California Air Resources Board

Staff Concept Paper

California Fuels Update

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INTRODUCTION

California has made significant progress in improving air quality and reducing greenhouse gas (GHG) emissions and has reduced GHG emissions below the 2020 target four years ahead of schedule while its economy continues to grow. California's 2017 Climate Change Scoping Plan Update charts a technologically feasible and cost-effective path to meet the State's 2030 climate goal. Beyond 2030, Executive Order B-55-18 establishes a statewide goal for California to achieve carbon neutrality by 2045. In addition, Board Resolution 17-46 directs California Air Resources Board (CARB) staff to continue to evaluate and explore opportunities to achieve significant cuts in GHG emissions from all sectors and sources.

Staff is planning to propose amendments to various California fuels regulations and programs, as well as a new regulation, keeping in mind the State's long-term goals. Proposed regulatory items include adoption of a Low Emission Diesel (LED) Standard, updates to existing alternative fuels, alternative diesel fuels, gasoline, and diesel regulations, and the potential development of new E15 fuel specifications. Many of the existing regulations are critical for reducing criteria pollutants and improving air quality. The focus of the rulemakings would be to update existing fuels regulations and programs, and continue to reduce criteria pollutants from California's fuels, as California transitions away from the combustion of fossil fuels. These regulations and amendments would provide focus on clean renewable fuels such as renewable diesel, biodiesel, and E85.

1. Low Emission Diesel Standard

Background

CARB committed to adopting an LED standard in the State Strategy for the State Implementation Plan (SIP) to reduce oxides of nitrogen (NOx) and particulate matter (PM) emissions from on-road and off-road vehicles and equipment, including on-road heavy-duty vehicles, off-road engines, stationary engines, portable engines, marine vessels and locomotives through 2031.[1] Staff believes a performance-based LED standard would reduce NOx and PM emissions from California's diesel pool over time relative to conventional diesel. A LED Standard is expected to recognize emission reductions from fuels that can reduce NOx and/or PM, and may include: renewable diesel, NOx-mitigated biodiesel, renewable diesel/biodiesel blends, cleaner refined diesel, gas-to-liquid (GTL) diesel, and compressed natural gas (CNG). A LED Standard is also expected to result in emissions reductions of other criteria pollutants and potentially greenhouse gases and air toxics. CARB has committed to developing the LED Standard by the end of 2021 and to begin implementation of the LED Standard by 2023.

Proposal

Staff has developed two potential concepts for a potential LED Standard. These concepts represent different approaches to achieving the same objective: a reduction in NOx and PM emissions associated with diesel fuel use in California. Each concept is described below and is followed by a short list of considerations. Staff seeks stakeholder feedback related to each concept.

1. Volumetric Standard for LED Fuels

   Under this concept, CARB would require specific volumes of different LED fuels to replace or reduce the volume of conventional diesel in California, with the annual volume requirements for different LED fuels increasing over time, resulting in increasing reductions in NOx and PM emissions from the diesel fuel pool. LED fuels under the concept may consist of petroleum-based fuels (e.g., cleaner refined diesel, GTL diesel, and CNG) or non-petroleum-based fuels (e.g., renewable diesel, NOx-mitigated biodiesel, renewable diesel/biodiesel blends, and renewable natural gas (RNG)). This concept is similar to the federal Renewable Fuel Standard (RFS), which has a volume mandate for different categories of renewable fuels as well as a total renewable fuel volume requirement. Following the RFS example, the LED fuel volume requirements would apply to refineries and importers of diesel, who would achieve compliance by blending the required volumes of LED fuels into their conventional diesel fuels or by obtaining and retiring an equivalent number of volume-based credits to

[1] CARB. 2017. Revised Proposed 2016 State Strategy for the State Implementation Plan. March 7. Available at: https://www.arb.ca.gov/planning/sip/2016sip/rev2016statesip.pdf. Accessed: January, 2017.

meet their LED fuel volume obligation. As part of this approach, CARB would set up and manage a reporting and credit transactions system. Staff highlights the following considerations:

- The LED Standard described above would require that CARB set specific volume targets for each LED fuel, and thus, would not be fuel neutral;
- This concept would likely not be able to accommodate flexibility in volume requirements among different LED fuels due to differing NOx and PM reductions among these fuels;

2. Reduced Aromatic Content of Diesel Fuel

Reductions in total aromatic hydrocarbon content of diesel fuel can reduce tailpipe NOx and PM emissions. Additionally, reductions in polycyclic aromatic hydrocarbon (PAH) content of diesel fuel can reduce tailpipe NOx and PM emissions. Under this concept, CARB would amend the existing California Diesel Fuel Regulations (Diesel Regulations) to reduce the maximum aromatic hydrocarbon content of diesel, which is currently 10 percent by volume.[2,3] CARB would also add a provision to the Diesel Regulations specifying the maximum PAH content of diesel, based on the ratio of the maximum total aromatic hydrocarbon content to the maximum polycyclic aromatic hydrocarbon (PAH) content in reference diesel fuel. LED fuels contain no aromatics or very low levels of aromatics. Therefore, regulated parties (i.e., refiners and importers) would achieve compliance under this concept by producing or importing cleaner, refined diesel and/or blending their diesel fuels with volumes of LED fuels that are sufficient to meet the revised aromatics specification. Potential considerations for an LED Standard that involves a decrease in total aromatic hydrocarbon content and the addition of a provision for PAH content include:

- Additional literature review and potential refinery process and emissions modeling may be needed to quantify the impacts of changes in total aromatic content and PAH content of diesel fuel on NOx emissions; these would be conducted by CARB, or an outside consultant if necessary;
- Refineries producing cleaner petroleum diesels should have net zero emission increases (exclusive of fuel-related tailpipe emissions reductions) if produced fuel volumes do not change. The production of cleaner petroleum diesels should also not result in an increase in fuel production at refineries;

[2] The Diesel Regulations provide an exemption for small refiners that allows a maximum aromatic hydrocarbon content of 20 percent. The maximum aromatic hydrocarbon content for small refiners would also be reduced under the proposed amendment.

[3] The Diesel Regulations also allow a producer or importer to specify a designated alternative limit for aromatic hydrocarbons provided that the excess aromatic hydrocarbon content is fully offset. This provision would be unchanged under the proposed amendment.

2. Alternative Fuels Regulation

Background

CARB staff is proposing to update the Alternative Fuels Regulation (Title 13, California Code of Regulations, section 2290 – 2293.5). The Alternative Fuels Regulation established fuel specifications for methanol, ethanol, compressed natural gas (CNG), liquefied petroleum gas (LPG), and hydrogen. These fuel specifications were adopted in 1992 and have not been updated since originally adopted. CARB staff is proposing to update the specifications for E-85, CNG, and LPG, in order to reduce the need for test program exemptions (TPE). CARB staff is also proposing to revise and reorganize various provisions in the alternative fuels regulation.

CARB is currently working with the ethanol industry to conduct a multimedia evaluation on higher ethanol blends, focused on E15. Stakeholders have requested that CARB increase the amount of ethanol permitted to be blended in gasoline, but recent analysis using the gasoline predictive model suggests that higher blends of ethanol may increase NOx emissions from gasoline. As part of our multimedia evaluation of higher blends of ethanol, further study of E15 emissions will take place, and depending on these results we may consider adopting an alternative fuel specification for E15.

E85 specifications were developed when E85 was made from a blend of ethanol and gasoline according to Phase 1 California Reformulated Gasoline (CaRFG1) regulations (adopted in 1991). Now, however, phase 1 reformulated gasoline is no longer available. Current E85 blends, are made with either California reformulated gasoline blendstock for oxygenate blending (CARBOB), phase 3 California reformulated gasoline (CaRFG3) or other hydrocarbon blendstock, such as renewable naphtha and natural gasoline. Current E85 blends may have a lower vapor pressure and therefore may not meet the current applicable minimum vapor pressure specifications; however, no performance or compatibility issues have been reported to date. Thus, an update to the E85 specifications is warranted.

The CNG specifications were adopted to ensure that motor vehicles designed to use alternative fuels will have fuels available that are of consistent quality and produce the expected emissions benefits. At the time of adoption, there were no standards for vehicular CNG or LNG set by ASTM International (ASTM). ASTM is in the process of adopting a specification for CNG which the California Department of Food and Agriculture (CDFA) is expected to adopt. The proposed specification is less stringent than the CARB specification. Furthermore, if there is an existing state regulation that is more stringent than the ASTM standard, CDFA cannot adopt the less stringent ASTM specification. CARB may have to first rescind its regulation.

Similar to CNG, LPG specifications were adopted to ensure that motor vehicles designed to use alternative fuels will have fuels available that are of consistent quality and produce the expected emission benefits. At the time of adoption, there were no standards for vehicular LPG set by ASTM. ASTM first adopted a specification for LPG in 1997, and the latest update was adopted in 2018. The latest LPG ASTM specification, ASTM D1835-18a, contains requirements for commercial propane and

commercial butane as well as requirements for commercial propane/butane mixtures. The proposed change to the LPG specification would not conflict with the ASTM specification.

Proposed Updates

Staff proposes the following concepts for consideration:

a. E85 Fuel Specifications

Staff has developed two potential concepts for the proposed E85 update.

1. Update or rescind individual specifications:

Specification	Revision	
	Current	**Proposed**
Vapor Pressure	RVP Range / Volatility Class 6.5 - 8.7 psi: A, A/B, B/A 7.3 – 9.4 psi: B/C, C/B, C, C/D, D/C 8.7 – 10.2 psi: D, D/E, E/D, E Current RVP specifications depend on area and time of year	• Rescind minimum vapor pressure (lower RVP values result in less evaporative fuel emissions) and refer to ASTM D5798-18a: 5.5, 7.0, 8.5, 9.5 psi depending on area and time of year • Revise maximum RVP to 7.2 psi in summer as defined in CaRFG3, 13 CCR § 2262 (volatility class same as CaRFG3)
Ethanol Content	79 vol% (min)	• Revise minimum to 70-75 vol% (ASTM D5798-19a is 51 vol%) • Revise test method ASTM D3545 to ASTM D5501
Hydrocarbon Content	15 – 21 vol%	• Revise maximum to 25-30 vol% for E51 blends
Sulfur	40 ppm (max)	• Revise maximum to 20 ppm

2. Rescind entire E85 Specification (§ 2292.4) and refer directly to ASTM D5798. CARB must first confirm no air quality impacts. Based on monthly E85 data reported to CARB, no performance or compatibility issues.

b. CNG Fuel Specifications

Staff proposes to rescind the CNG Specification (§ 2292.5). In place of regulating CNG using alternative fuel specifications, staff is considering updating the engine certification fuel to be more representative of in-use fuel, potentially requiring multiple certification fuels to represent the range of available fuels.

Rationale/Key Considerations

- If CARB keeps the existing specification or one that is as stringent, pockets of gas will continue to be non-compliant and will continue to require TPEs.
- If CARB relaxes the specification, engine manufacturers may raise concerns because it will be less stringent than their own specifications. Also, CDFA must adopt the latest ASTM standards, which are in development.
- Generally, CARB incorporates ASTM specifications in the regulation and may adopt additional specifications. If specifications are more stringent, CARB must show a benefit.
- CARB staff tested various grades of CNG. Staff did not find differences in emissions sufficient to warrant setting specifications based on air pollution over performance.
- In the past, CARB's position has been to relax the specifications to allow more compliant natural gas. The reason is to increase percent of population of vehicles that can operate on low carbon biogas and low polluting CNG.

c. LPG Fuel Specification

Staff proposes to increase the maximum percentage of butane from five percent to ten percent and decrease the minimum percentage of propane from 85 percent to 80 percent in the LPG Specification (§ 2292.6) to reflect the properties of in-use renewable propane. Staff may consider a specification change that would allow levels of butane above 10 percent if accepted by industry and supported by data.

Rationale/Key Considerations

- The production of renewable propane can result in a fuel that contains higher levels of butane (up to 10 percent) than are currently allowed by the LPG specification.
- Higher levels of butane in LPG reduce the vapor pressure of the fuel, decreasing the potential for some fuel system failures and fuel venting for LPG-powered vehicles operating in hot climate areas; however, the relatively small proposed increase in maximum butane percentage may not be sufficient to substantially reduce fuel venting issues in hot climate areas. For reference, United Parcel Service is operating under a TPE that allows up to 60 percent butane in LPG fuel.
- CARB has limited data showing the emissions impact and necessity of using LPG with higher levels of butane (i.e., between 20% and 60% butane); additional data on emissions impacts and necessity would be needed to evaluate this proposed change.

d. E15 Fuel Specifications

Staff is considering adopting an E15 alternative fuel specification that would allow E15 to be used in 2002 and later model year cars, and to be distributed using infrastructure that is rated to handle up to E85. What the contents of this specification might be, and whether we adopt the specification will depend on the results of the current multimedia evaluation.

e. Other Amendments

Staff is proposing the following additional amendments:

Section	Action	Rationale
§ 2262.1. Fuels Specifications for M-100 Fuel Methanol	Reevaluate need for specifications	M100 currently not in use
§ 2262.2. Fuels Specifications for M-85 Fuel Methanol	Reevaluate need for specifications	M85 currently not in use
§ 2262.3. Fuels Specifications for E-100 Fuel Ethanol	Reevaluate need for specifications	E100 finished fuel ethanol currently not in use

3. Alternative Diesel Fuel Regulation

Background

CARB adopted a Regulation on Commercialization of Alternative Diesel Fuels (ADF regulation) found at California Code of Regulations (CCR), title 13, sections 2293 through 2293.9 which became effective January 1, 2016. The ADF regulation governs the introduction and use of innovative alternative diesel fuels in California while preserving or enhancing public health, the environment, and the emission benefits of the existing diesel fuel regulations.

The ADF regulation contains provisions requiring a program review of the biodiesel in-use requirements to determine the efficacy of in-use requirements and effects of offsetting factors, in addition to any other factors that may affect NOx emissions stemming from biodiesel use in motor vehicles.

Proposed Updates

Based on feedback received at the workshop and staff's continued analysis, staff may propose amendments to the regulation at the Board Hearing in 2020 in the areas of:

1. NOx mitigation point: Currently, the regulation does not specify a NOx mitigation point and allows NOx mitigation at any point before the final retail sale.

2. NOx mitigation control level: Currently, it is at B5 or B10 depending on the season and feedstock. Staff will examine if the current NOx control levels continue to be appropriate.

3. Cleanup of certification provisions.

4. General regulation language cleanup.

4. California Reformulated Gasoline Regulations

Background

CARB staff is proposing to update the California Reformulated Gasoline Regulations (CaRFG Regulations; Title 13, California Code of Regulations, Sections 2250-2273.5). The CaRFG program was implemented in three phases.

- Phase 1 (CaRFG1; implemented in 1992) established new specifications for RVP, detergents and deposit control additives, and required the phase out of leaded gasoline.[4]
- Phase 2 (CaRFG2; implemented in 1996) established a comprehensive set of specifications designed to achieve the maximum feasible reductions in emissions of criteria pollutants and toxic air contaminants from gasoline-fueled vehicles.[5] The standards cover sulfur, benzene, olefin, oxygen, and aromatic hydrocarbon contents, T50 and T90, and summertime RVP. Amendments (approved 1994) provided for the use of the California Predictive Model.[6,7]
- Phase 3 (CaRFG3; implemented in 1999) established new CaRFG3 flat, averaging, and cap limits for the eight properties regulated by the CaRFG2 program, updated CaRFG3 Predictive Model, and prohibited use of MTBE in gasoline.[8,9]

The requirements for CaRFG3 have been the same since 2010.

Proposed Updates

Staff proposes the following updates:

Section	Action	Rationale
§ 2257. Required Additives in Gasoline	Add maximum concentration statement	Concern for potential deposit formation in combustion chamber due to over treatment of gasoline with additives
§ 2258. Oxygen Content of Gasoline in the Wintertime	Delete entire section	Section has been repealed

[4] California Air Resources Board. CaRFG1 Staff Report. *Reformulated Gasoline: Proposed Phase 1 Specifications Staff Report.* August 13, 1990.

[5] California Air Resources Board. CaRFG2 Staff Report. *Proposed Regulations for California Phase 2 Reformulated Gasoline.* October 4, 1991.

[6] California Air Resources Board. Amendments to CaRFG2 Staff Report. *Proposed Amendments to the California Phase 2 Reformulated Gasoline Regulations, Including Amendments Providing for the Use of a Predictive Model.* April 22, 1994.

[7] California Air Resources Board. Resolution 94-38. June 9, 1994.

[8] California Air Resources Board. CaRFG3 Staff Report. *Proposed Amendments to the California Reformulated Gasoline Regulations, Including a December 31, 2002 Prohibition of Using MTBE in Gasoline, Adoption of Phase 3 Gasoline Standards, a Phase 3 Predictive Model, and Other Changes.* October 22, 1999.

[9] California Air Resources Board. Resolution 00-40. November 16, 2000.

Section	Action	Rationale
§ 2261. Applicability of Standards; Additional Standards	Reevaluate subsections referencing CaRFG2 specifications	CaRFG2 is currently not in use
§ 2262. The California Reformulated Gasoline Phase 2 and Phase 3 Standards	Reevaluate subsections referencing CaRFG2 specifications Consider reducing sulfur averaging limit to align with U.S. EPA	CaRFG2 is currently not in use Sulfur averaging limit is currently higher than U.S. EPA gasoline sulfur averaging limits
§ 2262.5.a Compliance with Minimum Oxygen Cap Limit Standard in Specific Areas in the Wintertime	Reevaluate	Determine if still applicable to identified areas
§ 2265.5 Alternative Emission Reduction Plan	Delete	Alternative Emission Reduction Plans are obsolete
§ 2266.5 Requirements Pertaining to California Reformulated Gasoline Blendstock for Oxygen Blending (CARBOB) and Downstream Blending	Reevaluate subsections referencing CaRFG2 specifications	CaRFG2 is currently not in use
§ 2272. CaRFG Phase 3 Standards for Qualifying Small Refiners	Reevaluate	Determine if still needed
§ 2273. Labeling of Equipment Dispensing Gasoline Containing MTBE	Reevaluate	MTBE is prohibited as an oxygenate in CaRFG3

5. California Diesel Regulations

Background

CARB staff is proposing to update the California Diesel Regulations (Diesel Regulations; Title 13, California Code of Regulations, Sections 2281-2285).

Proposed Updates

Staff proposes the following updates:

Section	Action	Rationale
§ 2281. Sulfur Content of Diesel	Update 500 ppm sulfur standard to 15 ppm	The 500 ppm sulfur standard is obsolete as the 15 ppm sulfur standard has been phased in as of 2006 Update maximum sulfur standard to 15 ppm
§ 2282. Aromatic Hydrocarbon Content of Diesel Fuel	Reevaluate subsection (e) Small Refiner Diesel Fuel	Determine if still needed
§ 2284. Lubricity of Diesel Fuel	Reevaluate entire section	CDFA DMS will be enforcing the lubricity standard per ASTM D975