



# Quantifying Reductions from Retrofit Projects

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# Outline

- What is NMIM?
  - Uses and limitations of NMIM
- How do you use NMIM to quantify retrofit reductions?



# What is NMIM?

- **National Mobile Inventory Model**

- A consolidated emission modeling system for MOBILE6.2 and NONROAD
  - A graphical user interface that runs MOBILE6.2 and NONROAD2005
  - A national county-level database of MOBILE and NONROAD inputs, including activity (VMT or hours)
  - Creates national county-level inventories for EPA rulemakings and for National Emission Inventory (NEI)



# What does NMIM do?

- Simplifies the process of creating national county-level inventories
  - Creates input files, runs MOBILE6.2 and NONROAD, and processes output to create inventories
- Includes capability to estimate reductions from retrofit projects based on user inputs
  - Can be used for general inventory development or just to calculate reductions from retrofit projects



# NMIM in SIPs and conformity analyses

- NMIM incorporates MOBILE6.2, EPA's current approved model for SIP and conformity purposes
  - NMIM can be used to create inventories for SIPs and conformity analyses
- NMIM is not considered a new motor vehicle emissions factor model
  - A new conformity grace period was not started for NMIM
- Use of NMIM for inventory creation is optional
  - States can continue to use MOBILE6.2 and NONROAD 2005 without using NMIM to create input files and process results



# Limitations of NMIM in SIPs and conformity analyses

- Some states may already be using more sophisticated inventory processing methods
  - Continue to use those methods rather than NMIM
- Need to verify that the most recent and best available local information is incorporated in NMIM database
  - Must modify the database to incorporate newer or better local data
- Most recent VMT in NMIM is 2002
  - Must include estimates or projections of VMT for any later years that are included in your SIP or conformity analysis



# NMIM and retrofit projects

- EPA recommends the use of NMIM to estimate retrofit emission reductions in SIPs and conformity analyses
  - NMIM can generate retrofit emission reductions based on same local inputs used in the SIP or conformity analysis
- Alternative approaches will be reviewed on a case-by-case basis



# How to quantify retrofit reductions with NMIM

- Run NMIM twice

- Base case without retrofit project inputs
- Control case with retrofit project inputs
- All other inputs should be the same in both cases
- Retrofit reduction is difference between the two cases
- If not using NMIM to generate local inventory, then calculate percentage difference between base and control case and apply that percentage to the local inventory



# NMIM input files for retrofit projects

- Retrofit parameters

- Separate onroad and nonroad files
- Describe the retrofit project (pollutants, effectiveness, implementation dates)

- Fleet information parameters

- Separate onroad and nonroad files
- Describe the specific fleet that the retrofit project applies to (vehicle class, number, activity)



# Fleet-wide vs. Fleet-specific retrofit projects

## ■ Fleet-wide projects:

- Projects for which the actual number of vehicles and their activity is not precisely known
  - E.g., wide availability of a low emission diesel fuel
- Use just the retrofit parameters file

## ■ Fleet-specific projects:

- Projects for which the number of vehicles and their activity are known
  - E.g, a school district retrofits 100 school buses
- Use both the retrofit parameter and fleet information parameter files



# Retrofit parameters

- Each line of the file has these parameters:
  - Program number
  - Pollutant affected by the retrofit project
  - Vehicle or engine types affected
  - Initial and final calendar years of retrofit implementation
  - Initial and final model years retrofitted
  - Percentage of the fleet retrofit per year
  - Percentage effectiveness of the retrofit



# Program number

- Allows the user to keep track of retrofit parameters for each retrofit project



# Pollutants affected by the retrofit project

- EPA and CARB have verified retrofit emission reductions for NO<sub>x</sub>, VOC, CO, PM<sub>10</sub>, and PM<sub>2.5</sub>
  - Direct PM inputs for diesel onroad are “SO<sub>4</sub>”, “ECARBON”, and “OCARBON”
  - Direct PM input for nonroad is simply “PM”
  - NMIM output is total PM<sub>10</sub> or PM<sub>2.5</sub> or both
- Need to include all pollutants for which the local area is nonattainment or maintenance
  - A few verified technologies result in emission reductions for some pollutants and increases for others



# Vehicle or engine types affected

- Onroad – use MOBILE6.2 vehicle class names
- Nonroad – four parameters
  - SCC of equipment affected
  - Beginning of horsepower range
    - Must use values specified in user guide
  - End of horsepower range
    - Must use values specified in user guide
  - Technology type
    - Must use values specified in user guide, or “ALL”, or left blank
- Only apply to diesel vehicle, engine, equipment types



# Calendar years of implementation

- Two parameters
  - Initial year of retrofit implementation
  - Final year of retrofit implementation



# Model years retrofitted

- Two parameters
  - Initial model year of vehicles or engines retrofitted
  - Final model year of vehicles or engines retrofitted
- Some verified technologies specify particular model years that they apply to
- In general, retrofit guidance applies to vehicles and engines manufactured before 2007 or 2008 model year standards are in place
  - See Sections 1.3 and 1.4 of guidance document for more details



# Percentage of the fleet retrofit per year

- Identifies the percentage of the fleet retrofit during each year specified by the range of calendar years implemented.
  - If:
    - Initial CY of implementation – 2007
    - Final CY of implementation – 2009
    - % of fleet retrofitted per year – 10%
  - Then:
    - 10% are retrofitted each year from 2007 through 2009



# Percentage effectiveness of the retrofit

- Provides the percent effectiveness of particular technology that is being applied in the retrofit project
- Use the EPA-verified technologies list at:
  - <http://www.epa.gov/otaq/retrofit/retroverifiedlist.htm>
  - Or use link to CARB-verified technologies
- Apply reductions only to the categories of vehicles or engines and the model years for which they have been specifically verified
- Note that some technologies result in increases in emissions for some pollutants
  - Be sure to include all effects for any pollutants for which the local area is nonattainment or maintenance



# Voluntary Diesel Retrofit Program

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## Verified Products

[National Clean Diesel Campaign: EPA creates new campaign to reduce pollution from diesel engines](#)

### Verified Technology List

This table summarizes all the diesel retrofit technologies that the U.S. Environmental Protection Agency (EPA) has approved for use in engine retrofit programs. Select the manufacturer link to learn more about the retrofit technology and its operating criteria. The table shows the percent reduction (of verified or tested levels) that EPA will recognize for emission reductions for each technology.

See the [retrofit manufacturers contact](#) page for more information on these manufacturers.

- Key Topics:**
- [Technology](#)
  - [Verification Process](#)
  - [Testing Protocols](#)
  - [In-use Testing](#)
  - [Technical Summary](#)
  - Verified Products
  - [Cost Survey](#)

Verified Retrofit Technologies						
Manuf.	Technology	Applicability	Reductions (%)			
			PM	CO	NOx	HC
<a href="#">Caterpillar, Inc.</a>	Catalyzed Converter/Muffler (CCM)	Highway, heavy-heavy and medium-heavy duty, 4 cycle, non-EGR, model year 1998 - 2003, turbocharged or naturally aspirated engines	20	20	na	40
<a href="#">Caterpillar Inc.</a>		Nonroad, 4 cycle, non-EGR equipped, model year 1996-2005, turbocharged engines with	--	--		--



# Fleet parameters

- Each line of the file has these parameters:
  - Vehicle class or engine parameters
  - Model year
  - Number of vehicles
  - Average annual mileage or hours of activity
- For nonroad equipment there is a second line:
  - Monthly activity allocation



# Vehicle class or engine parameters

- Onroad – use MOBILE6.2 vehicle class names
- Nonroad – three parameters
  - SCC of equipment affected
  - HP bin
    - Upper end of a single specific bin
    - Must use values specified in user guide
  - Technology type
    - Must use values specified in user guide, or “ALL”, or left blank
- Only apply to diesel vehicle, engine, equipment types



# Model year

- The model year of the particular vehicle class being modeled



# Number of vehicles or population

- The number of vehicles in the fleet that have been retrofitted
- Estimate projected attrition in future years
  - Example:
    - In 2007, retrofit a fleet of model year 1999 vehicles
    - How many will still be in use in 2010? 2015?
  - Can use best estimate of useful life based on past experience
    - Use interagency consultation process to resolve questions




# Average annual mileage or hours of activity

- Onroad file uses average annual mileage
- Nonroad file uses average hours per year equipment is operated
- Nonroad file includes an additional line for monthly activity allocation to account for seasonal variation in nonroad equipment use
  - Enter 12 monthly activity fractions, or
  - Enter “DEFAULT” to use NONROAD model defaults



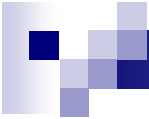
# Activity data issues

- Possible sources of data
  - Maintenance records, user logs, fuel records
- Account for activity that occurs in the nonattainment area
- In absence of specific information, use interagency consultation process to determine best available information
- Agencies could agree to use local average estimates in the absence of better information



# Quantifying replacement projects

- Use fleet-specific approach
- Set retrofit effectiveness at 0
- Run NMIM twice
  - Base case – enter model year of engines being replaced
  - Control case – enter model year of replacement engines
- Replacement reduction is difference between the two cases



# Quantifying replacement projects

- Reductions should not be used beyond the remaining useful life of the engines being replaced
  - Example: If a model year 2001 truck with a typical useful life of 10 years is replaced by a model year 2007 truck, emission reductions are available for calendar years 2007 through 2011
  - Can use best estimate of useful life based on past experience
    - Use interagency consultation process to resolve questions