

State of California  
AIR RESOURCES BOARD

**PROPOSED AMENDMENTS TO THE REGULATION ON THE  
COMMERCIALIZATION OF ALTERNATIVE DIESEL FUELS –  
15-DAY CHANGES**

**APPENDIX B  
STAFF ANALYSIS OF RENEWABLE DIESEL/BIODIESEL FORMULATIONS  
AND NOX EMISSIONS**

**DATE OF RELEASE: October 14, 2020**

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## I. Introduction

At its April 23, 2020, public hearing, the California Air Resources Board (CARB or Board) approved for adoption the proposed amendments to sections 2293.2 and Appendix 1 of title 13, division 3, chapter 5, article 3, subarticle 2, California Code of Regulations. During the Board Hearing discussion of the item, Vice Chair Sandy Berg recommended, and other Board members agreed, to “give the Executive Officer the discretion on both the lab and on the blending issue,” (i.e., the number of laboratories required for certification testing, and lower renewable hydrocarbon diesel (renewable diesel) blend ratios for approved ADF formulations).<sup>1</sup>

This staff paper focuses on staff’s evaluation, based on publicly available data and studies, of potential overall NOx emissions that may result from the proposed conforming modifications. These proposed modifications include:

1. Addition of a second approved ADF formulation consisting of at least 55 percent renewable diesel and at most 20 percent biodiesel;
2. A requirement for certification testing of candidate fuels containing renewable diesel to demonstrate at least a two percent reduction in average NOx emissions relative to the Diesel Test Fuel;<sup>2</sup> and
3. An adjustment of the effective date of certification requirements from January 1, 2021 to April 1, 2021.

Staff developed these proposed modifications taking into account: the importance of renewable diesel as an offsetting factor for NOx emissions from biodiesel blends below the NOx control level (usually B5), data from previous certifications of renewable diesel-based ADF formulations, and data from previous CARB studies and analyses of biodiesel and renewable diesel NOx emissions. Each of these considerations contributed to staff’s understanding that the modifications listed above are not anticipated to increase overall NOx emissions in California.

### *Importance of Renewable Diesel as an Offsetting Factor*

The ADF regulation NOx mitigation framework relies on NOx emissions reductions from the use of renewable diesel to offset NOx emissions increases from biodiesel blends below the NOx control level (usually B5). Since the in-use requirements came into effect at the beginning of 2018, certified additives have been the option used by the majority of the market to mitigate biodiesel NOx emissions from use of biodiesel blends above the NOx control level. If currently-certified additives and formulations are no

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<sup>1</sup> See “State of California, Air Resources Board, Board Hearing Transcript.” April 23 (2020). Page 116 (16-20), Page 117 (7-17, 23-25), Page 118 (1-8, 23-25). Available at: <https://ww3.arb.ca.gov/board/mt/2020/mt042320.pdf>

<sup>2</sup> Diesel Test Fuel is defined in Title 13 of the California Code of Regulations (CCR), Section 2293.2(a)(10.6) as “a fuel against which alternative diesel fuels are tested for emission-equivalency and certification. Designated Equivalent Limits Diesel and Reference CARB Diesel are Diesel Test Fuels.”

longer available to mitigate biodiesel NOx emissions above the NOx control level when the proposed amendments become effective, biodiesel producers and blenders will need to use other methods of compliance, such as blending down to the NOx control level, or use of an approved ADF formulation to ensure that biodiesel blends above the NOx control level are mitigated to the level of conventional diesel.

### *Previous CARB-Certified Renewable Diesel-Based ADF Formulations*

Previous CARB certifications of ADF formulations have provided testing data that demonstrates the ability of various renewable diesel and biodiesel formulations to reduce NOx emissions and offset emissions from biodiesel blends below the NOx control level. When reviewing testing data from previous CARB certifications, staff also considered the impact additional certified ADF formulations could have on the total volumes of renewable diesel and biodiesel fuel used in California. Substantial use of renewable diesel in approved and certified ADF formulations to mitigate NOx emissions from use of biodiesel blends above the NOx control level could reduce the amount of renewable diesel available to offset NOx emissions from biodiesel blends below the NOx control level. Sufficient volumes of renewable diesel not used to mitigate biodiesel NOx above the control level must be available to fully offset NOx emissions increases from biodiesel blends below the NOx control level; this was also a primary consideration for approval of the certification of Renewable Energy Group's (REG) first two ADF formulations (Executive Orders G-714-ADF02 and G-714-ADF06),<sup>3</sup> including a certified blend of R75 B20. Based on further analysis of renewable diesel supplies in California, CARB later certified an REG ADF formulation composed of 16 percent proprietary REG renewable diesel and 20 percent biodiesel based on the same emissions testing data used to certify the R75 B20 blend (the initial test fuel was an R45 B55 blend, equivalent to R16 B20), but included an expiration date on the Executive Order of December 31, 2022 to ensure the opportunity for additional staff analysis to evaluate this certification in the context of overall NOx equivalency of the ADF program.

### *Previous CARB Studies and Analyses of NOx Emissions from Renewable Diesel*

Past CARB-commissioned studies have demonstrated the ability for some ADF Formulations to reduce NOx emissions, compared to conventional diesel. A study commissioned by CARB in 2009 found that a blend of 55 percent renewable diesel, 20 percent biodiesel, and 25 percent conventional diesel (R55 B20, which equates to a ratio of 2.75 gallons renewable diesel to one gallon biodiesel) resulted in a small NOx reduction (0.8%) compared to conventional diesel. Previous CARB staff analyses have

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<sup>3</sup> See "Executive Order G-714-ADF02." CARB. 2018. January 18. Available at: [https://www3.arb.ca.gov/fuels/diesel/altdiesel/20180118\\_reg\\_eo\\_adf02.pdf?\\_ga=2.228549661.1680858013.1588706403-1042658205.1574400241](https://www3.arb.ca.gov/fuels/diesel/altdiesel/20180118_reg_eo_adf02.pdf?_ga=2.228549661.1680858013.1588706403-1042658205.1574400241) and "Executive Order G-714-ADF06." CARB. 2018. June 1, 2018. Available at: [https://www3.arb.ca.gov/fuels/diesel/altdiesel/20180612\\_reg\\_eo\\_adf06.pdf?\\_ga=2.44342444.969776230.1588719562-347889477.1588719562](https://www3.arb.ca.gov/fuels/diesel/altdiesel/20180612_reg_eo_adf06.pdf?_ga=2.44342444.969776230.1588719562-347889477.1588719562)

also calculated<sup>4</sup> the NOx emissions from biodiesel use at varying blend ratios and the NOx reductions from renewable diesel use.<sup>5</sup>

For this Staff Paper, staff relied on data from the 2009 study,<sup>6</sup> data from prior CARB-certified ADF formulations, and previous staff analyses on biodiesel and renewable diesel, to estimate the overall potential NOx emissions that could be a result of the proposed modifications.

Staff's analysis demonstrates that the proposed modifications related to the approved ADF formulation blend content are protective of overall NOx emissions and thus beneficial to California's long-term air quality. *Therefore, staff's analysis supports staff's conclusion in the 15-day Notice that the proposed modifications do not change implementation of the regulation in any way that affects the conclusions of the environmental analysis (EA) addendum included in the Staff Report.*

## **II. Analysis of Potential Overall NOx Emissions of Proposed Modifications**

Staff analyzed the overall NOx emissions of the proposed modifications related to the approved ADF formulation blend content using publicly available data and studies. As noted in the introduction, staff's analysis of the proposed modifications in the following paragraphs demonstrates that they are protective of overall NOx emission reductions and thus beneficial to California's long-term air quality.

### **A. Potential Overall NOx Emissions Associated with Additional R55 B20 Approved ADF Formulation**

In June 2020 CARB staff released an analysis of the NOx emissions of an R75 B20 approved ADF formulation and determined that this formulation provides NOx emissions reductions on a per gallon basis compared to conventional diesel and is NOx beneficial

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<sup>4</sup> See "Final Supplemental Disclosure Discussion of Oxides of Nitrogen Potentially Caused by the Low Carbon Fuel Standard Regulation." CARB. 2018. September 17. Available at: [https://www3.arb.ca.gov/regact/2018/lcfs18/finaldisc.pdf?\\_ga=2.130894351.1260211689.1588616941-1042658205.1574400241](https://www3.arb.ca.gov/regact/2018/lcfs18/finaldisc.pdf?_ga=2.130894351.1260211689.1588616941-1042658205.1574400241)

<sup>5</sup> In Section B of Chapter 6 of the staff report for the 2015 ADF regulation staff concluded low saturation biodiesel results in a NOx increase of 4.0% for B20 and 1.0% for B5 versus CARB diesel and the relationship is linear and can be extrapolated to a NOx increase of 20.0% for B100, based on a literature search described in that chapter. Staff's Supplemental Disclosure Discussion Analysis assumed a NOx decrease of 10 percent for R100, based on the staff report for the 2015 ADF regulation. See "Proposed Regulation on the Commercialization of Alternative Diesel Fuels - Staff Report: Initial Statement of Reasons." CARB. 2015. January 2. Available at: <https://www3.arb.ca.gov/regact/2015/adf2015/adf15isor.pdf>

<sup>6</sup> See "CARB Assessment of the Emissions from the Use of Biodiesel as a Motor Vehicle Fuel in California, "Biodiesel Characterization and NOx Mitigation Study," Final Report." Durbin et al. 2011. October. Available at: [https://www.arb.ca.gov/fuels/diesel/altdiesel/20111013\\_CARB%20Final%20Biodiesel%20Report.pdf](https://www.arb.ca.gov/fuels/diesel/altdiesel/20111013_CARB%20Final%20Biodiesel%20Report.pdf).

as a whole.<sup>7,8</sup> This analysis also included an evaluation of the overall NOx emissions of other ADF formulations, including the potential NOx emissions that could result from an R55 B20 ADF formulation under various future renewable diesel and biodiesel fuel volumes. The quantitative analysis, using renewable diesel, biodiesel, and conventional diesel fuel volume data based on the LCFS compliance scenarios publicly released in 2018,<sup>9</sup> showed a potential NOx emissions increase in 2021 and NOx emissions reductions in 2022 and 2023.<sup>10</sup> The potential NOx emissions increase in 2021 that staff calculated in the analysis was a direct result of using the estimated renewable diesel and biodiesel volumes (from the 2018 LCFS compliance scenarios). Staff compared the estimated renewable diesel and biodiesel volumes from the LCFS compliance scenario with recently reported trends in actual renewable diesel and biodiesel volumes and concluded that the volumes used in the analysis are not reflective of recent renewable diesel and biodiesel volume trends, the outcome identified in the analysis is unlikely, and that the addition of an R55 B20 approved ADF formulation would be protective of overall NOx emissions and therefore beneficial.

#### *Recent Trends Indicate Protective Volumes of Renewable Diesel*

Staff reviewed trends in quarterly real-world renewable diesel volumes and biodiesel volumes from Quarter 1, 2018 through Quarter 1, 2020, shown in Figure 1.

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<sup>7</sup> See “State of California, Air Resources Board, Public Hearing to Consider the Proposed Amendments to the Regulation on the Commercialization of Alternative Diesel Fuels, Staff Report: Initial Statement of Reasons.” January 7 (2020). Available at:

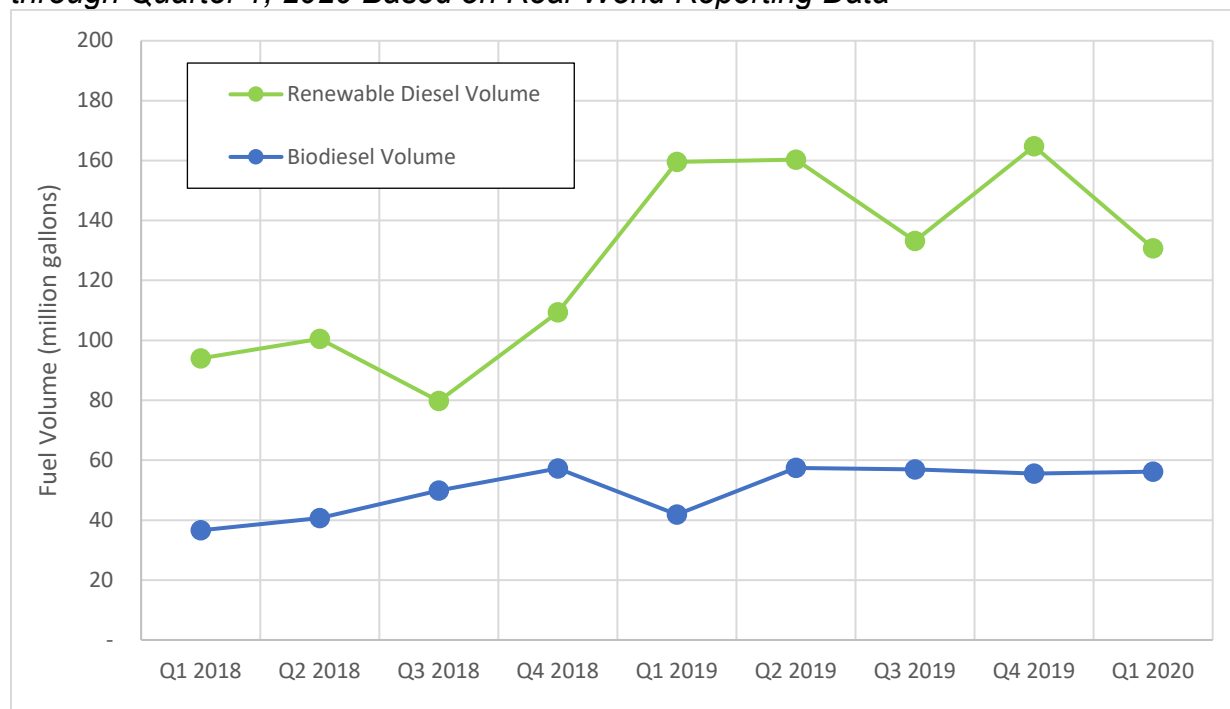
[https://www3.arb.ca.gov/regact/2020/adf2020/isor.pdf?\\_ga=2.142177842.1277515527.1593467990-211680084.1591108534](https://www3.arb.ca.gov/regact/2020/adf2020/isor.pdf?_ga=2.142177842.1277515527.1593467990-211680084.1591108534)

<sup>8</sup> See “Staff Analysis of ADF Public Formulation Blend Level.” CARB 2020. June 4. Available at: [https://www2.arb.ca.gov/sites/default/files/2020-06/Staff\\_Analysis\\_ADF\\_Public\\_Formulation\\_Blend\\_Level.xlsx](https://www2.arb.ca.gov/sites/default/files/2020-06/Staff_Analysis_ADF_Public_Formulation_Blend_Level.xlsx)

<sup>9</sup> The basis for the fuel volumes used in the quantitative analysis are described in further detail in the subsection below entitled “Description of Quantitative NOx Emissions Analysis.”

<sup>10</sup> See “Staff Analysis of ADF Public Formulation Blend Level.” CARB 2020. June 4. Available at: [https://www2.arb.ca.gov/sites/default/files/2020-06/Staff\\_Analysis\\_ADF\\_Public\\_Formulation\\_Blend\\_Level.xlsx](https://www2.arb.ca.gov/sites/default/files/2020-06/Staff_Analysis_ADF_Public_Formulation_Blend_Level.xlsx)

*Figure 1: Quarterly Renewable Diesel and Biodiesel Volumes for Quarter 1, 2018 through Quarter 1, 2020 Based on Real-World Reporting Data*



Renewable diesel volumes fluctuated somewhat from Quarter 2, 2019 through Quarter 1, 2020, but are on an upward trend. Biodiesel volumes remained relatively steady over the same time period. Figure 1 shows an increasing trend in renewable diesel volumes over the time period from Quarter 1, 2018 through Quarter 1, 2020, and a trend of small or no increase in biodiesel volumes.

The ratio of renewable diesel to biodiesel is an important indicator of the overall change in NOx emissions from use of biodiesel and renewable diesel. Based on emissions studies described in the introduction, renewable diesel reduces NOx by 10 percent and biodiesel increases NOx by 20 percent, meaning two gallons of renewable diesel can fully mitigate NOx emissions from a gallon of biodiesel. Based on these emissions a renewable diesel to biodiesel volume ratio of 2.0 statewide results in overall NOx equivalence with conventional diesel, if no other NOx mitigation is employed. Similarly, renewable diesel to biodiesel volume ratios above 2.0 would result in overall NOx emissions reductions, and renewable diesel to biodiesel volume ratios below 2.0 may result in NOx emissions increases. It is important to note that renewable diesel to biodiesel volume ratios below 2.0 may not result in NOx emissions increases if other mitigation methods are employed.

Table 1 below shows the annual volumes, volume ratios, and NOx emissions for 2018 and 2019 in tons per day (TPD) assuming that additives were ineffective in mitigating biodiesel NOx above the NOx control level during these years.



*Table 1: Renewable Diesel and Biodiesel Volumes and Relative Overall NOx Emissions Based on Recent Reporting Data*

Year	Source of Fuel Volume Data	Renewable Diesel Volume (million gallons)	Biodiesel Volume (million gallons)	Renewable Diesel to Biodiesel Volume Ratio	Change in Overall NOx Emissions Relative to Conventional Diesel Use (TPD)
2018	Actuals Based on LCFS Reporting Data	384	184	2.1	-0.2
2019		618	212	2.9	-2.6

### *Compliance Options Other than Renewable Diesel Enhance Protection*

The ADF regulation contains multiple compliance options to meet the NOx control requirements, including certified additives, an approved additive, and exemptions for entities that primarily operate using or selling fuel for use in New Technology Diesel Engines that do not experience NOx increases with biodiesel use. These compliance options will continue to be available after the proposed modifications become effective. These compliance options are likely to mitigate NOx emissions such that a ratio below 2.0 may still achieve NOx emissions equivalence or benefits.

### *Pure Renewable Diesel Provides Additional Protection*

The quantitative analysis that results in a potential overall NOx emissions increase in 2021 is also unlikely because renewable diesel is unlikely to be used only in the R55 B20 approved ADF formulation. A number of public and private vehicle fleets in California, including those of the State of California; City and County of San Francisco; County of Sacramento; Cities of San Diego, Oakland, Carlsbad, San Leandro, and Walnut Creek; UPS; Google; and Ecology have partially or fully transitioned their diesel-fueled vehicle fleets to pure renewable diesel (R100/R99) or high renewable diesel blend fuel (i.e., 95 percent or greater renewable diesel).<sup>11</sup> In addition, Propel Fuels

<sup>11</sup> See "Diesel, Biodiesel, and Renewable Hydrocarbon Diesel Bulk Fuel Purchases – 3627." State of California, Department of General Services. October 2015. Available at:

<https://www.dgs.ca.gov/Resources/SAM/TOC/3600/3627>. Accessed: August 27, 2020.

See "Neste's renewable diesel to power San Francisco's city fleet." Neste US, Inc. December 16, 2015. Available at: <https://www.neste.com/nestes-renewable-diesel-power-san-franciscos-city-fleet>. Accessed: September 11, 2020.

See "Media Release: Renewable Diesel." SACCOUNTY NEWS. August 26, 2016. Available at: <https://www.saccounty.net/news/latest-news/Pages/Press-Release-Renewable-Diesel.aspx>. Accessed: August 27, 2020.

See "City Using Renewable Diesel to Make Its Vehicle Fleet Greener." City of San Diego. October 27, 2016. Available at: <https://www.sandiego.gov/mayor/news/releases/city-using-renewable-diesel-make-its-vehicle-fleet-greener>. Accessed: September 11, 2020.

See "City of Oakland, Google buses and UPS now drive with Neste's NEXBTL renewable diesel." Neste US, Inc. November 11, 2015. Available at: <https://www.neste.us/city-oakland-google-buses-and-ups-now-drive-nestes-nexbtl-renewable-diesel>. Accessed: September 11, 2020.

currently operates over 30 retail fueling locations throughout California that offer pure renewable diesel (R100/R99),<sup>12</sup> and Neste operates four commercial fueling locations for fleet vehicles that offer pure renewable diesel.<sup>13</sup> These higher renewable diesel blends yield NOx reductions that increase the ability of renewable diesel to offset potential NOx increases associated with use of biodiesel blends below the NOx control level and to provide overall NOx reductions.

### *Description of Quantitative NOx Emissions Analysis*

Consistent with previous CARB analyses of overall NOx emissions of biodiesel and renewable diesel use in California,<sup>14</sup> staff utilized publicly-available data, including 2018 fuel mix volumes for renewable diesel and conventional diesel<sup>15</sup> and NOx emission factors for renewable diesel and biodiesel. Staff assumed that all biodiesel use above the NOx control level (usually B5) is mitigated with the R55 B20 approved ADF formulation, all renewable diesel is used in the R55 B20 approved ADF formulation, and the total biodiesel volumes are maximized.<sup>16</sup> These assumptions, however, reflect an unlikely scenario, as described in more detail below. The results of staff's quantitative analysis of overall NOx emissions for the proposed R55 B20 approved ADF formulation

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See "Neste Renewable Diesel to power City of Carlsbad's Fleet in California." Neste US, Inc. July 11, 2016. Available at: <https://www.neste.com/releases-and-news/renewable-solutions/neste-renewable-diesel-power-city-carlsbads-fleet-california>. Accessed: September 11, 2020.

See "City of San Leandro in California switches its municipal vehicles to run on Neste MY Renewable Diesel." Neste US, Inc. May 23, 2018. Available at: <https://www.neste.com/releases-and-news/renewable-solutions/city-san-leandro-california-switches-its-municipal-vehicles-run-neste-my-renewable-diesel>. Accessed: September 11, 2020.

See "City of Walnut Creek Climate Action Plan Assessment Report." Michael Baker International. September, 2016. Available at: <https://www.walnut-creek.org/home/showdocument?id=12701>.

See "Californian transportation company Ecology lowers its carbon footprint with clean-burning Neste MY Renewable Diesel." Neste US, Inc. November 7, 2018. Available at: <https://www.neste.com/releases-and-news/californian-transportation-company-ecology-lowers-its-carbon-footprint-clean-burning-neste-my>. Accessed: September 11, 2020.

<sup>12</sup> See "Propel Fuels Diesel HPR Stations in California". Propel Fuels. 2020. Available at: <https://propelfuels.com/locations>. Accessed: September 10, 2020.

<sup>13</sup> See "New Neste commercial fueling sites now open in Northern and Central California." Neste. August 28, 2019. Available at: <https://www.neste.com/releases-and-news/new-neste-commercial-fueling-sites-now-open-northern-and-central-california>. Accessed: August 25, 2020.

<sup>14</sup> See "Final Disclosure Discussion of Oxides of Nitrogen Potentially Caused by the Low Carbon Fuel Standard Regulation." CARB. 2018. September 27. Available at: [https://ww3.arb.ca.gov/regact/2018/lcfs18/finaldisc.pdf?\\_ga=2.130894351.1260211689.1588616941-1042658205.1574400241](https://ww3.arb.ca.gov/regact/2018/lcfs18/finaldisc.pdf?_ga=2.130894351.1260211689.1588616941-1042658205.1574400241) and

"State of California, Air Resources Board, Public Hearing to Consider the Proposed Amendments to the Regulation on the Commercialization of Alternative Diesel Fuels, Staff Report: Initial Statement of Reasons." January 7 (2020). Available at: [https://ww3.arb.ca.gov/regact/2020/adf2020/isor.pdf?\\_ga=2.142177842.1277515527.1593467990-211680084.1591108534](https://ww3.arb.ca.gov/regact/2020/adf2020/isor.pdf?_ga=2.142177842.1277515527.1593467990-211680084.1591108534)

<sup>15</sup> 2018 fuel mix volumes correspond to volumes from the "Project Scenario" in the LCFS Illustrative Compliance Scenario Calculator. See "Illustrative Compliance Scenario Calculator." CARB. August 15 (2018). Available at: [https://www.arb.ca.gov/fuels/lcfs/2018-0815\\_illustrative\\_compliance\\_scenario\\_calc.xlsx](https://www.arb.ca.gov/fuels/lcfs/2018-0815_illustrative_compliance_scenario_calc.xlsx)

<sup>16</sup> Staff's assumption that all biodiesel use above the NOx control level is mitigated with the R55 B20 approved ADF formulation limits the total biodiesel use to a volume less than indicated in the "Project Scenario" in the LCFS Illustrative Compliance Scenario Calculator. Staff maximized the total biodiesel volume by assuming that all renewable diesel in California is used in the R55 B20 approved ADF formulation and that the remaining total diesel demand is saturated to B5.

are summarized in Table 1 for the period 2021 through 2023.<sup>17</sup>

*Table 2: Overall NOx Emissions from R55 B20 ADF Formulation Based on an Unlikely Scenario that Maximizes Biodiesel Use*

Year	RD Volume (million gallons)	BD Volume (million gallons)	Change in Overall NOx Emissions Relative to Conventional Diesel (TPD)
2021	750	390	0.3
2022	850	419	-0.1
2023	900	434	-0.2

*Quantitative Analysis is Based on Unlikely Scenario and Conservative Assumptions*

Table 1 indicates that use of an R55 B20 ADF formulation under an unlikely scenario that maximizes future biodiesel volumes would result in NOx reductions relative to conventional diesel, except in 2021. The potential NOx emissions increase in 2021 would only occur under unlikely scenarios similar to the scenario described above. Staff has concluded that this scenario is unlikely because:

1. It does not reflect updates in real-world fuel volume trends;
2. The R55 B20 approved formulation is unlikely to be the only compliance option used to mitigate NOx emissions from biodiesel use above the NOx control level; and
3. It is unlikely that all renewable diesel in California will be used as part of the R55 B20 approved formulation.

Staff has provided additional discussion below explaining the reasons why the scenario that results in a potential NOx emissions increase is unlikely.

*Unlikely Scenario Does Not Reflect Updates in Real-World Fuel Volumes*

As indicated above, the scenario that results in a potential overall NOx emissions increase in 2021 is unlikely because it is not based on updates in real-world fuel volume reporting data in California that show lower biodiesel use and higher renewable diesel use than in the unlikely scenario. Although the scenario has matched combined volumes of biodiesel and renewable diesel fairly well, it does not match the split between the two well. When considering the overall NOx emissions associated with anticipated lower biodiesel use and higher renewable diesel use based on real-world reporting data from 2018 through Quarter 1, 2020,<sup>18</sup> there is a lower overall NOx emissions trend for 2021 compared to the NOx emissions trend in 2021 that was

<sup>17</sup> Staff analyzed the period 2021 through 2023 based on the effective date of the proposed amendments (April 1, 2021) and the anticipated sunset date for in-use requirements for biodiesel blends above the NOx control level in the on-road sector (2023). After the sunset date, mitigation of NOx emissions associated with use of biodiesel blends above the NOx control level will not be required for the on-road sector.

<sup>18</sup> See "LCFS Quarterly Data Spreadsheet." CARB. July 31 (2020). Available at: [https://ww3.arb.ca.gov/fuels/lcfs/dashboard/quarterlysummary/quarterlysummary\\_073120.xlsx](https://ww3.arb.ca.gov/fuels/lcfs/dashboard/quarterlysummary/quarterlysummary_073120.xlsx)

derived based on the unlikely scenario described above. Table 3 presents annual fuel volumes, the ratio of fuel volumes, and the overall annual NOx emissions changes relative to conventional diesel use for real-world reporting data from 2018 through 2019 and for the unlikely scenario from 2021 through 2023 associated with use of an approved R55 B20 approved ADF formulation.

*Table 3: Summary of Renewable Diesel and Biodiesel Volumes and Changes in Overall NOx Emissions Based on Recent Reporting Data and an Unlikely Scenario Associated with Use of an R55 B20 Approved ADF Formulation*

Year	Source of Fuel Volume Data	Renewable Diesel Volume (million gallons)	Biodiesel Volume (million gallons)	Renewable Diesel to Biodiesel Volume Ratio	Change in Overall NOx Emissions Relative to Conventional Diesel Use (TPD)
2018	Actuals Based on LCFS Reporting Data	384	184	2.1	-0.2
2019		618	212	2.9	-2.6
2021	Unlikely Scenario Based on LCFS Illustrative Compliance Scenario Calculator	750	390	1.9	0.3
2022		850	419	2.0	-0.1
2023		900	434	2.1	-0.2

Table 3 indicates that a substantial increase in biodiesel volumes, much higher than indicated by real-world reporting data from Quarter 1, 2018 through Quarter 1, 2020, would be needed to reach the biodiesel volume assumed for 2021 under the unlikely scenario (i.e., 390 million gallons, almost double the amount in 2019). Table 3 also shows that a much smaller increase in real-world renewable diesel volumes would be needed to reach the renewable diesel volume assumed for 2021 under the unlikely scenario (750 million gallons, about a 20 percent increase from 2019). Based on real-world reporting and trends indicated in Table 3, however, it is clear that it is more likely that real-world renewable diesel volumes in 2021 will be much higher than the volumes in the unlikely scenario and real-world biodiesel volumes in 2021 will be much lower than the volumes in the unlikely scenario. These likely higher renewable diesel volumes and likely lower biodiesel volumes would likely drive NOx reductions in future years, including 2021.

As described above, use of an R55 B20 approved ADF formulation would result in a potential overall NOx emissions increase only under unlikely scenarios similar to the scenario described above. Reasonably foreseeable scenarios that are based on fuel volumes that are more reflective of anticipated updates and trends in real-world fuel volumes, consider compliance options other than the approved R55 B20 approved formulation, and include renewable diesel use in California outside of the R55 B20

approved formulation, would result in overall NOx emissions reductions in 2021-2023. Therefore, staff concludes that the proposed modification to add an R55 B20 approved ADF formulation is protective of overall NOx emissions.

### **B. Potential Overall NOx Emissions Associated with Required NOx Reductions for Candidate Fuels Containing Renewable Diesel**

Staff also analyzed the potential overall NOx emissions associated with the proposed requirement for certification testing of candidate fuels containing renewable diesel to demonstrate a NOx reduction relative to the Diesel Test Fuel on a per-gallon basis. As indicated above, substantial use of renewable diesel in approved and certified ADF formulations, including the proposed R55 B20 approved formulation, to mitigate NOx emissions from use of biodiesel blends above the NOx control level could reduce the amount of renewable diesel available to offset NOx emissions from biodiesel blends below the NOx control level. To address this issue, staff proposed that certification testing of candidate fuels containing renewable diesel be required to demonstrate a per-gallon NOx reduction relative to Diesel Test Fuel in order to maintain renewable diesel's effect as an offsetting factor for NOx emissions from biodiesel below the NOx control level.

Staff considered the potential overall NOx emissions associated with different levels of required NOx reductions for candidate fuels containing a range of renewable diesel contents. The results of staff's analysis indicated that a requirement for certification testing of candidate fuels to demonstrate at least a two percent NOx reduction on a per-gallon basis relative to Diesel Test Fuel would also result in potential overall NOx reductions and maintain renewable diesel's effect as an offsetting factor for NOx emissions from biodiesel below the NOx control level, and is therefore protective of NOx emissions.

The current ADF regulation grants certification approval to ADF formulations that demonstrate NOx equivalence. Because the proposed modification would require certification testing of ADF formulations containing renewable to demonstrate at least a two percent NOx reduction, this proposed modification is more protective of NOx emissions than the current ADF regulation and therefore beneficial.

### **C. Potential Overall NOx Emissions Associated with Adjusting the Effective Date**

Staff also evaluated the potential overall NOx emissions of adjusting, from January 1, 2021 to April 1, 2021, the date after which only biodiesel additives or ADF formulations approved or certified under the proposed amendments can be used to comply with biodiesel in-use requirements. Based on the 2018 LCFS compliance scenario<sup>19</sup> that varies from the real world data CARB received in recent fuels reporting from 2018

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<sup>19</sup> See "Illustrative Compliance Scenario Calculator." CARB. August (15), 2018. Available at: [https://www.arb.ca.gov/fuels/lcfs/2018-0815\\_illustrative\\_compliance\\_scenario\\_calc.xlsx](https://www.arb.ca.gov/fuels/lcfs/2018-0815_illustrative_compliance_scenario_calc.xlsx)

through Quarter 1, 2020,<sup>20</sup> staff calculated that the use of renewable diesel and biodiesel, assuming the continued use of ineffective additives,<sup>21</sup> could result in a potential overall NOx emissions increase of 1.1 TPD from January 1, 2021 through March 31, 2021 (Quarter 1, 2021) relative to conventional diesel use. However, staff does not believe this scenario is reasonably foreseeable.

The estimated potential overall 1.1 TPD NOx emissions increase in Quarter 1, 2021 is based on an unlikely scenario and is a speculative assessment because it was not based on anticipated updates in real world fuel volume reporting data for Quarter 1, 2021. In fact, real-world data from Quarter 1, 2018 through Quarter 1, 2020 indicate a lower NOx emission trend for Quarter 1, 2021 than was estimated in the 2018 ADF rulemaking when considering the potential overall emissions associated with anticipated lower biodiesel use and higher renewable diesel use, as described above.

Staff also estimated that the continued use of ineffective additives in biodiesel blends above the NOx control level, considered separately from use of renewable diesel and biodiesel blends below the NOx control level, could result in a potential NOx emissions increase of up to 7.1 TPD for the remainder of 2021 (i.e., Quarters 2 through 4, 2021).<sup>22</sup> The amendments and proposed modifications would avoid this potential NOx emissions increase by providing alternative compliance options in the form of approved and certified renewable diesel-based ADF formulations that are NOx-reducing and by requiring currently certified additives to be uniformly certified according to more rigorous procedures. The potential 7.1 TPD NOx reduction in Quarters 2 through 4 of 2021 resulting from implementation of the amendments and proposed modifications dwarfs the unlikely potential overall 1.1 TPD NOx emissions increase in Quarter 1, 2021.

In summary, to ensure that ADF additives adequately mitigate NOx emissions from biodiesel by achieving verifiable NOx reductions and approved and certified ADF formulations achieve NOx reductions sufficient to offset NOx increases from biodiesel blends below the NOx control level, staff proposed and the Board approved for adoption the amendments described in the Staff Report,<sup>23</sup> and staff is proposing the modifications described above.

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<sup>20</sup> See "LCFS Quarterly Data Spreadsheet." CARB. July 31 (2020). Available at:

[https://www3.arb.ca.gov/fuels/lcfs/dashboard/quarterlysummary/quarterlysummary\\_073120.xlsx](https://www3.arb.ca.gov/fuels/lcfs/dashboard/quarterlysummary/quarterlysummary_073120.xlsx)

<sup>21</sup> Staff assumed that all additives are completely ineffective.

<sup>22</sup> Staff estimated potential NOx emissions due to biodiesel use above the NOx control level based on 2018 LCFS Compliance Scenario fuel volumes and the assumption that all additives are completely ineffective. See "Illustrative Compliance Scenario Calculator." CARB. August (15), 2018. Available at: [https://www.arb.ca.gov/fuels/lcfs/2018-0815\\_illustrative\\_compliance\\_scenario\\_calc.xlsx](https://www.arb.ca.gov/fuels/lcfs/2018-0815_illustrative_compliance_scenario_calc.xlsx)

<sup>23</sup> See "State of California, Air Resources Board, Public Hearing to Consider the Proposed Amendments to the Regulation on the Commercialization of Alternative Diesel Fuels, Staff Report: Initial Statement of Reasons." January 7 (2020). Available at:

<https://www3.arb.ca.gov/regact/2020/adf2020/isor.pdf? ga=2.142177842.1277515527.1593467990-211680084.1591108534>

### **III. Conclusions**

Based on staff's analysis, staff concludes that the proposed modifications do not require additional environmental review under the California Environmental Quality Act. After its approval of the ADF amendments on April 23, 2020, the Board filed a notice of decision with the Secretary of the California Natural Resources Agency for its adoption of an addendum to the environmental analysis that the Board certified in 2018 and its approval of the regulations that staff presented to the Board that day for adoption. The proposed modifications, while related to the Board's April 23, 2020 final action on the adopted regulations, require a separate approval to become an effective part of CARB's regulations. CARB does not expect that any changes in compliance responses resulting from the modifications would result in any of the circumstances requiring a subsequent environmental analysis because the proposed modifications are consistent with the framework of the existing and recently adopted ADF regulation and finds that an additional addendum to the 2018 EA is appropriate for the proposed modifications. (Title 14 CCR sections 15164 and 15162)

Relying on the foregoing NOx emissions analysis in this staff paper, the proposed modifications do not propose substantial changes to the ADF regulation which require major revisions of the 2018 EA that involve new significant environmental effects, or a substantial increase in severity of the previously identified significant effects because the proposed modifications do not result in NOx emission levels above the NOx control level. Nor are there substantial changes with respect to the circumstances under which the proposed modifications are undertaken that requires major revisions to the 2018 EA because the proposed modifications do not involve new significant effects, as explained in detail, above. Additionally, there is no new information of substantial importance related to the emissions analysis that shows new significant effects or previously identified significant effects that would be more severe. Rather, as illustrated above, the proposed modifications are protective of NOx emission reductions and beneficial for long-term air quality in California.