



**January 31, 2022**

**Submitted Via e-Mail to [adf@arb.ca.gov](mailto:adf@arb.ca.gov)**

Oil and Gas and GHG Mitigation Branch Chief  
California Air Resources Board  
1001 I Street  
Sacramento, CA 95812

**RE: Valero Feedback on the Low Emission Diesel (LED) Study: Biodiesel and Renewable Diesel Emissions in Legacy and New Technology Diesel Engines**

Dear Ms. Carolyn Lozo:

On behalf of Valero Renewable Fuels Company LLC., Valero Refining Company – California, Ultramar Inc., and Valero Services as operator of the Diamond Green Diesel, LLC renewable diesel facility in Norco, Louisiana (together “Valero”), I appreciate the opportunity to provide the following feedback regarding the University of California at Riverside evaluation of oxides of nitrogen and particulate matter emissions from the use of renewable diesel blends in new technology diesel engines dated November 2021.

The California Air Resources Board (CARB) recently contracted with the University of California at Riverside (UCR) Bourns College of Engineering – Center for Environmental Research and Technology (CE-CERT) to evaluate oxides of nitrogen (NOx) and particulate matter (PM) emissions from the use of renewable diesel (RD)/biodiesel (BD) blends in one on-road and one off-road new technology diesel engine (NTDE) with selective catalytic reduction (SCR) and diesel particulate filter (DPF) exhaust aftertreatment systems, and one off-road non-NTDE (legacy engine) without DPF and SCR.

UCR’s “Final Report - Low Emission Diesel (LED) Study: Biodiesel and Renewable Diesel Emissions in Legacy and New Technology Diesel Engines” (“Final Report”) was released in November 2021, and CARB has invited stakeholders to review several questions posed by the agency and offer comments. This letter presents Valero’s feedback to the questions posted by CARB.

**A. NOx Emission Results from RD Fuel Use**

CARB has requested feedback on the question “How might these findings impact NOx emissions estimates from BD and RD fuel use?”

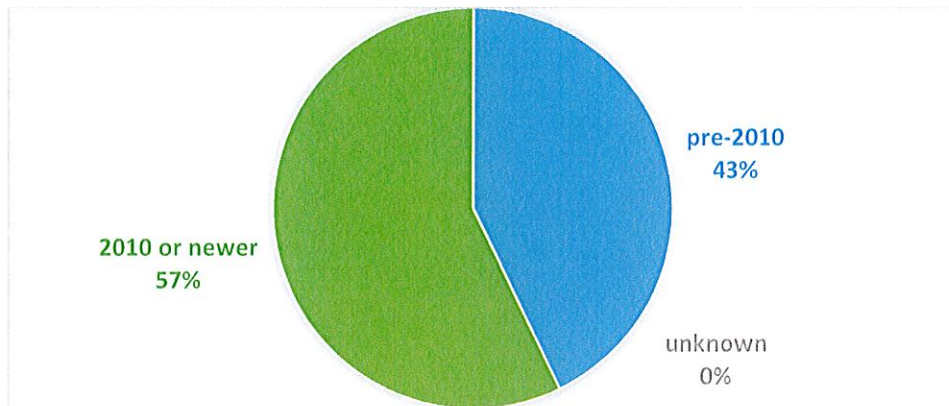
Legacy HDV

UCR’s Final Report observes that NOx emissions from the testing of the off-road legacy diesel engine with neat renewable diesel (RD100) are an average of 5% lower than with



conventional diesel.<sup>1</sup> The observation is consistent with results presented to the Bay Area Air Quality Management District (BAAQMD) and South Coast AQMD (SCAQMD) in 2017 for legacy on-road and off-road diesel Heavy-Duty Vehicles (HDV).<sup>2</sup> The improved NOx performance in legacy HDV is notable, given that 43% of the diesel HDV registered in California are of pre-2010 Model Years and are not likely to be factory-equipped with advanced NOx emission controls such as SCR.<sup>3</sup>

Figure 1: Breakdown of Diesel HDV Registration in California by Model Year



## NTDE

UCR’s Final Report concludes that NOx emissions from both NTDE using RD100 as the test fuel were not statistically different from the petroleum-based CARB reference fuel.<sup>4</sup> The “CARB Notice” posted by CARB on its website concludes similarly that “NOx emissions from RD100 were shown to be no different than conventional diesel.”<sup>5</sup>

UCR’s study relies on p-values for a statistical comparison between NOx emissions using the CARB reference fuel and NOx emissions using RD100. Based on the range of p-values observed for each NTDE and test cycle, Valero supports the conclusions by both UCR and CARB that

<sup>1</sup> On a per brake-horsepower-hour (bph-hr) basis. Observed reductions by cycle were 5.4% during testing of NRTC Cycle, and 4.9% during testing of D2 Cycle (Section 4.1.1).

<sup>2</sup> “Renewable Diesel as a Major Transportation Fuel in California: Opportunities, Benefits and Challenges,” Gladstein, Neandross & Associates, August 2017

<sup>3</sup> “Vehicle Fuel Type Count by Zip Code” dataset, CA.gov Open Data Portal, dataset updated Jan 1, 2020; <https://data.ca.gov/dataset/vehicle-fuel-type-count-by-zip-code>, accessed on January 27, 2022

<sup>4</sup> “Final Report - Low Emission Diesel (LED) Study: Biodiesel and Renewable Diesel Emissions in Legacy and New Technology Diesel Engines”, University of California, November 2021, page viii

<sup>5</sup> “CARB Notice - Low Emission Diesel (LED) Study: Biodiesel and Renewable Diesel Emissions in Legacy and New Technology Diesel Engines”, CARB, undated, page 2, [https://ww2.arb.ca.gov/sites/default/files/2022-01/CARB\\_Note\\_for\\_Low\\_Emission\\_Diesel\\_Study.pdf](https://ww2.arb.ca.gov/sites/default/files/2022-01/CARB_Note_for_Low_Emission_Diesel_Study.pdf), accessed on January 27, 2022



NOx emissions observed with RD100 in the on-road and off-road NTDE are no different from those observed with conventional diesel. As such, no NOx mitigations are warranted for the use of renewable diesel in on-road or off-road NTDE.

Valero appreciates the opportunity to provide feedback on this alternative diesel fuel study. If you have any questions, please contact me at (210) 345-4393 or via email at [lori.taylor@valero.com](mailto:lori.taylor@valero.com).

Sincerely,

A handwritten signature in blue ink that reads 'Lori Taylor'.

Lori Taylor  
Director Fuels Regulatory Affairs