Mobile Source Modeling: Strengths, Weaknesses, and Opportunities for Improvement

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Emissions Director

LADCO Regional Air Quality Meeting – Spring 2019
April 17th, 2019

Isle Royale NP, MI
Credit: Ray Dumas

Boundary Waters Wilderness, MN
Credit: Mike Sweet
State of Technology

• LADCO works directly with US EPA to build onroad and nonroad emissions inventories for modeling; we pool resources and expertise.

• MOVES is EPA’s Java/MYSQL software for calculating onroad (cars/trucks) emissions.

• Needs fleet age/technology, activity, fuel, vehicle population and speed.

• LADCO has worked with Coordinating Research Council (CRC) to improve MOVES inputs like speed, age, and temporal profiles.
LADCO led six projects through CRC to evaluate MOVES inputs

- **A-84**: Identified the input variables most likely to impact modeling and inventories: vehicle age, car/truck mix, vehicle count, speed distribution, road type distribution.
- **A-88**: National VIN decode for 2011, get vehicle counts. Use models to get passenger/heavy truck mix
- **A-100**: Use of telemetry data to improve MOVES inputs: speed distribution, temporal
- **A-103**: Improve cloud based computing
- **A-106**: Improved start information from telemetry
- **A-115**: Re-evaluate VIN decode techniques and update age distributions.
- **A-119**: (Pending) project to build modeling to remote sensing tools.
Age Distribution Example
(from CRC Project A-88)

MI, source Motorcycle

Age Fraction

Age

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Chicago Telemetry Data

Urban Restricted Access
8:00 - 8:59 AM

- Buses, Refuse, MH (No change)
- Cars, Passenger Trucks, MC (LD-Lo)
- Light Commercial Truck (MD)
- Single and Combination Unit Trucks (HD)

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<th>Emissions (tons)</th>
<th>NOx</th>
<th>VOC (x2)</th>
<th>PM2.5 (x20)</th>
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<tr>
<td>Base</td>
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<td>3.50</td>
<td>0.25</td>
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<tr>
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Telemetry Data Improvement
Weekday, LD Passenger Vehicles

Urban Restricted Roads

Urban Unrestricted Roads
2014 Vehicle Count by Age

Passenger Cars

Vehicle Count

EPA Count
State Count

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Onroad Mobile Data Strengths

• We continue work with states and cities to improve transportation data. This includes reflecting the differences between states and cities.

• Changes to these inputs do have a measureable effect on emissions.

• Awareness that even if inputs are good, will model produce realistic emissions.
  • Use satellite and remote sensing data to verify inventories and models
  • Compare ground based measurements and Inventories
Data Weaknesses

- Cars are becoming so clean that outliers define the category
- How does MOVES compare to real world data?
- MOVES is only as good as the drive cycles that it is based off. If drivers deviate from the predictable then we may see significant impact.
Historic and current emissions rates from in-use measurements
Heavy Duty Off Cycle Idling
Heavy Duty Defeat Device

- Aftermarket Defeat Device – “any part or component... where a principal effect... is to bypass, defeat, or render inoperative any device or element of design installed on or in a motor vehicle or motor vehicle...”
**EPA Tuner Emissions Tests**

Stock Calibration Equipment vs. Emissions Equipment wo/ Tuners

Source: Phil Brooks OECA presentation April 5th 2018
• EPA recently added nonroad source calculation into MOVES. The model creates emissions estimates for engines that do not operate on highways.

• Difficult to inventory because of diversity of sources, across many industries, low individual emissions, large composite emissions.
  • Recreational vehicles, all-terrain vehicles and off-road motorcycles;
  • Logging equipment, chain saws;
  • Agricultural equipment, tractors, combines;
  • Construction equipment, graders and back hoes;
  • Industrial equipment, forklifts and sweepers;
  • Residential and commercial lawn and garden equipment, tillers, leaf and snow blowers
  • Recreational and commercial marine vessels, power boats and oil tankers
  • Railway equipment, train and switching engines
  • Aircraft, Baggage handling equipment, jets and prop planes.
Mobile source contributions to ambient ozone and particulate matter in 2025, Margaret Zawackia, Kirk R. Baker, Sharon Phillips, Kenneth Davidson, Philip Wolfe
LADCO Improvements to Rail

- LADCO and IL, MI have put significant effort into rail inventories.
- Included passenger (Amtrak) and commuter (METRA) into inventories into national inventory for the first time ever.
- Use proprietary rail administration database of link level activity and we identified yards as points.
- METRA change is the most significant recent change. Metra’s fleet is older, 10% of fleet will upgrade by 2023.
What Can We Do About Vehicle Emissions?

• VW Settlement
• Diesel Emissions Reduction Act (DERA)
• Heavy Duty Diesel Devices/Programming
• Heavy Duty Diesel Device Idling
• Work with EPA on national standards
• LADCO needs to characterize reductions in SIP
Questions and Contact

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Sleeping Bear Dunes, MI

Garden of the Gods, IL

Credit: NPS
Credit: Daniel Schwen