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

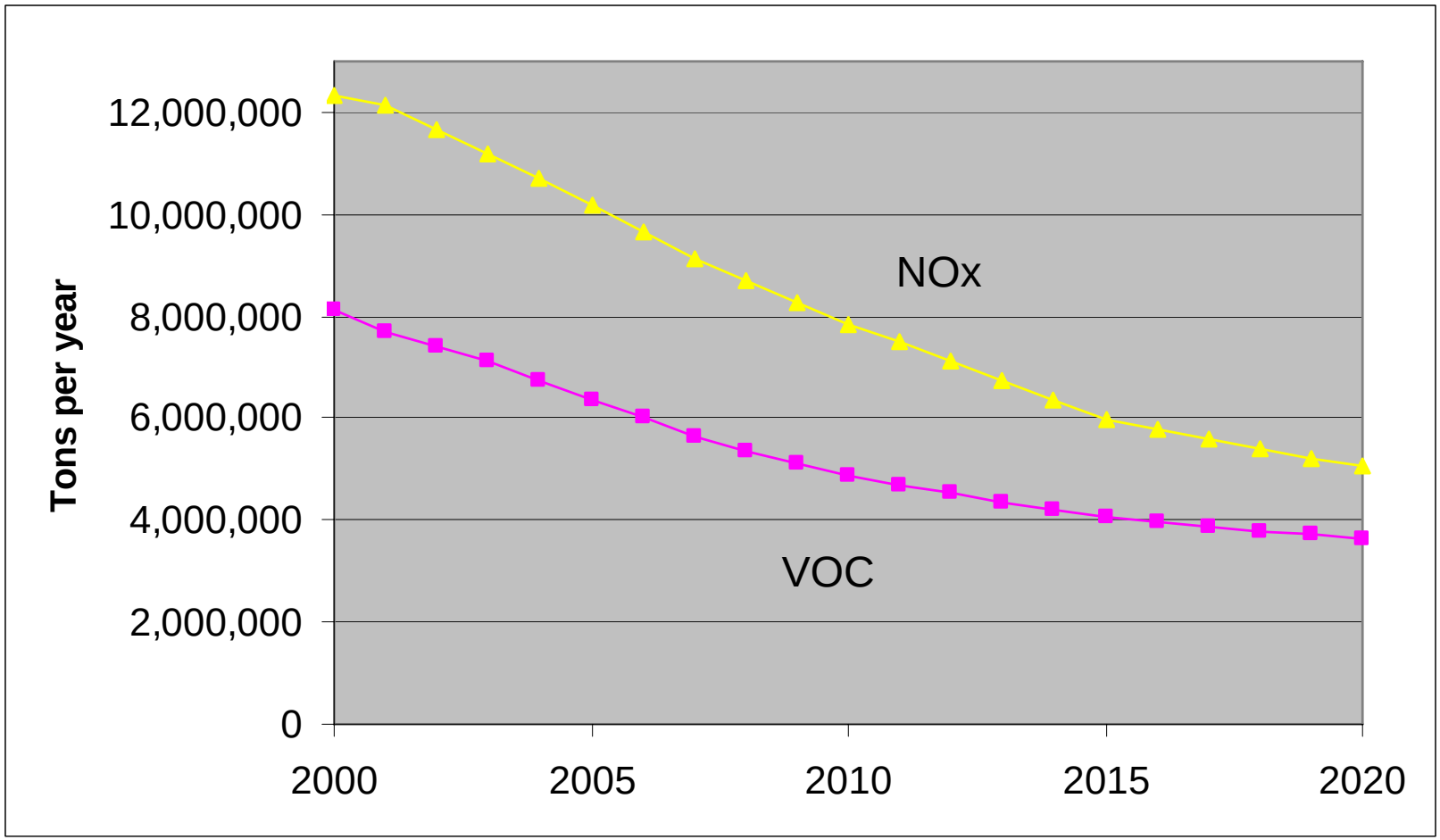
Outline

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

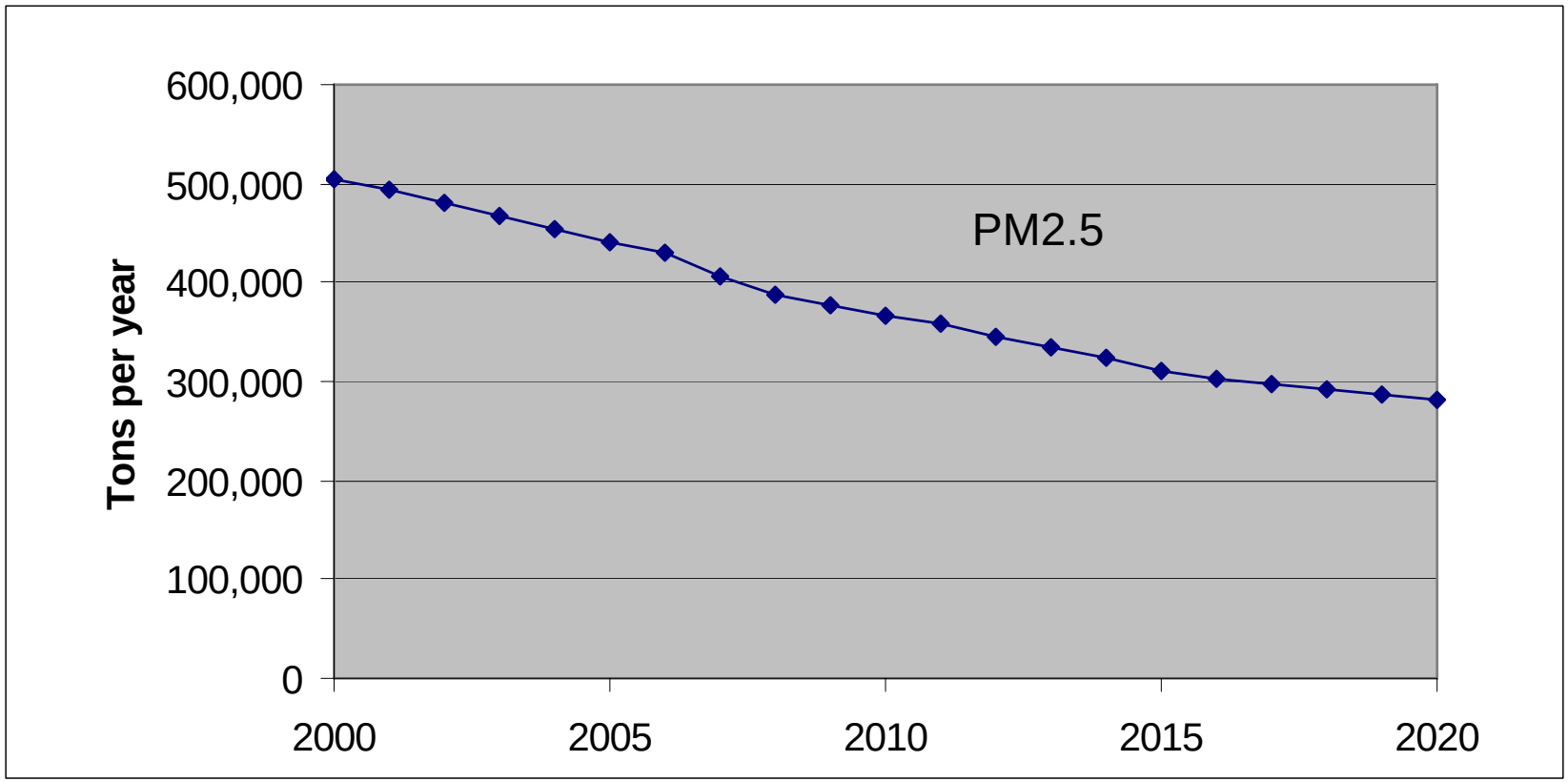
Federal Measures

- 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



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
  - Cost effectiveness document available at:
    - http://www.epa.gov/otaq/stateresources/policy/general/420b07006.pdf
- 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
- 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
  - 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.