

To: Volkswagen Diesel Emissions Environmental Mitigation Trust Interested Parties
From: Greg Kerr
Re: Emissions Tools
Date: April 2019

For those administrators who want to get the best results from their Volkswagen Diesel Emissions Environmental Mitigation Trust funds, it is important to use the most accurate emissions calculator to estimate impact. There are two common options for calculating emissions and as explained below, Argonne National Lab's Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) and associated Heavy-Duty Vehicle Emissions Calculator (HDVEC) are much more accurate than EPA's Diesel Emission Quantifier (DEQ). HDVEC is based on AFLEET and is simplified with outputs for alternative fuel emissions reductions versus diesel. The online AFLEET tool had more inputs and allows for calculation of emissions percentage reductions for various fuels.

HDVEC: <https://afleet-web.es.anl.gov/hdv-emissions-calculator/>
ALFEET: <https://afleet-web.es.anl.gov/afleet/>
DEQ: <https://cfpub.epa.gov/quantifier/>

HDVEC

- Recommended calculator for calculating emissions benefits for VW trust funding.
- Most accurate and thorough method to estimate emissions benefits for vehicles.
- Contains emissions factors for some alternative fuels.
- Contains state-specific emissions factors.
- Includes option for ultra-low NOx emission engines.
- Includes option for diesel in-use multiplier. This accounts for actual measured diesel NOx emissions, which are considerably higher than certification emissions.

DEQ

- Not recommended to calculate emissions benefits for VW trust funding
- Meant to only be used for medium- and heavy-duty diesel vehicles. Therefore, DEQ is not accurate for cleaner alternative-fueled vehicles, specifically propane medium- and heavy-duty vehicles.
- Does not include emission factors for propane vehicles, instead incorrectly assuming these vehicles emit NOx and other pollutants at the same levels as new diesel engines.

For states that require the use of DEQ, the tool allows for manual insertion of accurate emissions factors for various fuels. The Propane Education & Research Council (PERC) recommends the following steps for those states that are using DEQ.

1. Access AFLEET online calculator (<https://afleet-web.es.anl.gov/afleet/>) and start a new project.
2. Select vehicle type, LPG vehicle, and adjust MPDGE if appropriate.
3. Click vehicle options and enter information or use defaults
 - a. Check the "Use Diesel In-Use Multiplier" box.

- b. Check the “Use Low NOx Engines?” box if using certified low NOx engine.
4. Return to main screen and click “Calculate Results”
5. Click “Save and Export Results” in order to get actual calculated results.
6. Open exported Excel file, navigate to “Results” tab and scroll down to access calculated results.
7. Calculate % reduction for pollutants.
 - a. If LPG value is greater than diesel, % reduction is zero.
 - b. If LPG value is less than diesel, % reduction is calculated as follows.

$$((\text{Diesel value} - \text{LPG value}) / \text{Diesel value}) \times 100$$

8. Access DEQ online calculator (<https://cfpub.epa.gov/quantifier/>) and start new project.
9. Enter appropriate information for new upgraded and replaced vehicles.
10. When prompted to manually enter “Percentage of Emissions Reduced,” enter calculated numbers from AFLEET online model.

The AFLEET model and the associated HDVEC calculator are the most accurate methods to calculate emissions using a mathematical model because they have emissions factors for some alternative fuel vehicles, account for low NOx engine options, and more importantly account for measured in-use diesel emissions data. The calculators are conservative and contain assumptions in cases where they don't contain a reasonable amount of real-world data. As explained above, if the EPA DEQ model must be used to calculate emissions, the output from the AFLEET online calculator can be used to manually insert “Percentage of Emissions Reduced” data. However, PERC recommends a more accurate option that contains actual in-use emissions data as outlined below.

The Center for Alternative Fuels, Engines, and Emissions at West Virginia University has recently completed a report that established exhaust emissions and performance characteristics of propane-fueled school buses through in-use testing methods in comparison to engines fueled with diesel fuel. Two propane and two diesel vehicles were exercised over two different pre-determined routes three separate times for repeatability purposes. The exhaust and performance measurements were collected with a portable emissions measurement (PEMS) system. Propane buses were model year 2015 and 2017 and diesel buses were model year 2014 and 2017. One route consisted of city and highway driving and the other route simulated a typical school bus stop and go route. The average values of all the tests are outlined below. The PEMS system does not measure particle emissions.

Averages	CO (g/mile)	CO2 (g/mile)	THC (g/mile)	NOX (g/mile)
Propane	2.56	1984	0.129	0.102
Diesel	1.69	2157	0.057	2.23
% Reduction Propane	0	8	0	95.4