Mobile Source Inventory Development

Gene Tierney
Office of Transportation and Air Quality

November 12, 2008
Overview

- State of Mobile Source Inventory Generation
- Status of MOVES
- MOVES Developments
- MOVES and Inventory Development
Mobile Source Inventory

Strengths

- Regional and larger scales
  - Multi-county, metropolitan area, state, nation
- Common, well-studied sources
  - LDGV, for example
- Gaseous criteria pollutants
  - HC, CO, NOx
- Standard operating modes
  - FTP, LA92
- Common fuels
  - Gasoline and diesel
Mobile Source Inventory Weaknesses

- County and smaller scales
  - Hot spot and project level analysis
- Less common equipment
  - Large trucks, bulldozers, aviation, marine
- PM and non-criteria pollutants
  - Greenhouse gases and most of the toxics
- Unusual and less studied operating modes
  - Starts, extended idle, high speed, most nonroad cycles
- Alternative and less common fuels
  - Ethanol, biodiesel, aviation gasoline
- Newest technologies
Opportunities for Improvement

- Better fleet information
  - Age distributions and population data
- Better activity information
  - When, where & how do mobile sources operate?
  - How much do they operate?
    - VMT, hours of operation, starts, hours in specific modes
  - Usage patterns associated with age
- Better emission factors
- Better models
What To Do?

- Improve activity data gathering
  - Deploy PAMS on both onroad vehicles & nonroad equipment
  - Use aerial & satellite data to assess real world speed-acceleration
- Improve allocation of VMT from state to county
  - Current methods use road length and population
  - Potential surrogates are population density, transportation usage, and census data
- Maintain/expand U.S. Census data collection
  - VIUS was recently deleted from the budget
Better Emission Factors

- Less common operating modes
  - Starts and extended idle
- Cold temperature data
  - Especially starts, when catalysts are not functioning
- Pollutants that have been poorly measured
  - PM, N2O, CH4, NH3, toxics, metals, etc.
- Deterioration factors for various pollutants and various technologies
What to Do?

- Deploy PEMS
  - Measure common pollutants under a wide variety of operating modes and environmental conditions
- Expand PEMS capability
  - Measure pollutants they cannot currently measure
- Conduct targeted dyno/lab testing
  - For pollutants that PEMS cannot yet measure
- Commit to longitudinal studies for deterioration
Better Models
MOVES2009 Status

- Draft to be released early 2009
  - For preview and comments, not official use
  - Official version - end of 2009 or early 2010
  - Comment period allows us to update model before final

- Starting to share results with stakeholders
  - FACA Workgroup meeting October 27
  - NACAA and DOT next
Analyzed data on millions of vehicles

<table>
<thead>
<tr>
<th>Dynamometer</th>
<th>Remote Sensing (RSD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/M</td>
<td>I/M</td>
</tr>
<tr>
<td>AZ (Phoenix)</td>
<td>AZ (Phoenix)</td>
</tr>
<tr>
<td>IL (Chicago)</td>
<td>IL (Chicago)/ N. IN</td>
</tr>
<tr>
<td>MO (St. Louis)</td>
<td>MO (St. Louis)</td>
</tr>
<tr>
<td>British Columbia</td>
<td>Maryland/ N. Va</td>
</tr>
<tr>
<td>CO (Denver)</td>
<td>Houston</td>
</tr>
<tr>
<td>Indiana</td>
<td>Los Angeles</td>
</tr>
<tr>
<td>Ohio</td>
<td>Atlanta</td>
</tr>
<tr>
<td>Wisconsin</td>
<td></td>
</tr>
<tr>
<td>Non I/M</td>
<td>Non I/M</td>
</tr>
<tr>
<td>Kansas City</td>
<td>VA (Richmond)</td>
</tr>
<tr>
<td>EPA IUVP</td>
<td>Augusta/Macon</td>
</tr>
<tr>
<td>Other MSOD</td>
<td>Omaha</td>
</tr>
<tr>
<td></td>
<td>Tulsa</td>
</tr>
</tbody>
</table>

AZ IM240 data best available

- Data from nearly 70,000 vehicles used to develop emission rates in MOVES
What we’ve learned

- Fleet deterioration flattens out in time
  - MOBILE assumed emissions keep increasing
  - Dirtier vehicles leave I/M fleet in Phoenix
    - Move to non-I/M areas
    - Register elsewhere (and stay in area)
    - Get scrapped
  - Assume emissions keep increasing in non-I/M areas
- I/M works!!!!
  - Clear benefit compared to non-I/M vehicles
What we’ve learned

- Tier2 deterioration looks much like Tier1
  - MOBILE6 Tier 2 assumptions are very conservative
    - Almost no OBD response outside of warranty
    - Significant number of high emitters & high emissions
  - Increased useful life has improved durability
  - OBD & enhanced evap work, even in non-I/M areas

- Tier2 deterioration will be lower in MOVES
  - Percent I/M benefit comparable between Tier1 & 2
  - A shift from MOBILE6
Evaporative Emissions

- Enhanced Evaporative vehicles show very low emissions when properly operating
- Main source of emissions are vapor & fuel leaks
- Current testing (E-77-3) will better quantify prevalence of leaks
### Anticipated Changes

**Light Duty Emission Rates**

<table>
<thead>
<tr>
<th></th>
<th>Tier 1</th>
<th>Tier 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx</td>
<td>Up</td>
<td>Down</td>
</tr>
<tr>
<td>Exhaust HC</td>
<td>Down</td>
<td>Down</td>
</tr>
<tr>
<td>Evap HC</td>
<td>Down</td>
<td>Down</td>
</tr>
<tr>
<td>PM</td>
<td>Up</td>
<td>Up</td>
</tr>
</tbody>
</table>

*Heavy-duty analysis still underway*
Making the Transition

- Improving handling of different domain sizes
- Developing importers to simplify data input
- Preparing guidance documents
- Planning outreach and training
Levels of Analysis

- Designed for macro, meso & micro scales
- Translates into different geographic domains:
  - National
    - Uses national default data with allocation to county level
    - Primary use is broad-scale national analysis
    - Not appropriate for use in SIPs or conformity
  - Nonattainment Area or County
  - Project
Nonattainment Area or County Level

- Define a “domain” as a single county or group of counties
- Input local environmental, fleet, and activity data similar to MOBILE
- Output is at county level by road type
- Appropriate for SIPs & regional conformity
Project Level

- Define inputs at project level as individual links
  - Enter fleet and activity data specific to each link
  - Could enter detailed driving behavior by link
  - Multiple links could be modeled in a single run
- Able to input idle and start information
- Appropriate for project level conformity analyses
Look-up Table Output

- MOVES is an inventory model
  - Designed to produce total emissions incorporating VMT by road and vehicle type
  - Outputs tons!
- Optional look-up table output produces running rates in g/m for post-processing
  - Will work at all levels – national, nonattainment area, and project
  - EPA is considering g/hour output for non-running emissions
Data Importers

- Interfaces that can create alternate databases, tables, and data records for use by MOVES
- Currently developing data importers to simplify creation of local input files
- Advantages
  - Do not require knowledge of database commands and syntax
  - Can assure updates are made only to the appropriate tables
  - Can require complete information, preventing data gaps
  - Can include some error checks
  - Can be designed to convert data from MOBILE6 to MOVES
Guidance Documents

- Expect to release several guidance documents
  - Technical Guidance for SIPS and conformity
  - Project Level Conformity Guidance for PM
  - SIP and Conformity Policy Guidance
- Release draft guidance for comment soon after release of draft MOVES2009
- Final guidance will be available when final MOVES2009 is released
Outreach and Training

- Developing a joint training plan with FHWA
- Near-term outreach prior to release of draft
  - Focus on basic information to prepare for transition
- More detailed training after release of draft focusing on use for SIPs and conformity