Multi-pollutant Control Strategies for Mobile Sources

Presentation for the Air Quality Management Planning Conference
June 5, 2008
Rudy Kapichak
U.S. EPA
Office of Transportation and Air Quality
Outline

- Federal Measures
- Long Duration Idling Reduction
  - Trucks
  - Locomotives
- Diesel Retrofits
- Commuter Projects
- SmartWay Projects
- Appendix
Federal Measures

- Tier 2 light-duty vehicle standards and low sulfur gasoline – NOx and VOC reductions
- Highway heavy duty diesel vehicle and fuel standards – NOx and PM reductions
- Tier 2, 3 and 4 nonroad diesel standards – NOx and PM reductions
- Tier 3 and 4 locomotive and marine standards - NOx and PM reductions
National Mobile Sources NOx and VOC Emissions Trends
National Mobile Sources PM2.5 Emissions Trends

![Graph showing the trend of PM2.5 emissions from 2000 to 2020. The emissions have decreased over time, from about 600,000 tons per year in 2000 to about 200,000 tons per year in 2020.]
Long Duration Truck Idling – Opportunities for Reductions

- Emissions from:
  - 500,000-1 million heavy-duty idling trucks
  - Average idle/rest period: 1,800-2,400 hrs/yr
  - Locations: private truck stops, public rest areas, company terminals, ports, borders, and near drop-off/pick up location
Long Duration Truck Idling - Guidance

- Guidance released January 2004
- Provides PM and NOx reductions
- Focus on Class 8 trucks
- Two idle reduction strategies
  - Stationary - truck stop electrification (TSE)
  - Mobile - auxiliary power units (APUs)
- General SIP requirements
  - Quantifiable, surplus, federally enforceable, permanent, adequately supported
Long Duration Locomotive Idling – Opportunities for Reductions

- Emissions from:
  - Approximately 5,000 locomotive switchers
  - Average idling times: 3,000-5,000 hours/yr
  - Locations: switch yards
Long Duration Locomotive Idling - Guidance

- Guidance released January 2004
- Provides PM and NOx reductions
- Focus on switch yard locomotives (SYL)
- Two idle reduction strategies
  - Stationary - stationary locomotive parking electrification
  - Mobile - auxiliary power units (APUs)
- General SIP requirements
Diesel Retrofits – Opportunities for Reductions

- Diesel retrofit projects are a cost-effective way to improve air quality and protect public health
  - Emissions reductions up to 90% for PM, 50% for NOx, and 90% for VOC

- Transportation act (SAFETEA-LU) directs MPOs to give priority to funding diesel retrofits under Congestion Mitigation and Air Quality Improvement Program (CMAQ) ($8.6 B over 5 years)
  - Nonroad retrofits are now eligible for CMAQ dollars
Diesel Retrofits - National Clean Diesel Campaign

- The Campaign seeks to reduce emissions from the 11 million diesel engines in the existing fleet through:
  - Technology verification
    - Rigorous EPA test program
    - MOA between EPA and CARB
    - Many retrofit technologies already verified
      - http://www.epa.gov/otaq/retrofit/retroverifiedlist.htm
  - Incentives such as grants, innovative financing, and others
  - Coalition-building and outreach
  - Technical and policy analysis
Diesel Retrofits – Guidance

- Released June 9, 2006
- Applies to:
  - Highway and nonroad diesel vehicles, engines, and equipment
  - EPA and CARB verified technologies for PM, NOx, and VOC reductions
  - Engine replacements or early replacement of vehicles or equipment
Diesel Retrofits – SIP Options

- Highway and nonroad retrofit reductions must meet same requirements as any other SIP control measure

- Current guidance addresses retrofit projects as:
  - A voluntary measure, under the Voluntary Mobile Source Emission Reduction Program (VMEP) SIP guidance
    - 3% VMEP cap could be exceeded on a case-by-case basis through SIP approval process
  - A mandatory measure (no cap on reductions)
    - e.g., where states/cities require retrofitted equipment in their transportation construction contracts
    - Guidance notes that preemption issues under CAA Section 209 may apply in some cases for retrofits, so consult with EPA
Best Workplaces for Commuter Programs - Guidance

- Guidance released October 2005
- Provides NOx, VOCs, and PM reductions
- Applies to Best Workplaces for Commuters (BWC) and other commuter benefit programs that reduce vehicle trips and miles
  - Employer-paid transit passes
  - Employer-paid vanpool benefits
  - Telework
  - Parking cash-out
Best Workplaces for Commuter Programs – SIP requirements

- General SIP requirements
- Need to account for seasonality
  - For PM, year-round commuter programs may be preferable to ozone season commuter programs
- Make sure that reductions are not already in the baseline
SmartWay Projects – Guidance

- Guidance released June 2007
- Focus is on Class 8 trucks
- Applies to trucks with certain types of aerodynamic devices and low rolling resistance tires
- Provides NOx reductions
  - No direct PM reductions
Sources of information

- These guidance documents, and others that might be applicable are at:
  - [http://www.epa.gov/otaq/stateresources/policy/pag_transp.htm](http://www.epa.gov/otaq/stateresources/policy/pag_transp.htm)

- If you are considering control measures not covered by guidance documents on this web page, contact your Regional office early in the process.
Appendix
Long Duration Truck Idling – SIP Requirements

- For TSE projects, need to document historic idling activity and monitor usage of TSE equipment
- For APUs, need to come up with reliable estimates of operation of APUs in the nonattainment area
Long Duration Truck Idling – Limitation on Reductions

- MOBILE6.2 does not separately account for long duration idling, but some of this idling is included in MOBILE emission factors.
- Based on analysis of MOBILE emission factors, not more than 3.4% of the emission factor for Class 8 trucks is due to long duration idling.
- Total allowable emission reductions from idling projects cannot exceed 3.4% of the Class 8 truck inventory.
Long Duration Truck Idling - Quantification

- Guidance provides emission factors for long duration idling
  - PM emission factor is 2.52 g/hr in 2009
  - NOx emission factor is 135 g/hr from 2002 to 2030
- For TSEs, emission reduction is hours of idling reduced multiplied by idling emission factor
- For APUs, need to include emissions of APUs
  - Emission reduction = (hours of idling * idling emission factor) – APU emissions
  - Details in guidance
Long Duration Locomotive Idling – SIP Requirements

- Demonstrate that SYL emissions (including idling) are included in the inventory
- For electrification projects, need to document historic idling activity and monitor usage of electrification equipment
- For APUs, need to come up with reliable estimates of operation of APUs in the nonattainment area
Long Duration Locomotive Idling - Quantification

- Guidance provides emission factors for long duration idling
  - PM emission factor is 26 g/hr for 2-stroke and 32 g/hr for 4-stroke
  - NOx emission factor is 800 g/hr for 2-stroke and 620 g/hr for 4-stroke
- For electrification projects, emission reduction is hours of idling reduced multiplied by idling emission factor
- For APUs, need to include emissions of APUs
  - Emission reduction = (hours of idling * idling emission factor) – APU emissions
  - Details in guidance
Diesel Retrofits - Quantifying Reductions

- In California, need to consult with EPA Region 9 and ARB on appropriate methods to quantify emission reductions from retrofit projects.

- For the rest of the country, EPA recommends use of National Mobile Inventory Model (NMIM):
  - NMIM is an inventory development tool that creates input files, runs MOBILE6.2 and NONROAD, and processes output.
  - NMIM includes capability to estimate reductions from retrofit projects based on user inputs:
    - User can input number of vehicles retrofit, model years and types of vehicles retrofit, average annual miles or hours of use, % reduction for retrofit technology, etc.
  - EPA will review alternative approaches on a case-by-case basis.
Diesel Retrofits – Using 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
Diesel Retrofits – Key NMIM inputs

- 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)
Diesel Retrofits – Verified Technologies List

- 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](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
Diesel Retrofits – 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 2009? 2014?
  - Can use best estimate of useful life based on past experience
    - Use interagency consultation process to resolve questions
Diesel Retrofits – 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
Diesel Retrofits – 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
Diesel Retrofits – Quantifying replacement projects

- 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
Diesel Retrofits – 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
Best Workplaces for Commuter Programs – Quantification

- For regionally significant commuter projects, reductions should be calculated in the context of the area’s regional travel demand forecasting
  - Interagency consultation used to determine regional significance
  - Details in guidance
- For non-regionally significant projects, estimate miles and trips reduced and multiply by vehicle emission factors
  - Can use COMMUTER model or another appropriate model to handle travel data but must use locally-generated MOBILE6.2 emission factors
Best Workplaces for Commuter Programs – Data

- When developing input data for modeling, you should consider
  - Reasonable assumptions for employee participation
  - Experience from other areas
  - Elasticity assumptions for travel decisions
SmartWay Projects - Quantification

- Recommended method uses NMIM
- Reductions vary by speed – up to 10% reduction in NOx at 65 mph
- Guidance explains how to apply retrofit function in NMIM to estimate emission reductions on different roadway types at different average speeds.