Comments of the

Diesel Technology Forum

On the Matter of

The Impact to California of Appendix D of the VW Settlement

Before the

State of California Senate Transportation Committee & Environmental Quality Committee

March 21, 2017

Sacramento CA

Thank you for the opportunity to provide these comments concerning the $381 million California is set to receive through the Environmental Mitigation Trust (“Trust”) established in the VW settlement. The purpose of the Trust is to fund projects to immediately reduce emissions of oxides of nitrogen (NOx) to mitigate the excessive NOx emissions generated by the population of VW cars in California found to have been outfitted with a device to sidestep U.S. EPA and California Air Resources Board emissions requirements.

Because the Trust was established with the express purpose of mitigating emissions of NOx, we believe that the state should focus on the largest sources of NOx emissions in California and then make the most cost effective investments to achieve immediate term NOx reduction that will improve air quality in the near term for all Californian’s and ensure compliance with the goals of the Trust.

The Diesel Technology Forum represents the manufacturers of diesel engines, vehicles and equipment including small passenger vehicles and pickups to large commercial vehicles and off-road equipment, locomotives and stationary engines. The Forum is a not-for-profit educational organization dedicated to raising awareness of the clean air and economic benefits of diesel engines, vehicles and equipment along with cleaner diesel fuel including biodiesel and renewable diesel fuel. More information is available at www.dieselforum.org.

The State will undoubtedly receive many arguments and proposals for investing in various alternative fuels and technologies or infrastructure. In nearly all these cases, the costs would be higher, the incremental NOx benefits would be lower and they would accrue over a longer term than any clean diesel replacement options.

Summary
• According to the latest emissions inventory, the largest sources of NOx emissions in California are attributable to older engines that power heavy-duty vehicles and equipment. In general, diesel engines last much longer than their counterparts. Therefore, the most important opportunity for NOx mitigation in California is replacing heavy-duty engines or the vehicles and equipment they power with new technology.

• Recent studies from U.S. EPA, U.S. DOT and other sources conclude that the most cost effective strategy to reduce NOx emissions from heavy-duty sources are investments in the latest clean diesel technology. Investing Trust revenues in replacing older commercial vehicles with clean diesel technology will allow for greater immediate term air quality benefits beyond that of investments in other technologies, and provide more direct benefits to more small businesses and regions of California than would other technologies and approaches.

• Upgrading or replacing older off-road engines including switch locomotives and marine applications yields enormous air quality benefits and is one of the most cost effective near-term NOx investments that also would have one of the lowest administrative burdens for California relative to other options that would entail a greater number of vehicles or projects.

• Given California’s experience with the Diesel Emissions Reduction Act Program (DERA), the Trust provides that funds are eligible to be used as part of non-federal matching grants for eligible DERA projects. This option would provide an even greater ability to introduce more new clean technology in a wider variety of off-road construction equipment throughout California.

• Funding provided through the Trust for projects to achieve immediate term NOx reduction would not come at the expense of other programs to advance other technologies.

1. Diesel engines, equipment and trucks are the technology of choice for key sectors of California’s economy.

Because of their unmatched combination of power, performance and efficiency, diesel engines are the technology of choice powering key sectors of California’s economy, particularly the goods movement (trucks, railroads, workboats) construction and agricultural sectors. In 2004, it was estimated that the diesel industry contributed $12.4 billion to California’s economy. In California, 70 percent of Class 3-8 trucks in use are powered by a diesel engine and diesel powers 96 percent of the largest Class 8 trucks.

<table>
<thead>
<tr>
<th>Class 3-8 Commercial Vehicles in Use in California</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Vehicles in Operation</td>
</tr>
<tr>
<td>CNG</td>
</tr>
<tr>
<td>16,509</td>
</tr>
<tr>
<td>Share of the Commercial Vehicle Fleet</td>
</tr>
<tr>
<td>CNG</td>
</tr>
<tr>
<td>1.2%</td>
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2. **California’s Trust investments should target the largest sources of NOx emissions.**

The largest sources of NOx emissions in California, according to the latest emissions inventory conducted by the California Air Resources Board, are attributable to older heavy-duty vehicles and equipment including trucks, buses, construction and agricultural equipment, locomotives and marine workboats.

<table>
<thead>
<tr>
<th>Sources of NOx Emissions (2012)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Stationary</td>
<td>13.5%</td>
</tr>
<tr>
<td>Areawide</td>
<td>3.6%</td>
</tr>
<tr>
<td>Mobile Sources</td>
<td>83.0%</td>
</tr>
<tr>
<td>Trucks, Buses, Trains, Vessels and Equipment</td>
<td>69.1%</td>
</tr>
<tr>
<td>Passenger Cars</td>
<td>11.3%</td>
</tr>
<tr>
<td>Aircraft</td>
<td>2.6%</td>
</tr>
</tbody>
</table>


Projects to replace these vehicles and equipment quickly will have immediate term benefits for the communities in they operate. Communities near freight facilities like ports and railyards will benefit the most given the large population of this equipment and the around-the-clock use of this equipment.

3. **California is home to the oldest equipment population of commercial trucks in use in the country. Targeting this population of engines, vehicles and equipment will generate immediate term air quality benefits.**

While California is a leader when it comes to electric vehicle registrations, the state leads the nation in the fleet of trucks that do not meet the latest near-zero emissions standards. Almost three quarter of a million diesel trucks in use in California are of the generation technology built prior to 2010. This compares to a total diesel truck population of about 950,000.

According to the latest vehicle-in-use data (Diesel Technology Forum analysis of IHS Automotive commercial vehicles in operation statistics for 2016), California has among the largest and oldest fleet of commercial vehicles in the nation that are not of the most current generation technology.

_The South Coast Air Quality Management District estimates that NOx emissions could fall by 70 percent or 86 tons each day if every commercial truck in the region were powered by the latest clean diesel engine._

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**Off-Road Engines and Equipment**

Off-road engines and equipment including marine vessels and locomotives have been required to achieve near zero emissions levels of NOx and Particulate Matter similar to the requirements for commercial vehicles. Beginning in 2014 (and 2015 for the largest applications including locomotives and marine vessels), new “Tier 4” emissions requirements for new engines are in effect which result in 90 percent to 95 percent reduction in emissions relative to the oldest engines of the same type.

The life cycles for off road engines and equipment – which are nearly 100 percent powered by diesel technology - are vastly different than those for on-highway commercial trucks, which turn over about every ten years. These off road engines and equipment are typically much larger capital investments and have much longer useful lives, thereby with a slower turnover from older generation technology to new technology.

The U.S. EPA estimates that by 2020, only 3 to 5 percent of all of the largest applications including switch locomotives and marine workboats, will be of the newer generation Tier 4 emissions performance, given the durability and longevity of these larger diesel engines.³

4. **California should invest in proven and available technologies that yield proven clean air benefits. Clean diesel is the most compelling option.**

As a result of decades of research and investment, clean diesel technology yields near-zero emissions, including NOx emissions, and is widely available today to provide immediate term air quality benefits. Clean diesel refers to a system of cleaner diesel fuel, advanced engine designs and after-treatment technologies to meet the most stringent emissions requirements established by the U.S. Environmental Protection Agency (EPA) and the California Air Resources Board (CARB) for heavy-duty on-road vehicles and off-road equipment. Those standards require near-zero emissions, including NOx, for commercial vehicles beginning in model year 2010 and off-road equipment beginning in 2014.

> A new heavy-duty Class 8 truck powered by a clean diesel engine certified to the model year 2010 EPA/CARB emissions standard on the road for one year can reduce emissions of NOx by 1.1 tons relative to a truck manufactured to meet the previous emissions standard.

Equally impressive emission reductions are achievable from the latest clean diesel engines that power off-road equipment including construction and agricultural equipment, locomotives and marine vessels. Depending on horsepower range, these clean diesel “Tier 4” engines reduce NOx emission by 90 to 94 percent relative to the oldest generations of engines. Many of the oldest engines are in use in rail operations and marine applications including push boats and other workboats and replacing these engines with “Tier 4” engines yield enormous air quality improvements.

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³ National Port Strategy Assessment: Reducing Air Pollution and Greenhouse Gases at U.S. Ports (September 21, 2016)
Advancing the introduction of clean diesel technology in heavy duty applications represents the largest category of anticipated NOx reduction, according to the latest emissions inventory for NOx emissions compiled by CARB. The use of the $381 million Trust represents one revenue stream to help achieve these reductions much sooner than anticipated.  

The table below shows cost effectiveness for various technology investments that could be incentivized with California’s Trust funds. Replacing pre-1991 heavy duty trucks with clean diesel trucks would cost approximately $86 for every pound of NOx removed. Similarly, repowering a Tier 0 with a Tier 4 locomotive engine would cost approximately $80 per pound of NOx removed. These clean diesel investments contrast this with the cost to replace one MY 2000 bus with an EV bus at $503 per pound of NOx removed. The table also shows (column G) how many total pounds of NOx could be removed by each type of project, if all the $381,000,000 funds were used exclusively for such projects. The clean diesel investment strategy would reduce NOx emissions by 6 tons/day - a significant amount, and do so immediately. The table is not meant to provide an exhaustive list of all the projects California should consider, but rather a demonstration of the cost effectiveness of investments in clean diesel.

### How to Make the Most of $381,000,000 for Immediate NOx Reduction

<table>
<thead>
<tr>
<th>Project Description</th>
<th>A) Price per Application</th>
<th>B) # of Vehicles or Equipment Put Into Service</th>
<th>C) Anticipated NOx (lbs) Reduction per Year per Project</th>
<th>D) Total Cost to exclusively fund a particular project [ A \times B ]</th>
<th>E) Cost to Remove each lb of NOx ($/lb) [ A \div C ]</th>
<th>F) Total NOx (lbs) Reduction per Year [ B \times C ]</th>
<th>G) Total NOx Reduction per Day ( \frac{F}{2000 \times 365} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre 1991 Port truck replacement with clean diesel</td>
<td>$110,000</td>
<td>3,464</td>
<td>1,282</td>
<td>$381,040,000</td>
<td>$86</td>
<td>$4,440,382</td>
<td>6.08</td>
</tr>
<tr>
<td>Pre 1991 Port truck replacement with CNG</td>
<td>$140,000</td>
<td>2,721</td>
<td>1,292</td>
<td>$380,940,000</td>
<td>$108</td>
<td>3,516,086</td>
<td>4.82</td>
</tr>
<tr>
<td>MY 2000 Bus with Hydrogen Bus</td>
<td>$1,200,000</td>
<td>318</td>
<td>1,162</td>
<td>$381,600,000</td>
<td>$1,033</td>
<td>368,935</td>
<td>0.51</td>
</tr>
<tr>
<td>MY 2000 Bus with EV Bus</td>
<td>$800,000</td>
<td>433</td>
<td>1,162</td>
<td>$381,040,000</td>
<td>$757</td>
<td>503,093</td>
<td>0.69</td>
</tr>
<tr>
<td>MY 2000 Bus with clean diesel bus</td>
<td>$370,000</td>
<td>1,030</td>
<td>1,062</td>
<td>$381,100,000</td>
<td>$348</td>
<td>1,093,573</td>
<td>1.50</td>
</tr>
<tr>
<td>T0 to T4 clean diesel switch locomotive loco</td>
<td>$3,000,000</td>
<td>127</td>
<td>37,602</td>
<td>$381,000,000</td>
<td>$80</td>
<td>4,775,454</td>
<td>6.54</td>
</tr>
</tbody>
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5. **Clean Diesel is the most cost effective investment for trust revenue because it delivers more clean air for the dollar, faster than other strategies**

While the settlement presents California with an unexpected source of revenue, how the state choses to invest the dollars can maximize and expand the $381 million through the investment in cost-effective strategies. The most cost effective strategy to replace older commercial vehicles is investments in clean diesel technology. On a dollar-for-dollar basis, recent evidence suggests that investments in proven and available clean diesel technology are a more cost effective investment to reduce NOx and achieve the clean air priorities established by the Trust to generate immediate term benefits for California residents.

The state should weigh the utilization and availability of the technologies vying for the Appendix D settlement funding.

- Consider investments in electric vehicle charging infrastructure. The incremental increase in utilization of such infrastructure by a relatively small population of vehicles traveling low annual mileage would likely yield far lower NOx reductions than any clean diesel option, and then not for many years.
- Compare alternative fuel investments to a replacement strategy for a single heavy-duty diesel truck that is 8 years old and travels 80,000 to 100,000 miles a year, with a majority of that portion being in California. Replacing an older heavy-duty truck with a newer technology truck, will achieve more NOx reductions than investments in other longer term alternative fuel infrastructure investments.
- As evidenced by the relatively low market penetration of 1.2 percent, natural gas vehicles today are not yet available in the full range of size and horsepower to serve all of the needs of California’s truckers, thereby limiting the market interest in investing in these technologies because of their special fueling requirements and other limitations.

**According to key sources, clean diesel technology is the most cost effective means to reduce NOx emissions from a variety of commercial vehicles.**

*U.S. Department of Transportation: CMAQ Program (2015)*

The U.S. Department of Transportation, using the latest emissions model generated by the U.S. Environmental Protection Agency (EPA) found that 1 ton of NOx emissions may be eliminated by investing, on average, $20,000 in clean diesel technology versus, on average, $1 million in electric infrastructure.\(^5\) Replacing a model year 2000 engine found in a Class 8 truck, a school bus and a transit bus with a model year 2015 diesel engine is a more cost effective strategy than investments in electric vehicle charging infrastructure.

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\(^5\) [Congestion Mitigation and Air Quality (CMAQ) Improvement Program Cost-Effectiveness Tables Development and Methodology](https://www2.transportation.gov/cmaq/docs/2015/cost_effectiveness/methods.pdf) (December 3, 2015)
## Cost Effectiveness Of Diesel Engine vs. EV Charging Infrastructure

(Source: Congestion Mitigation Air Quality (CMAQ) Improvement Program  
US Department of Transportation (2015))

<table>
<thead>
<tr>
<th>Investment Choice</th>
<th>Emission Reduction ($/lb of NOx)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel Engine Replacement: Heavy-Duty Truck</td>
<td>$6.90</td>
</tr>
<tr>
<td>Diesel Engine Replacement: Transit Bus</td>
<td>$25.6</td>
</tr>
<tr>
<td>Diesel Engine Replacement: School Bus</td>
<td>$38.7</td>
</tr>
<tr>
<td>Electric Vehicle Charging Infrastructure</td>
<td>$731.3</td>
</tr>
</tbody>
</table>

The EPA similarly concluded recently that investments in clean diesel technology are a more cost effective strategy to immediately reduce NOx emissions from older port trucks than emerging alternatives such as battery electric commercial trucks. Investments in clean diesel generate greater NOx reduction benefits.

### U.S. Environmental Protection Agency: National Port Strategy Assessment: Reducing Air Pollution and Greenhouse Gases at U.S. Ports (October 2016)

<table>
<thead>
<tr>
<th>Model year 2010 or newer Diesel</th>
<th>Replacing a pre-1991 Class 8 port truck with....CNG</th>
<th>Replacing a pre-1991 Class 8 port truck with....Battery-Electric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lbs of NOx reduced</td>
<td>1,282</td>
<td>1,292</td>
</tr>
<tr>
<td>Cost of technology</td>
<td>$110,000</td>
<td>$140,000*</td>
</tr>
<tr>
<td>$/Lbs of NOx</td>
<td>$86/lbs</td>
<td>$107/Lbs</td>
</tr>
</tbody>
</table>

* Based on average $30,000 price premium of a new Class 8 CNG tractor relative to a comparable new diesel tractor

**Clean Air Task Force (www.catf.us)**

Examining the benefits of clean diesel relative to CNG in the transit bus fleet, the Clean Air Task Force reached a similar conclusion – greater NOx reduction can occur by replacing older transit buses with new clean diesel models as opposed to investments in CNG equipment. New diesel engines, while generating slightly less NOx than a comparable CNG transit bus, also come at a much lower expense. The Clean Air Task Force estimates that a comparable CNG bus costs about $70,000 more and also requires an investment of $25,000 in specialized fuel infrastructure and equipment. For a $10 million investment, more clean diesel buses can be put into service to retire older buses and generate greater air quality benefits than investments in CNG.

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6 National Port Strategy Assessment: Reducing Air Pollution and Greenhouse Gases at U.S. Ports (September 21, 2016)  
7 Clean Diesel Versus CNG Buses: Cost, Air Quality & Climate Impacts. Clean Air Task Force. February 2012
7. The Diesel Emission Reduction Act program is a proven mechanism to administer a NOx reduction program, and will greatly minimize the administrative burdens on California.

Clean diesel technology has a proven track record when it comes to improving the environmental performance of older equipment through the Diesel Emission Reduction Act (DERA) program, and DERA is a familiar and proven program within many air agencies. The DERA program is a proven, established and ready means to quickly execute projects funded under the Trust with minimal administrative impacts. Since 2008, a variety of state agencies have received an EPA DERA award for retrofitting or replacing trucks and marine vessels.

The $2.7 billion Environmental Mitigation Trust includes specialized or niche off-road applications, such as forklifts and airport ground equipment, as eligible categories for funding. However, the Trust does not directly include the enormous variety and population of the most used pieces of off-road equipment including construction and agricultural equipment as eligible projects.

However, the Trust does include a DERA option that allows states to use Trust revenue as the non-federal match in DERA project applications. This would allow California to utilize a proven and established system for funding new technology projects and to dramatically leverage the $381 million into far greater investments and impact through an approach centered on the non-federal DERA match.

This key provision is available to designated lead agencies in the Trust program that enables the replacement or repower of a wider variety of off-road equipment and ultimately gives the California greater flexibility for its investment, and the potential to leverage the investment for greater benefits for the state and the project recipients.

8. Making the most of cost effective investments to achieve immediate term air quality benefits will not come at the expense of other California programs

California’s vision of a zero emission transportation future will not be materially impacted with investments of the $381 million trust for the purpose of upgrading heavy duty vehicles engines and equipment with clean diesel technology. Alternative fuel vehicles, hybrid trucks and buses and advanced technology demonstration projects all receive substantial funding derived from the Greenhouse Gas Reduction Fund and the AQIP/AB 118 programs. These are programs that very often entail a long term view towards generating air quality benefits and require the lengthy development of emerging engine and vehicle technologies and additional time for these vehicles to enter into the population in sizeable numbers to generate quantifiable emission reductions along with additional significant investments in refueling or charging infrastructure.
Funding derived from the Environmental Mitigation Trust to advance the introduction of clean diesel technologies and generate immediate term air quality benefits is complementary to the other advanced technology programs which will take longer to yield quantifiable and significant NOx emission reductions.

CONCLUSION

The Environmental Mitigation Trust represents a historic opportunity to provide clean air benefits to communities across California including those located closely with port and goods movement facilities. The cost effectiveness of investments in proven and available diesel technology make clean diesel a compelling technology to make the most of this historic opportunity to improve air quality immediately. More clean air, faster, for the dollar can be achieved from clean diesel technology than through other approaches.

Thank you for the opportunity to provide insights concerning the benefits of greater investments in clean diesel technology. The Diesel Technology Forum looks forward to providing additional analysis or insight to California’s efforts to implement strategies to make the most of the Trust. Please contact us at (301) 668-7230 with any questions or concerns.

Very truly yours,

Allen R. Schaeffer
Executive Director

Contact Information

Allen Schaeffer
Executive Director
(301) 668-7230
ascheffer@dieselforum.org
5291 Corporate Drive; Suite 102
Frederick, MD 21703

Ezra Finkin
Director – Policy and Outreach
(301) 668-7230
efinkin@dieselforum.org
5291 Corporate Drive; Suite 102
Frederick, MD 21703