

## DEQ Release Notes

May 2, 2022

### 1. Introduction

This is a summary of changes to the DEQ including updates to data, algorithms and sources, as well as improvements to functionality and appearance in these recent releases:

- Version 9.1 on May 2, 2022 **NEW**
- Version 9.0 on July 15, 2021
- Version 8.4 on December 18, 2020
- Version 8.3 on June 22, 2020
- Version 8.2 on December 19, 2019
- Version 8.1 on July 23, 2019
- Version 8.0 on May 1, 2019
- Version 7.7 on October 23, 2018
- Version 7.6 on May 31, 2018
- Version 7.5 on April 16, 2018
- Version 7.4 on December 6, 2017
- Version 7.3 on October 4, 2017
- Version 7.2 on July 28, 2017
- Version 7.1 on June 5, 2017
- Version 7.0 on April 12, 2017
- Version 6.1 on July 27, 2016
- Version 6.0 on February 26, 2016

### 2. Terminology

Some terminology has been updated for clarity.

- a. **'Project'** has replaced 'Fleet'. 'Project' is more descriptive than 'Fleet' and more consistent with EPA's grant terminology. (v. 7.0)
- b. **'Upgrade'** has replaced 'Technology'. 'Upgrade' is more all-encompassing than 'technology' or 'retrofit' and more obviously includes things like replacements, cleaner fuels, and tires. (v. 7.0)
- c. **'Onroad'** has replaced 'On Highway'. 'Onroad' better describes where these vehicles are used. (v. 7.0)
- d. **'Railyard'** has been split out of the old 'Rail' and includes non-locomotive, rail-related nonroad equipment. The remaining part of the old 'Rail' is now called **'Locomotive'**. (v. 7.0)
- e. **'Baseline'** has been added to several Vehicle Group fields, indicating fields that define the original baseline fleet. (v. 7.1) **Upgrade Year** has been moved below the baseline fields. (v. 7.2)

- f. **'Uncontrolled'** has replaced the term 'Base' for nonroad and marine pre-Tier 1 engines. 'Uncontrolled' has been added for locomotive switch engines. (v. 7.2)
- g. **'Total Project Costs'** has replaced the field name 'Total Project Funding'. This field represents the total of all *costs*, and the clarification is particularly relevant in cases where funding amount is not yet known. (v. 7.7)
- h. **'Target Fleet'** has replaced several field names ('Class or Equipment' and 'Target') for a unified field describing the type of equipment producing emissions to be quantified. (v. 8.3)
- i. **'Class'** has replaced 'Class or Equipment' for Onroad vehicles. (v. 8.3)

### 3. Look and Feel

The look and feel of DEQ has been updated to make it more intuitive and easier to use.

- a. **Modern grid format** provides a quick view of Projects, Vehicle Groups, and Upgrades and makes it easier to find a specific project. Grid headers can be used for sorting. (v. 7.0)
- b. **Options for Groups and Upgrades** are all displayed, providing a complete menu of choices on the Group and Upgrade screen. (v. 7.0)
- c. **Upgrade** details are now viewable and editable (v. 7.0)
- d. **Scalable display** allows for viewing on computers, tablets, and mobile phones. (v. 7.0, v. 7.3)
- e. **EPA website format** has been integrated into DEQ's redesign. (v. 7.0)
- f. **Numeric fields** (other than percentage reductions) are now displayed as whole numbers. (v. 7.1)
- g. **Screen text and 'help' notes** (denoted by question marks) have been edited to provide additional information and clarity. (v. 7.1 and v. 7.2)
- h. **State field** on the project screen has been eliminated. Emission reduction calculations are not state-specific (health benefits are and the state may be selected there). If needed, the state may be included in the project name. (v. 7.3)
- i. **Multiple funding source fields** have been eliminated from the project screen as DEQ uses only total project funding and/or capital costs. (v. 7.3) Total project funding field now allows up to 9 digits. (v. 7.5)
- j. **Copy Project and Copy Group** buttons allow users to duplicate an existing project (including all groups and upgrades) or an existing vehicle or engine group (including all upgrades). (v. 7.3)
- k. **Annual Fuel Gallons** are now entered on a per vehicle or per engine basis, rather than per group, making it consistent with all other usage-related inputs (miles traveled, usage hours, idling hours, hoteling hours). Related fields 'diesel-equivalent gallons' and 'annual diesel gallons reduced' (for engine or vehicle replacement) have also been changed to per vehicle or per engine. Saved projects and quantifications have been updated to reflect this change. (v. 7.3)
- l. **DEQ help** email contact has been added. (v. 7.6)

- m. **DEQ User Guide** documentation is available on the login screen and on the Help page. (v. 8.3)
- n. **Project Type** has been removed from the Create Project screen because **Marine Engines** are no longer required to be a separate project. All vehicle and engine types can be combined into a single project; the user no longer has to select either Marine or Onroad/Nonroad/Locomotive when creating a project. (v. 8.0)

#### 4. Onroad Vehicles

Onroad default values, remaining lives, vehicle types and other inputs have been updated using MOVES2014. (v. 6.1). Fuel consumption rates for onroad idling have been updated using MOVES2014 (v. 7.2). Onroad emission factors have been updated using MOVES3. (v. 9.0)

- a. **Running emission factors** for onroad vehicles are now generated at the national level. The selection of a state no longer affects the calculations. (v. 6.1) Running emission factors were updated using data from MOVES3. (v. 9.0)
- b. **Idling emission factors** for onroad vehicles are now identified both by vehicle type and by idling or hoteling emissions (long haul combination only). (v. 6.1) Idling emission factors were updated using data from MOVES3. (v. 9.0).
- c. **Hoteling emission factors** for onroad vehicles (long-haul combination trucks only) were updated using data from MOVES3. (v. 9.0)
- d. **Fuel consumption** rates for onroad idling have been updated using MOVES2014 and are used to calculate CO<sub>2</sub> reductions resulting from Idling Control Strategies. (v. 7.2)
- e. **Default values** for onroad annual fuel gallons, annual miles traveled, annual idling hours and annual hoteling hours have been updated or added using data from MOVES2014. (v. 6.1) These default values are now selected field by field instead of as a group. (v. 7.3) Default fuel volume now considers the fuel type for the baseline vehicle group. All defaults were previously for ULSD vehicles. (v. 8.3)
- f. **Remaining life** is the fleet owner's estimate of the number of years until the unit would have been retired from service if the unit were not being upgraded or scrapped now, even if the unit were to be sold to another fleet owner. Remaining life is entered by the user, up to a maximum life of 99 years minus the current age of the engine. (v. 7.0, v. 8.2)
- g. **CNG and LNG** baseline fuel types now quantify NO<sub>x</sub>, PM<sub>2.5</sub>, HC and CO emissions using emission factors developed by the Department of Energy Argonne National Laboratory for model years 2010 and later. (v. 9.1 **NEW**) The DEQ uses ULSD factors when alternative fuel factors are not available. (v. 8.1, v. 8.2)
- h. **LPG/propane** baseline fuel types now quantify NO<sub>x</sub>, PM<sub>2.5</sub>, HC and CO emissions using alternative fuel factors from the Department of Energy Argonne National Laboratory's GREET model when available. For LPG/propane vehicles, alternative fuel factors are available **ONLY** for school buses with model years 2010 and later. (v. 9.1 **NEW**) The DEQ uses ULSD factors when alternative fuel factors are not available. (v. 8.1, v. 8.2)

- i. **Vocation** is a new field that captures the manner in which the vehicle is being used. This field is currently required for Short Haul trucks only because vocation can be assumed for other vehicle types based on Target Fleet. This value does not affect calculations. (v. 8.3)
- j. **Sector** is a new field that captures the industry in which the vehicle is working. This value does not affect calculations. (v. 8.3)
- k. **Class options for Refuse Haulers and School Buses** have been added. Users must now select a class for those Target Fleets. (v. 9.0)

## 5. Nonroad Engines

Nonroad emission factors are now generated within DEQ using data, factors and logic from the NONROAD2008 model and regulatory documents. Previously they came from NONROAD output that was converted into factors that could be used in DEQ. Some horsepower and upgrade year combinations were missing, but all combinations are now available, removing the 'holes' that existed previously. (v. 6.0)

- a. **Sulfur adjustment** has been added to the calculation for baseline PM emissions for Tier 4A, 3 and earlier. Since PM emissions depend on the sulfur content of the fuel, an adjustment is needed to account for the current use of ULSD, which was not the standard when the older regulations were written. (v. 6.0) The sulfur adjustment has been tweaked to account for only the PM2.5 portion of PM. (v. 7.2) Some lookup values involved in Sulfur adjustment equations have been corrected. (v. 7.5)
- b. **Horsepower** for nonroad engines is now an open field, allowing the user to enter specific data rather than selecting from a limited list. (v. 6.0)
- c. **Engine tier** can now be user-entered instead of assumed. Both Model Year and Tier must be entered for all Nonroad engines. (v. 9.0) Certain Model Year-Tier combinations will no longer be prohibited. A warning message will appear if the combination is outside the expected range, but the user will still be able to save and run the DEQ. (v. 7.7) For Tier 4, users may specify the standard their engine is certified to (Interim or Final) if they have that information. This '**Tier 4 Standard**' field is optional. (v. 7.7)
- d. **Remaining life** is the fleet owner's estimate of the number of years until the unit would have been retired from service if the unit were not being upgraded or scrapped now, even if the unit were to be sold to another fleet owner. Remaining life is entered by the user, up to a maximum life of 99 years minus the current age of the engine. (v. 7.0, v. 8.2)
- e. **Replacement engine fields** for tier (v. 6.1) and horsepower (v. 7.0) have been added to the engine specs.
- f. **Default values** for annual fuel gallons, annual usage hours, and horsepower are now selected field by field instead of as a group. (v. 7.3) Default fuel volume now considers the fuel type for the baseline vehicle group. All defaults were previously for ULSD vehicles. (v. 8.3)
- g. **Sector** options have been updated for Nonroad equipment. (v. 8.3)

- h. **Target Fleet** options have been updated for Nonroad equipment and now include Transport Refrigeration Units. (v. 8.3)
- i. **Tiers 0, 1, 2, and 3 PM emission factors** have been tweaked to reflect PM<sub>2.5</sub> regulatory standards, rather than PM<sub>10</sub>. (v. 7.2)
- j. **Tier 4 emission factors** have been updated to the latest factors from MOVES2014b. Users may specify the after-treatments that their engine utilizes (DPF and/or SCR or neither) if they have that information. Users may answer 'Unsure' for this '**Tier 4 Aftertreatment**' field if they do not know that information. (v. 9.0)
- k. **The deterioration factor** calculation has been corrected to cap the adjustment in emissions estimates. Only older or heavily used engines will be affected. (v. 9.0)

## 6. Locomotive Engines

Locomotive emission factors come from *Emission Factors for Locomotives (EPA 420-F-09-025)*.

**Locomotives** are now their own vehicle type and no longer part of Nonroad. (v. 7.0)

- a. **Duty cycle** options are now available for line haul engines, which can be used in either line haul or switch capacity. (v. 7.0) Duty Cycle is now captured in the Target Fleet description. (v. 8.3)
- b. **Load factors**, which reflect actual horsepower usage, have been calculated as 8.27% for switch and 26.89% for line haul. They are included in baseline emission calculations and result in emissions that are either 8.27% or 26.89% of the baseline emissions calculated prior to this change. (v. 6.0) Passenger engines also use a load factor of 26.89%. (v. 7.0) The load factor for passenger engines was corrected to 24.47%. (v. 7.5)
- c. **Sulfur adjustment** has been added to the calculation for baseline PM emissions for Tier 2 and earlier. Since PM emissions depend on the sulfur content of the fuel, an adjustment is needed to account for the current use of ULSD, which was not the standard when the older regulations were written. (v. 8.0)
- d. **Horsepower** for locomotives is now an open field, allowing the user to enter specific data rather than selecting from a limited list. (v. 6.0)
- e. **Engine tier** can now be user-entered instead of assumed. (v. 6.0) When both Tier and Model Year are entered, certain combinations will no longer be prohibited. A warning message will appear if the combination is outside the expected range, but the user will still be able to save and run the DEQ. (v. 7.7)
- l. **Tiers 0, 1 and 2 emission factors** have been tweaked to match regulatory standards. (v. 7.2)
- m. **Tier 0 for switch engines** is now split into 'Uncontrolled' for model years 1940-1972 and 'Tier 0' for model years 1973 and later. (v. 7.2)
- n. **Remaining life** is the fleet owner's estimate of the number of years until the unit would have been retired from service if the unit were not being upgraded or scrapped now, even if the unit were to be sold to another fleet owner. Remaining life is entered by the user, up to a maximum life of 99 years minus the current age of the engine. (v. 7.0, v. 8.2)

- o. **Replacement engine tier and horsepower** fields have been added to the engine specs. (v. 7.0)
- p. **Sector** is a new field that captures the industry in which the locomotive is working. This value does not affect calculations. (v. 8.3)

## 7. Marine Engines

Marine emission factors come from *Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Ignition Engines Less than 30 Liters Per Cylinder (EPA 420-R-08-001)*.

- a. **Sulfur adjustment** has been added to the calculation for baseline PM emissions for Tier 2 and earlier. Since PM emissions depend on the sulfur content of the fuel, an adjustment is needed to account for the current use of ULSD, which was not the standard when the older regulations were written. (v. 7.2) The equation used for marine sulfur adjustment has been modified to provide more accurate results. (v. 7.7)
- b. **PM emission factors** for Tiers 2 and earlier have been corrected for Category 2 engines. (v. 7.7)
- c. **Horsepower** for marine is now an open field, allowing the user to enter specific data rather than selecting from a limited list. (v. 7.0)
- d. **Horsepower and displacement combinations** now include only combinations for which DEQ has data, removing some combinations that could previously be selected. (v. 6.1)
- e. **Engine tier** can now be user-entered instead of assumed. (v. 6.0)  
When both Tier and Model Year are entered, certain combinations will no longer be prohibited. A warning message will appear if the combination is outside the expected range, but the user will still be able to save and run the DEQ. (v. 7.7)  
The expected Model Year ranges for Category 1 engines Tiers 2 and earlier have been updated, and Tier 1's voluntary status is now accounted for. These ranges are now only used for default Tier or Model Year when only one of the two has been entered. (v. 7.7)
- f. **Remaining Life** is the fleet owner's estimate of the number of years until the unit would have been retired from service if the unit were not being upgraded or scrapped now, even if the unit were to be sold to another fleet owner. Remaining life is entered by the user, up to a maximum life of 99 years minus the current age of the engine. (v. 7.0, v. 8.2)
- g. **Replacement engine tier and horsepower** fields have been added to the engine specs. (v. 7.0)
- h. **Annual Fuel Volume field** now allows up to 8 digits. (v. 7.2)
- i. **Idle control strategies** can be applied to Auxiliary Marine engines. The user has two options: 1) Shore Power, where the vessel is plugged into the local electricity grid and the auxiliary engine is turned off while at berth, and 2) Other. (v. 7.4)
- j. **Vocation** has replaced the previous Application field describing vessel type, and options have been updated. (v. 8.3)

- k. **Sector** is a new field that captures the industry in which the marine engine is working. This value does not affect calculations. (v. 8.3)

## 8. Upgrades

- a. **Upgrade options** now list only upgrades that have been EPA- or CARB-verified. (v. 6.1)
- b. **Emission reduction percentages** have been updated to match verification data. These fields may be edited. In most cases, an 'other' option is available so the user can input technologies and reduction percentages that are not specified in the DEQ. (v. 6.1)
- c. **Idle control strategies** reduction factors have been updated. (v. 6.1) The entry screen has been updated to ask for New Idling Hours, rather than Reduced Idling Hours. (v. 8.1)
- d. **Engine or vehicle replacements**
  - 1. **Hybrid and electric** options have been added. (v. 7.0) Hybrid replacements now calculate reductions like a standard diesel replacement, rather than assuming zero reductions. Users are able to enter their own reduction values if they have them. (v. 8.3)
  - 2. **For CNG and LNG onroad replacement engines or vehicles:** NO<sub>x</sub>, PM<sub>2.5</sub>, HC and CO emissions are now quantified using emission factors developed by the Department of Energy Argonne National Laboratory for model years 2010 and later. (v. 9.1 **NEW**) The DEQ uses ULSD factors as surrogates when alternative fuel factors are not available. These fields are editable by the user. (v. 7.0)
  - 3. **For LPG/propane onroad replacement engines or vehicles:** NO<sub>x</sub>, PM<sub>2.5</sub>, HC and CO emissions are now quantified using alternative fuel factors from the Department of Energy Argonne National Laboratory's GREET model when available. For LPG/propane replacements, alternative fuel factors are available **ONLY** for school buses with model years 2010 and later. (v. 8.1, v. 8.2, v. 9.1 **NEW**) The DEQ uses ULSD factors as surrogates when alternative fuel factors are not available. These fields are editable by the user. (v. 7.0)
  - 4. **For Biodiesel 5 and Biodiesel 20 onroad replacement engines or vehicles:** Reduction factors for NO<sub>x</sub>, PM<sub>2.5</sub>, HC and CO emissions for onroad vehicles are based on fuel-specific data from MOVES2014. MOVES2014 does not have biodiesel data for model years after 2007, so ULSD factors are used for those engines/vehicles. (v. 8.3)
  - 5. **For Gasoline school bus replacement engines or vehicles:** Reduction factors for NO<sub>x</sub>, PM<sub>2.5</sub>, HC and CO emissions for replacement school bus are based on fuel-specific data from MOVES3. (v. 9.0)
  - 6. **For CNG, LNG, LPG/propane, Biodiesel, Diesel, and Gasoline replacement engines or vehicles:** CO<sub>2</sub> reductions are based on user-entered new fuel volume, although users may change the CO<sub>2</sub> reduction percentage from its calculated value. (v. 8.4) When the new engine or vehicle does not use diesel, the fuel volume is converted to diesel-equivalent gallons. (v. 8.1)

- 7. **For all-electric and fuel cell replacement engines or vehicles:** NO<sub>x</sub>, PM<sub>2.5</sub>, HC, CO and CO<sub>2</sub> reductions default to 100%. (v. 7.2) There is no offset for power plant emissions. **Note:** If you saved an all-electric or fuel cell replacement project prior to v. 7.2, your CO<sub>2</sub> reductions are no longer calculated based on diesel fuel reduced. Please be sure the CO<sub>2</sub> reduction percentage is 100% on the upgrade input screen.
- 8. **For gasoline, genset, and 'other' replacement engines or vehicles where fields are auto-filled with zero:** the DEQ does not have the data necessary to calculate the reduction. These fields are editable by the user. (v. 7.0)
- e. **B5 and B20 Fuel Options**
  - 1. **Reduction factors for NO<sub>x</sub>, PM<sub>2.5</sub>, HC and CO emissions** for onroad vehicles switching from ULSD to B5 or B20 are based on fuel-specific data from MOVES2014. MOVES2014 does not have biodiesel data for model years after 2007, so ULSD factors are used, resulting in no reduction. (v. 6.1)
  - 2. **CO<sub>2</sub> reduction factors** are based on user-entered new fuel volume, although users may change the CO<sub>2</sub> reduction percentage from its calculated value. (v.8.4) The biodiesel fuel volume is converted to diesel-equivalent gallons. (v. 8.2)
- f. **Diesel-equivalent gallons** for both baselines and upgrades have been updated to align with data from Department of Energy's Alternative Fuels Data Center. ([www.afdc.energy.gov/fuels/fuel\\_comparison\\_chart.pdf](http://www.afdc.energy.gov/fuels/fuel_comparison_chart.pdf)). (v. 7.0, v. 7.4)
- g. **Engine upgrade kits** are now a separate option and allow for user-entered reductions based on verified or certified data. (v. 7.0)
- h. **All 'other' upgrades** have a required field for users to enter a description of the upgrade being added. (v. 8.2)
- i. **Users may edit an engine group** without having to delete the following upgrades - Emission Control Devices, Engine Upgrade Kits, Tire Technologies, and Aerodynamic Devices. However, Idling Control Strategy; Engine, Vehicle, and Locomotive Replacement; and Fuel Option upgrades must be deleted prior to editing a group (including Marine) as these upgrades may be impacted by changes to the group. (v. 7.4)

## 9. How DEQ works

- a. **For upgrades other than engine or vehicle replacements:**
  - 1. DEQ calculates emissions for the baseline engine.
  - 2. DEQ multiplies the baseline emissions by the EPA- or CARB-verified (or user-entered) emission reduction factors.
  - 3. The results are the estimated emission reductions from the upgrade.
- b. **For most engine or vehicle replacements:**
  - 1. DEQ calculates emissions for both the baseline and replacement engines.
  - 2. DEQ subtracts replacement emissions from baseline emissions and divides the difference by baseline emissions to calculate the emission reduction factors.
  - 3. DEQ multiplies the baseline emissions by the calculated emission reduction factors.
  - 4. The results are the estimated emission reductions from the replacement.