regulation to be the cost of enhanced monitoring at $1,600 per year per producer and blender/distributor, or $56,000 total cost per year for all producers and distributors, and the cost of using NOx controls. Upon implementation of the ADF regulation in 2016, the annual biodiesel production is projected to be 129 million gallons (see Appendix B, Table B1) for an incremental biodiesel cost of less than one cent per gallon. These costs would remain steady through 2017.

In 2018, the projected volume increases to 180 million gallons for an incremental cost of less than one cent per gallon for recordkeeping. However, in 2018, in-use requirements take effect for NOx emissions control on certain biodiesel blends. From 2019 through 2020, projected volumes remain steady at 180 million gallons and from 2021 until the sunset provision in 2023, the volumes remain steady at 185 million gallons. However, it should be noted that from 2019 through 2023, the VMT of NTDEs is projected to increase considerably, due to other CARB regulations, which will allow for more biodiesel blends to be sold to exempted fleets with costs for in-use requirements. This would reduce the overall costs of NOx controls. The total cost of the regulation in 2018 is expected to reach $3,071,000. Each year thereafter, starting in 2019 will result in a reduction in costs from the previous year because of the increasing exemptions from NTDE fleets.

6. Potential Economic Costs to Consumers

As noted, we expect individual consumers would incur minimal or no costs as a result of the proposed regulation. Fuel suppliers already blend up to five percent biodiesel by volume in the CARB diesel that is offered throughout the state. Higher blends of biodiesel are currently sold at a price premium relative to CARB diesel, but such premiums exist in the absence of the proposed regulation. Therefore, the proposal should not adversely affect retail prices for biodiesel blends based on the anticipated minimal costs discussed above. Consumers that own either light or medium duty

vehicles will not likely experience an increase in cost for biodiesel blends up to B20, because these fleets qualify for exemptions from in-use requirements.

D. Cost Effectiveness

Cost effectiveness is typically defined as the dollars spent to reduce a unit mass of a specified pollutant. Because the proposal is designed to maintain current environmental protections rather than achieve additional air pollution reductions, the concept of cost-effectiveness does not apply to the proposal. Nevertheless, upon implementation of the proposed ADF regulation in 2016, the regulatory costs of compliance (up to the low tens of thousands of dollars per year), if passed on to the consumer, would yield a per-gallon impact that is small (e.g., $56,000 per year /129 million gallons per year or less than one cent per gallon with full pass-through).

In 2018, when in-use requirements take effect the cost on a per gallon basis would increase, then go back down in subsequent years (e.g., $3,071,000 per year /180 million gallons per year or less than 2 cents per gallon increase if full pass-through).

No alternative considered by the agency would be more effective in carrying out the purpose for which the regulation is proposed or would be as effective as or less burdensome to affected private persons than the proposed regulation.

F. Reasons for Adopting Regulations Different from Federal Regulations

A main objective of the proposed ADF regulation is to consolidate existing requirements, supplemented with minor additional data requirements and enhanced recordkeeping provisions, to provide a clear, legal pathway to commercialization for new ADFs. As noted, many of the proposed regulatory requirements already exist in various State and federal programs.

Table 10.6 shows the existing applicable mandates, which require the same information required under the proposed regulation. However, under the proposed regulation, information generally would be required early in the phase-in process and before the ADF is commercialized in California to allow for screening of environmental and public health impacts. For purposes of this cost analysis, staff did not consider the costs of meeting the existing applicable mandates that overlap with the requirements under the proposal.

For example, H&SC section 43830.8 currently requires a multimedia evaluation to be conducted for any fuel before the ARB can establish motor vehicle fuel specifications for any particular fuel. Thus, while a multimedia evaluation is required under Stage 2 of the proposed regulation, the cost of that evaluation is not attributable to this rulemaking.

Table 10.6: Applicable Requirements from Various State and Federal Mandates

	Proposed Regulation	FTC[1] Labeling	DMS Fuels[2] Authority	DMS Fuel[3] Variance	H&S Code 43830.8[4]
Test Program Application	x			x	
- Test Plan (vehicle ID, fuels, duration, etc.)	x			x	
- Fuel Chemical Properties	x			x	
- U.S.EPA Registration[5]	x				
- Reporting & Recordkeeping	x	x	x	x	
Consensus Fuel Specification Development	x			x	
Enforcement of ASTM Stds.			x		
Fuel Quality Testing	x		x	x	
Pump Labeling (biodiesel blends)		x			
Multimedia Evaluation[6]	x				x
Determination of Pollution Control Levels	x				x
Enhanced Reporting	x				

1. Federal Trade Commission regulation on biodiesel pump labeling under 16 CFR Part 306.
2. CA Dept. of Food & Ag.-Div. of Measurement Stds. authority to enforce ASTM fuel quality stds. under CCR, title 4, §§ 4140, 4148, 4200, 4202-4205.
3. CDFA-DMS administration of developmental fuel variance program under CCR, title 4, §§4144, 4147 - 4148.
4. Multimedia evaluation requirements under Health & Safety Code §43830.8.
5. USEPA fuels and additives registration program under 40 CFR Part 79.
6. Also requires lifecycle analysis, release scenarios & emissions testing.

Another set of State mandates affecting the enforcement of potential ADFs pertains to regulatory requirements promulgated by the California Department of Food and Agriculture, Division of Measurement Standards (DMS). Under California Code of Regulations (CCR), Title 4, sections 4140-4149 and 4200-4205, DMS has the responsibility to enforce the consensus (ASTM) standards for the fuels listed therein,

including biodiesel. Therefore, costs for meeting the ASTM standards or developing consensus standards for future ADFs are attributable to the DMS regulations.

The DMS also administers a program that is similar to the proposed Stage 1 requirements. Known as the developmental fuel variance (DFV), this program is authorized under Title 4 CCR, Sections 4144, 4147 and 4148. The DFV program allows unconventional motor vehicle fuels to be used in limited quantities to develop data in support of the development of consensus standards for those fuels. Stage 1 of the proposed regulation requires the same information as that required under the DFV, as well as some additional information. Thus, staff's analysis for the proposal does not consider the portion of the costs that would already be incurred under the DFV program.

Two federal programs also apply to ADFs that would be subject to the proposal. First, U.S. EPA requires a gasoline, diesel, or additive supplier to register under 40 CFR 79 prior to the sale or supply of such fuel products in California. Similarly, the proposed regulation would require U.S. EPA registration before an ADF could be sold or supplied in California under Stage 1. Second, the FTC specifies particular labeling requirements on individual pumps that dispense B6-B20 and blends above B20 (no labeling requirements for B5 and below). For enforcement purposes, fuel marketers are required to maintain volume sales and other fuel content records for these labeled pumps. The proposed regulation contains recordkeeping, testing, and reporting requirements that would piggyback on these existing federal requirements.

Alternative diesel fuels that meet the criterion for a Stage 3A will be required to conduct enhanced recordkeeping to monitor progress towards meeting any pollutant emissions levels that would require pollutant controls. The level of enhanced recordkeeping, and the cost of the pollutant controls (when applicable), will be a case-by-case determination because different ADFs have different chemistries.

G. Impacts to California State or Local Agencies

Several state agencies operate large fleets, often with many alternative fuel vehicles included in their fleet. Staff contacted several State agencies to determine biodiesel usage and received responses from some, but not all of the agencies contacted. Those that did respond did not indicate any usage of biodiesel blends with in-use requirements, and thus higher cost. During this period, staff became aware that Caltrans was the State agency using the most biodiesel. According to a 2013 report, "Caltrans Activities to Address Climate Change[40]", Caltrans is the biggest user of biodiesel in the State and is only using B5 blends currently; although they've used B20 blends in the past. As such, Caltrans would not incur any additional costs due to this regulation. In addition, the University of California system was contacted and staff was informed that the majority of their biodiesel use was B5, and that the majority of their fleet was vehicles eligible for an exemption to in-use requirements.

[40] Department of Transportation *Caltrans Activities to Address Climate Change Reducing Greenhouse Gas Emissions and Adapting to Impacts*, April 2013

Staff also contacted local municipalities and found that with the exception of San Francisco, all of the municipalities that responded did not use biodiesel blends above B5. Anecdotal evidence suggests that some school districts may be using biodiesel blends with in-use requirements. Therefore only those few agencies opting to use biodiesel blends with in-use requirements may incur some minor costs; though these can likely be absorbed in existing budgets. If these same agencies opt to use CARB diesel or lower blends of biodiesel, they could incur a costs savings.

CHAPTER 11. ANALYSIS OF REGULATORY ALTERNATIVES

As required by Senate Bill 617 (Chapter 496, Status of 2011), State agencies must conduct a Standardized Regulatory Impact Assessment (SRIA) when a proposed regulation has an economic impact exceeding $50 million in any 12-month period between the date the major regulation is estimated to be filed with the Secretary of State through12 months after the regulation is estimated to be fully implemented. The Department of Finance is required to review the completed SRIA submitted by agencies and provide comment(s) to the agency on the extent to which the assessment adheres to the regulations adopted by Finance. Rules implementing these requirements are found at title 1, sections 2000-2004 of the California Code of Regulations.

As part of the SRIA process, ARB solicited public input on alternative ADF approaches, including any approach that may yield the same or greater benefits than those associated with the proposed regulation, or that may achieve the goals at lower cost. Alternative approaches submitted to ARB were considered as staff prepared a SRIA. The combined SRIA of Low Carbon Fuel Standard and ADF summary is posted at: http://www.dof.ca.gov/research/economic_research_unit/SB617_regulation/2014_Major_Regulations/documents/ADF_DF_131_SUMMARY.PDF

Staff solicited public input and received two alternatives to the proposal that were considered as part of the SRIA process. The full analysis and comparison is located in Appendix D. The alternatives are summarized below:

A. Alternative Submitted by Growth Energy

The first alternative considered was submitted by Growth Energy (GE). Key provisions are listed below, along with the reason for rejecting this alternative in the following paragraphs.

- Treating animal- and non-animal-based biodiesel the same: setting the significance level for both at zero percent, as compared to the ADF proposal, which sets the significance level at B5 for non-animal-based biodiesel and B10 for animal-based biodiesel; and
- Eliminating the provisions for exemptions based on the use of NTDEs, as compared to the ADF proposal, which provides exemptions for biodiesel used in NTDEs; and
- Eliminating the sunset provision of the ADF proposal, whereas the ADF proposal would likely end mitigation for biodiesel in 2024.

This alternative proposal retains the same biodiesel NOx mitigation options as the ADF proposal. However, under the GE alternative, animal and non-animal biodiesel would be treated equally and require NOx mitigation for all biodiesel blends, including blends below B5. ARB rejects this alternative because the costs are significantly higher than the ADF proposal and do not achieve additional emissions benefits. During the

development of this regulation, staff considered alternatives to the proposal and determined that the proposal represents the least-burdensome approach that best achieves the objectives at the least cost.

B. Alternative Submitted by National Biodiesel Board

The second alternative considered was submitted by the National Biodiesel Board (NBB). Key provisions are listed below, along with the reason for rejecting this alternative in the following paragraphs.

- Setting a significance level threshold for biodiesel at 10% biodiesel blend (B10) for all biodiesel feedstocks;
- Establishing an effective blend level that accounts for the impact of NTDEs, RD, and animal biodiesel, vs per-gallon mitigation in the ADF proposal; and
- Including a three-year phase-in period for the regulation.

This alternative would treat animal- and non-animal-based biodiesel the same by setting a significance level for both at 10 percent annually by volume. The alternative also includes a three-year phase-in period; accordingly, there are no costs for biodiesel mitigation in the first three years. For this alternative, mitigation would not be necessary until the statewide biodiesel content is up to 10 percent; after which the 10 percent any additional biodiesel would be mitigated using the same options available in the ADF proposal.

Because this alternative achieves substantially fewer emissions benefits than the ADF proposal, it does not meet the goals of the ADF proposal and ARB rejects the NBB alternative.

C. Conclusions

No alternatives were presented that would achieve the same emissions benefits and lessen any adverse impact on small businesses that may occur due to the regulation. However, the phase-in period suggested in the NBB proposal was modified to two years and included in the regulation to ensure ample time for small businesses to prepare and alter their business models to minimize their costs.

CHAPTER 12. SUMMARY AND RATIONALE

The Proposed ADF regulation is designed to allow a streamlined path to commercialization for alternative diesel fuels, while ensuring no increase in air pollution from those fuels. This section discusses the requirements and rationale for each provision of the proposed regulation.

Subarticle 1. Specifications for Alternative Motor Vehicle Fuels

Summary and Rationale for Subarticle 1
Article 1 is being renamed Subarticle 1 as part of splitting the article for clarity. Additionally, minor changes were made to accommodate the subarticle renaming and authority cited was added for clarity.

Subarticle 2. Commercialization of Alternative Diesel Fuels

Section 2293 Purpose

Summary of section 2293
Section 2293 states the purpose of the proposed regulation.

Rationale for section 2293
This section is needed to inform the regulated public and other market participants of the proposed regulation's intent.

Section 2293.1 Applicability

Summary of section 2293.1
Subsection(a) establishes January 1, 2016, as the effective date of the proposed regulation, as well as laying out general requirements for alternative diesel fuels (ADFs) in California.

Rationale for section 2293.1
This section is needed to establish the implementation date, and general requirements that will apply to ADFs in California.

Section 2293.2 Definitions

Summary of section 2293.2
This section introduces definitions to the terms used in the regulation as well as the acronyms used in the proposed regulation.

Rationale for section 2293.2
It is necessary that ARB defines terms as applicable to the Alternative Diesel Fuels regulation. Several of these terms are used in the same manner as other articles and titles in the California Code of Regulations, Government Code sections or statutes. It is necessary for ARB to be consistent with existing definitions to the extent that they apply to this regulation.

Section 2293.3 Exemptions

Summary of section 2293.3

Section 2293.3 introduces the list of exemptions that apply to this proposed regulation.

Rationale for section 2293.3

This section is necessary for clarity of which fuels or additives are not subject to the regulation. The exempted fuels are already regulated elsewhere.

Section 2293.4 General Requirements Applicable to All ADFs

Summary of section 2293.4

This section outlines the provisions that apply to all ADFs in California

Rationale for section 2293.4

This section is necessary to ensure that it is clear that other applicable local, State, and federal requirements, including some specifically listed requirements, apply in addition to the provisions outlined in the proposed regulation.

Section 2293.5 Phase-In Requirements

Summary of section 2293.5

Section 2293.5 states that ADFs intended for use in motor vehicles that do not meet the requirements of this regulation by having a fuel specification or approved Executive Order in place cannot be sold without being in violation of this regulation.

Rationale for section 2293.5

This section is necessary to introduce the different stages of the regulation and the Executive Order requirements in Stage 1. The goal of this comprehensive process is to foster the introduction of new, lower polluting ADF fuels by allowing the limited sales of innovative ADFs in stages while emissions, performance, and environmental impacts testing is conducted. This testing is intended to develop the necessary real-world information to quantify the environmental and human health benefits from using new ADFs, determine whether these fuels have adverse environmental impacts relative to conventional CARB diesel, and identify any vehicle/engine performance issues such fuels may have.

Summary of section 2293.5(a)

Subsection (a) outlines the requirements of Stage 1: Pilot Program. This is the first in a series of 3 stages leading to potential commercialization of ADFs, and includes an initial analysis, submittal of relevant data, and a limited use of ADF allowed.

Rationale for section 2293.5(a)

This section is needed to communicate clearly the requirements for application, acceptance, and completion of Stage 1 for ADF proponents who are initially proposing an ADF for use. The purpose of this stage is to allow limited, small fleet use of innovative fuels while requiring screening tests and assessments to quickly determine whether there will be unreasonable potential impacts on air quality, the environment and vehicular performance. Such data will help inform more extensive testing and analysis

to be conducted in Stage 2. This Stage 1 is modeled after the existing ARB regulation that provides limited, fuel test program exemptions under 13 CCR 2259. The required submittals allow ARB and the public to evaluate the rigor of any proposed testing plan.

Summary of section 2293.5(b)
Subsection (b) outlines the requirements of Stage 2: Development of Fuel Specification. This is the second in a series of 3 stages leading to potential commercialization of ADFs, and includes rigorous environmental testing, development of standards, determination of environmental impacts, and increased use of ADF allowed.

Rationale for section 2293.5(b)
Subsection (b) is needed to communicate clearly the requirements for application, acceptance, and completion of Stage 2 for ADF proponents who are getting closer to commercial operation. The purpose of this stage is to allow limited but expanded fleet use of an ADF that has successfully undergone the Stage 1 pilot program. Stage 2 candidate ADFs undergo additional emissions and performance testing to better characterize potential impacts on air quality, the environment and vehicular performance. This testing and assessment will be conducted pursuant to a formal multimedia evaluation leading to the development of a fuel specification, as appropriate. Further, the multimedia evaluation will be the basis for determining whether the candidate ADF has potential adverse emissions impacts. The determination of potential adverse emissions impacts determines whether the candidate ADF can proceed to Stage 3A or Stage 3B. The required submittals will allow ARB and the public to evaluate the rigor of the proposed testing.

Summary of section 2293.5(c)
Subsection 2293.5(c) outlines the requirements of Stage 3A: Commercial Sales Subject to in-use Requirements. This is the culminating stage for ADFs that have been found to have potential adverse emissions impacts, and includes provisions for determination of in-use requirements and or fuel specifications if they are determined to be necessary.

Rationale for section 2293.5(c)
Subsection (c) is needed to communicate clearly the requirements for full commercialization of ADFs that have been found to have potential adverse emissions impacts.

Summary of section 2293.5(d)
Subsection 2293.5(d) outlines the requirements of Stage 3B: Commercial Sales Not Subject to In-use Requirements. This is the culminating stage for ADFs that have either been found to have no potential adverse emissions impacts or that have been found in Stage 3A to have no adverse emissions impacts. ADFs subject to this stage have limited reporting requirements.

Rationale for section 2293.5(d)
Subsection (d) is needed to communicate clearly the requirements for full commercialization of ADFs that will have no adverse emissions impacts relative to conventional CARB diesel. The provision makes the reporting consistent with reporting requirements in place for existing motor vehicle fuels.

Section 2293.6 In-use Requirements for Specific ADFs Subject to Stage 3A
Summary of section 2293.6
Section 2293.6 includes provisions for any ADF that has undergone the 3-stage process for commercialization and has been determined to be in Stage 3A with in-use requirements.

Rationale for section 2293.6
This section is needed to implement the provisions of Stage 3A once an ADF has completed the 3-stage commercialization process.

Summary of section 2293.6(a)
Subsection 2293.6 (a) contains the in-use requirements that apply to biodiesel as the first commercial ADF. This subsection includes a phase-in period, pollutant control levels, provisions for feedstock differences, a sunset provision, a process for exemption from the in-use requirements for biodiesel, and a mid-term review of the biodiesel provisions.

Rationale for section 2293.6(a)
Subsection (d) is needed to implement the solutions to the adverse emissions impacts associated with biodiesel. These adverse emissions impacts vary based on feedstock and engines, as such specific provisions for each of these are included.

Section 2293.7 Specifications for Alternative Diesel Fuels
Summary of section 2293.7
Section 2293.7 is a lead sentence to be completed in subsections 2293.7(a) and (b) that provide the specifications that must be met by ADFs, if not under a mitigation strategy in effect.

Rationale for section 2293.7
This section is needed to provide a framework for subsequent subsections.

Summary of section 2293.7(a)
Section 2293.7(a) is a title line for biodiesel the specification subsection.

Rationale for section 2293.7(a)
This section is needed to provide a framework for subsequent subsections.

Section 2293.8 Reporting and Recordkeeping

Summary of section 2293.8

Section 2293.8 (a) states that the applicable sampling methodology set forth in 13 CCR section 2296 shall be used for sampling of fuel properties as required by the Executive Order.

Rationale for section 2293.8

This subsection is needed to provide the applicant with guidance regarding their sampling requirements.

Section 2293.9 Severability

Summary of section 2293.9

Section 2293.8 states that each part of this subarticle shall be deemed severable, and in the event that any part of this subarticle is held to be invalid, the remainder of this subarticle shall continue in full force and effect.

Rationale for section 2293.9

This subsection is needed to inform the applicant of their responsibility to adhere to all applicable requirements of this regulation, in the event that any part of this subarticle shall be deemed severable.

Subarticle 3. Ancillary Provisions

Section 2294. Equivalent Test Methods

Summary of and Rationale for section 2294

This is former section 2293 renumbered to section 2294 and grouped under new subarticle 3 for consistency and ease of reading.

Section 2295. Exemptions for Alternative Motor Vehicle Used in Test Programs

Summary of and Rationale for section 2295

This is former section 2293.5 renumbered to section 2295 and grouped under new subarticle 3 for consistency and ease of reading. This section facilitates innovation and testing for new fuels.

Appendix 1 In-use Requirements for Pollutant Emissions Control

Summary of Appendix 1

Appendix 1 outlines the in-use requirements that apply to ADFs operating under Stage 3A.

Rationale for Appendix 1

Appendix 1 is needed to identify the options that are available for complying with the provisions of Stage 3A

Summary of Appendix 1 (a)

This section includes the in-use requirement options that are available to biodiesel, currently additive blending and certification procedures.

Rationale for Appendix 1 (a)

This section is needed to convey the amount of additive needed to comply with in-use requirements for biodiesel based on time of year, feedstock, and blend level. The certification procedures are needed to provide flexibility for new in-use options that can be rigorously demonstrated to be effective.

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CHAPTER 13. REFERENCES

Note: The references are listed according to the footnote they correspond to in the ISOR. Not all footnotes are references and are only listed here to maintain the numbering system used for the ISOR footnotes. The footnotes that are not references are listed as "Explanatory Footnote."

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Chapter 11. Analysis of Regulatory Alternatives

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Chapter 12. Summary and Rationale

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