From: ARB Clerk of the Board
Subject: RE: ROUSH's Comments re: CA VW Diesel Emissions Mitigation Plan

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From: Chelsea L. Jenkins <Chelsea.Jenkins@roush.com>
Sent: Monday, May 21, 2018 3:41 PM
To: ARB vwmititrust <vwmititrust@arb.ca.gov>
Cc: Todd A. Mouw <todd.mouw@roush.com>; Chelsea E. Uphaus <Chelsea.Uphaus@roush.com>
Subject: ROUSH's Comments re: CA VW Diesel Emissions Mitigation Plan

Dear Mr. Christensen and Ms. Williams,

We appreciate the opportunity to submit the attached letter, which provides comments on the California beneficiary diesel mitigation plan. Additionally, we welcome the occasion to discuss any of the enclosed information should you have any questions.

Thank you for your kind consideration. We appreciate your efforts.

Sincerely,

Chelsea

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Submitted via email to vwmititrust@arb.ca.gov

May 21, 2018

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Re: VW Comment

Dear Mr. Christensen and Ms. Williams,

As the President of ROUSH CleanTech (ROUSH),[1] I write to thank the California Air Resources Board (CARB) for the opportunity to recommend how the state can best allocate its State Beneficiary Mitigation Funds. We view this as an incredible opportunity to further nurture advanced clean transportation market opportunities throughout the state of California, as well as throughout various niche markets. As an industry leader in alternative fuel vehicle technology development, including propane, natural gas and electric propulsion systems, ROUSH would like to support your efforts to decrease emissions, stimulate economic development opportunity and develop sustainable programs that improve public health. Specifically, the allocation of $130 million solely electric school buses does not represent the most cost-effective solution nor does it allow for statewide deployments to transform the transportation sector.

ROUSH's partners include a national network of Blue Bird, Ford and other partner dealerships and installers. Moreover, partners such as A-Z Bus Sales, Inc. have helped deploy over 12,000 propane-fueled buses in more than 800 school districts nationwide. Collectively, ROUSH and its partners have helped deploy over 19,000 alternative fuel vehicles that have accumulated over 450 million miles. ROUSH's primary product line currently focuses on school buses and medium-duty trucks, therefore our comments below will speak to those two particular markets.

School Buses: The Need Exist and is a Cost-Effective NOx Reduction Option

Most agree that NOx reductions should be of primary focus when designing mitigation programs. ROUSH has been working with Blue Bird Bus Company to develop low NOx powertrain solutions for our customers that remain affordable to purchase as well as maintain. In fact, ROUSH's model year 2017 propane school bus received its California Air Resources Board certification at 0.05 grams NOx per brake horsepower-hour (g/bhp-hr).[2] This new propane engine is 75 percent cleaner than today's cleanest diesel engines that are compliant with the model year 2010 standard

[1] ROUSH CleanTech is an industry leader of alternative fuel vehicle technology focused on developing innovative and reliable advanced clean transportation solutions for fleets across North America. CleanTech's portfolio of products include propane and natural gas fuel systems for medium-duty vehicles and school buses in addition to electric propulsion systems for medium-duty vehicles.
[2] "Executive Order A-344-0074". California Environmental Protection Agency, Air Resources Board, May 15, 2017. https://www.arb.ca.gov/msprog/onroad/cert/mdehdehdv/2017/roush_hdoe_a3440074_6d8_0d05_lpg.pdf.

of 0.2 g NOx / bhp-hr. What's more, our new propane buses will be 99 percent cleaner than the oldest, pre-2007 model year buses still operating in many school districts today.[3] Our team is also working to obtain 0.02 g/nhp-hr NOx this year making it among cleanest engines available for school buses today, as well as one of the lowest lifecycle NOx emissions options available.

These cleaner propane buses significantly reduce children's exposure to emissions that are associated with pre-2007 diesel buses, including increased asthma emergencies, bronchitis, and school absenteeism, especially among asthmatic children.[4] Propane school buses also effectively eliminate diesel particulate matter emissions that are associated with cancer and thousands of premature deaths nationwide every year. These vehicles are also a safe transportation solution because propane is non-toxic, non-carcinogenic and non-corrosive, and because their vehicle fuel tanks are 20 times more puncture-resistant than gasoline or diesel tanks.[5]

Propane school buses can be a smart investment for California as well as they can yield tremendous benefits, including fuel cost reductions of 60 percent per gallon and operations and maintenance savings of $0.37 per mile, as compared to diesel.[6] Propane school buses can thus support your agency's efforts to achieve cost-effective NOx emissions reductions.

Propane School Buses: A Diesel Mitigation Action Scenario

There are thousands of year 2009 and older school buses in operation in California that qualify for replacement under the Environmental Mitigation Trust criteria. Using lifecycle emissions data calculations from the 2017 Argonne National Laboratory's AFLEET tool with in-use adjustment shows that alternatives to diesel represent the most cost-effective way to reduce NOx emissions.

Gaseous fuels can afford school districts, particularly rural districts outside of major funding areas, the opportunity to reduce emissions in a cost effective manner and without major compromise to pupil transportation services.

Table 1. NOx Reduction and Cost Effectiveness Results Comparing Diesel, Propane and Electric School Buses Over a 10 Year Service Life.

Type of School Bus Purchased	Average Cost	NOx Reduced (Lifetime Pounds)	Cost-Effectiveness (Cost per Pound)
Propane Conventional	$128,000	1,800	$71
Electric Conventional	$400,000	2,101	$190
Diesel Conventional	$120,000	699.1	$172

[3] For model year 1998 to 2003 diesel engines, EPA established a NOx emission standard of 4.0 g NOx / bhp-hr. Please refer to EPA's summary table of diesel engine exhaust emission standards for further detail.
[4] Adar, S. et al. "Adopting Clean Fuels and Technologies on School Buses. Pollution and Health Impacts in Children." ATS Journals, Volume 191, Issue 12. http://www.atsjournals.org/doi/abs/10.1164/rccm.201410-1924OC#.WA-HINUrJhE, June 15, 2015.
[5] "Propane Autogas – Safe and Reliable." Blue Bird. https://www.blue-bird.com/blue-bird/Propane-is-safe.aspx.
[6] "Propane Testimonials." Blue Bird. http://www.blue-bird.com/blue-bird/propane-testimonials.aspx.

Medium-Duty Trucks: An Emissions Reductions Opportunity that Spurs Innovation and Public-Private Partnerships

In addition to school buses, thousands of Class 4 – 7 commercial, medium duty diesel powered vehicles serving in delivery, utility and vocational markets are being replaced by propane powered equivalents displacing millions of gallons of diesel each year. These replacement vehicles are displacing the same harmful containments with the same proven and ultra low NOx powertrain being utilized by the school buses described within this letter. The number of Class 4 – 7 commercial vehicles operating are increasing each year increasing levels of harmful containments.

Private fleet adoption also encourages development of public fueling infrastructure as well as technology innovation.

In-Use Emissions Data Substantiates the Prioritization of Alternatives

We believe there is a growing evidence manual of data to support the decision to prioritize alternative fuels, including propulsion systems other than electric and diesel. Several studies are highlighted below.

First, West Virginia University revealed that diesel school buses produced **26 times** the amount of NOx as propane school buses in a duty-cycle representative of most school buses. The Propane Education & Research Council (PERC) contracted the West Virginia University (WVU) Center for Alternative, Fuels, Engines, and Emissions to perform a research program testing in-use emissions and performance of propane versus diesel fueled engines in a school bus application.

A 2014 model year propane and diesel school bus were chosen for testing so that the school buses would have at least 25,000 miles logged. A total of 9 test routes were performed, including cold starts, hot starts and stop and go routes. Three stop-and-go route test results averaged 5.2 g/mile for the diesel school bus while the propane bus averaged 0.2 g/mile with minimal variability in measurement.[7] In other words, propane was 96% cleaner than diesel school buses over the test cycles. It is worth noting, the 2014 propane and diesel school buses used for testing met the same 0.2 g/bhp-hr certification standard, as ROUSH had not launch the low NOx engine option yet.

Second, recent analysis by the International Council on Clean Transportation (ICCT) indicates that negative health impacts from diesel-sourced NOx emissions are increasing, despite regulatory limitations.[8] Indeed, laboratory-certified vehicles met mandatory emission limits but exceeded NOx emission limits for heavy-duty diesel vehicles, by 1.45 times on average in real

[7] Ryskamp, Ross. "In-Use Emissions and Performance Testing of Propane-Fueled Engines. PERC Docket 20893" West Virginia University Center for Alternative Fuels, Engines, and Emissions. March 29, 2018.
[8] Anenberg, S. et al. "Impacts and mitigation of excess diesel NOx emissions in 11 major vehicle markets". Nature, 25 May 2017, doi:10.1038/nature22086.

world operation. These excess diesel NOx emissions contributed to an estimated 1,100 premature deaths in the United States in 2015.[9]

Finally, new test data published by the University of California at Riverside indicates that the selective catalytic reduction (SCR) systems on today's new diesel vehicles fall short of controlling NOx emissions in many duty cycles.[10]

Gaseous fuels not only reduce significant NOx emissions, but also do so in a cost effective manner and can help bridge the gap for school districts that can't yet afford or have the appetite to transition quickly to electrification deployment strategies.

Conclusion

As we prepare for the future of school bus and other transportation, ROUSH again commits to supplying its customers with a diverse, reliable set of alternative fuel engine technologies so that customers have a comprehensive solutions provider. We are happy to offer support to your office to ensure successful outreach, planning and ultimate deployment of alternative fuel school buses and other alternative fuel vehicles.

Thank you for considering our request. We look forward to continued dialogue with you and your team, and to a future collaboration that will help California meet its air quality goals.

Sincerely,

Todd Mouw
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[9] "New study quantifies global health, environmental impacts of excess nitrogen oxide emissions from diesel vehicles [press release]". The International Council on Clean Transportation, May 15, 2017. http://www.theicct.org/news/nature-impacts-diesel-nox-may2017.

[10] Boriboonsomsin, K. "Real-World Activty Patterns of Heavy-Duty Vehicles and Their implication on In-Use Emissions". ARB Research Seminar, May 31, 2017. https://www.arb.ca.gov/research/seminars/boriboonsomsin/boriboonsomsin.pdf.