Mobile Sources in State Implementation Plans (SIPs)

Deborah Dutcher Wilson, MARAMA
Gil Grodzinsky, GA EPD

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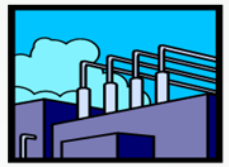
MARAMA
Mid-Atlantic Regional Air Management Association, Inc.

Emission Inventory Source Categories

Point



Area

OnRoad

NonRoad

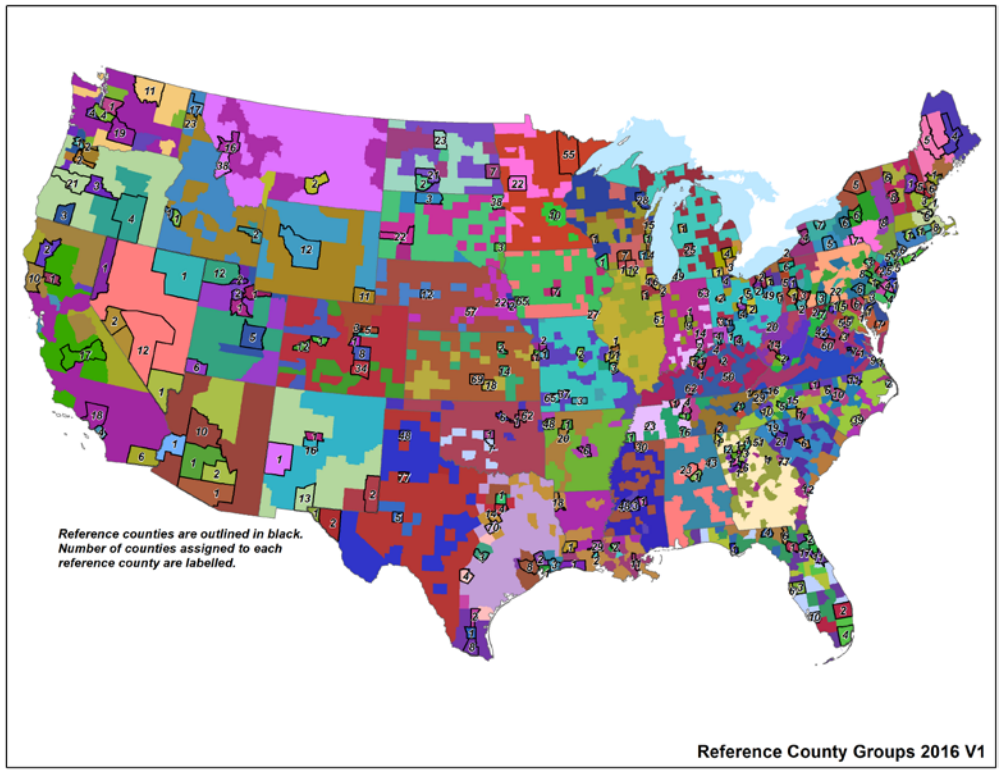
Biogenic

It's Complicated (but doable!)

- According to the EPA's MOBILE6 policy guidance

"If SIPs are revised…, base year motor vehicle emission inventories will need to be recalculated with the latest available planning assumptions.

Base year…inventories should use the best data available for those years."



Onroad Mobile Sources

- On-road mobile sources include all motor vehicles registered to use the public roadways (e.g., motorcycles, automobiles, buses, trucks).
- Emissions calculated by EPA model MOVES (current version MOVES3.1)
  - Designed to calculate criteria pollutants (except Pb) or their precursors (e.g., NOx and VOC for ozone), GHGs, MSATs and additional outputs for air quality models
  - Used for all types of SIPs and emission inventory development
- Emissions= Activity x Emission Factor
  - Activity= running, starts, evaporative, hoteling/extended idling
  - Emission Factor units: g/mi (running), g/start (starts), g/vehicle (starts, evaporative), g/profile (evaporative vapor venting), g/hour (extended idling)
  - MOVES inventory mode calculates emissions, rate mode provides emission factors
- MOVES3 expects enormous amount of local data input, such as the fleet characteristics, fleet mileage accrual rates, speed, fuel parameters, inspection and maintenance (I/M) program in place, and weather data.
- In the MOVES3 model, the total highway vehicle population is characterized by 13 source use types (the terminology MOVES has to describe vehicles), which are subsets of five Highway Performance Monitoring System (HPMS) vehicle types. It further classifies vehicle types by the fuel that the vehicle uses. MOVES allows for the modeling of hybrids and alternative fuel (AFV) which will be expanded upon in the next version of MOVES.
- MOVES (MOtor Vehicle Emissions Simulator)

Onroad Mobile Sources Transportation Conformity

In nonattainment and maintenance areas for NAAQS a transportation conformity process is required:

- Transportation conformity assures that the transportation planning process does not interfere with attainment, or delay attainment of any relevant NAAQS
- Demonstration is conducted by running MOVES through planning period based on inputs from travel demand models, MOVES defaults, and other locally acquired data (e.g., vehicle registration data, I/M program data) with years modeled defined by in 40 CFR 93 (e.g., for budget test: future years every 10 years or less apart, first year within 10 years of calibration year of travel demand model, must include budget years).
- Emissions from modeled years need to be below SIP budgets called “Motor Vehicle Emission Budgets” (MVEBs) to conform to the SIP. The budgets are developed in the SIP process where budget levels for onroad mobile sources are considered maximum levels allowable to assure no interference by transportation plan on reasonable forward progress to attainment (RFP SIPs), no delay in attainment (attainment SIPs), or continued attainment (maintenance SIPs).
- If PM or CO maintenance/nonattainment areas if project of local air quality concern (i.e., involve a significant percentage of diesel vehicles), a hot-spot analysis is required that uses MOVES and AERMOD (dispersion model) to confirm that local concentration levels (combining background and contribution from project) do not exceed the NAAQS levels due to the project.
    - Otherwise, project-level conformity is determined if project fulfills all NEPA requirements and is in a conforming transportation plan

Nonroad Sources

- Emissions for all nonroad vehicles and engines except for those at an airport (aircraft, ground support equipment (GSE) and, auxiliary power units (APU)), locomotives, and commercial marine vessels are calculated using USEPA's MOVES3.1-Nonroad model.
- The USEPA's MOVES3.1 NONROAD model estimates emissions from equipment such as recreational marine vessels, recreational land-based vehicles, farm and construction machinery, lawn and garden equipment, aircraft ground support equipment (GSE) and rail maintenance equipment. This equipment is powered by diesel, gasoline, compressed natural gas or liquefied petroleum gas engines.
- Marine, Air & Rail emissions are forecasted using survey data and projections.
  - Emissions from airports typically use the FAA Aviation Environmental Design Tool (AEDT) (previously EDMS) requiring landing and take-off (LTO) data as well as detailed aircraft engine type to estimate emissions and fuel burn from operations at airports across the US.

Nonroad Emission Methodology

The MOVES - Nonroad model estimates emissions for each specific type of nonroad equipment by multiplying together the following input data estimates:

- Equipment population for base year (or base year population grown to a future year), distributed by age, power, fuel type, and application;
- Average load factor, expressed as average fraction of available power;
- Available power, in horsepower;
- Activity, in hours of use per year; and
- Emission factor with deterioration and/or new standards.
- The emissions are then temporally and geographically allocated (top-down) using appropriate allocation factors.

Onroad Mobile Emission Control Strategies in SIPs

- Light duty: NLEV, Tier 1, 2, and 3 Vehicle Emission Standards (and New Federal Evaporative Test Procedures), 2012-2016 and 2017-2022 GHG and CAFÉ standards
  - Includes low sulfur fuel content requirements
- Medium-heavy duty highway and Phase 1-2 GHG and Fuel Efficiency standards and Ultra-low Sulfur Diesel Rule
- Vehicle Inspection and Maintenance (I/M) Programs (basic (moderate ozone nonattainment) and enhanced (severe ozone nonattainment or moderate/serious CO nonattainment))
- Reformulated Gasoline (severe ozone nonattainment)
- New Vehicle On-Board Vapor Recovery Systems (instead of Stage II vapor recovery, moderate ozone nonattainment)
- Transportation Congestion Controls (extreme ozone nonattainment)
- Transportation Control Measures (TCMs): EPA defines as "strategies that reduce transportation-related air pollution, GHG emissions, and fuel use by reducing vehicle miles traveled and improving roadway operations. " Considered essential in severe nonattainment and above, but not required if can demonstrate otherwise, so can also be considered a voluntary measure.
- State rules (e.g., Clean Cars Program (California Low Emission Vehicle II & III Standards))

Onroad Mobile Supplemental or Innovative Measures
(Some can be credited in SIP)

- Needs to be quantifiable, surplus (addition, not substitution for mandatory measure), enforceable, permanent, and supportable (VMEPs)
- Clean & Efficient Truck Engines (DERA, CMAQ funding): Replacement, repower, or retrofit old diesel MD/HD vehicles with new clean diesel, alternate fuels/EVs (school bus, transit bus, refuse trucks, freight)
- Live-work-play land use planning
- Ozone action days/alerts
- SmartWay: Improving freight supply chain efficiency
- Climate/sustainability programs (EV charging infrastructure, incentives for EV/alternative vehicle transition)
- ARPA/IIJA and IRA program funds

Onroad Mobile Supplemental or Innovative Measures
(Some can be credited in SIP)

- Employer Based Transportation Management Programs
  - Incentivize carpooling/vanpooling, telework, multimodal (transit, bike/ped, etc.)
- HOV lanes/dedicated transit lanes
- Work Schedule Changes
- Area-wide Rideshare Incentives
- Parking Management: Parking preference for carpool/vanpool, bike parking
- Special Event Travel Demand Management
- Vehicle Use Limitations/Restrictions
- Reduced Vehicle Idling

Onroad Mobile Supplemental or Innovative Measures (Some can be credited in SIP)

- Anti-Tampering Initiative
- Anti-Idling Initiative
- Traffic Relief Plans
- Transportation System Management & Operations (TSMO) Strategies
- Freight & Rail Programs
- Public Transportation Initiatives
- Electric Tolling
- Telework Options

Nonroad Mobile Emission Control Measures in SIP

Examples of the control measures in the MOVES3.1 Nonroad model include:

- Nonroad Vehicle Engine Standards (Tier 1, 2 and 3)
- Nonroad Diesel Fuel Standards
- New Nonroad Spark-Ignition (SI) Engines
- Heavy Duty Nonroad Diesel Engines
- Small Nonroad SI Engines (Phase II)
- Large Nonroad SI and Recreational Marine

Nonroad Mobile Emission Control Supplemental Measures (Some can be credited in SIP)

- Must be quantifiable, surplus, enforceable, permanent, and supportable (VMEPs)
- ARPA, IIJA, and IRA program funds for nonroad
- DERA Clean Construction and Clean Agriculture voluntary program
- FAA VALE program for aircraft ground support equipment and auxiliary power units
- Small Engine and Recreational Vehicle Programs

Marine, Air, and Rail Emission Control Programs (Voluntary and Regulatory)

- Sometimes referred to as "MAR"
- Tier 3 (2011/2012) and Tier 4 (2015) Locomotive Emission Standards
  - Low sulfur diesel locomotive fuel
- Aircraft Gas Turbine Tier 6 (2013) and Tier 8 (2014/2023) NOx Emissions Standards
- CMAQ funds for replacement, repower, retrofit MAR: Large reductions especially if oldest vehicles like rail yard switchers
- DERA program to replace, repower, retrofit MAR diesel: Potential large reductions with oldest vehicles
- FAA VALE program (not including ground support equipment or auxiliary power units)
- ARPA, IIJA, and IRA program funds
- Adoption of sustainable aviation fuels (confirm feedstock used reduces NOx emissions)

Voluntary Mobile Source Emission Reduction Programs (VMEPs)

- Voluntary measures that can be incorporated in SIPs (there is a limit)
- The following definitions apply to VMEPs as described in this memorandum.
- **Voluntary (continual) Measures**: Emission reduction programs that rely on voluntary actions of individuals or other parties for achieving emission reductions.
- **Seasonal Measures**: Emission reduction programs that are in effect only during the season in which the area experiences high pollutant concentrations.
- **Episodic Measures**: Activity-based mobile source programs that are implemented during identified periods of high pollutant concentrations, varying by meteorological conditions. These measures may or may not be continuous in nature depending on program design. The statutory authority for approval of episodic measures in SIPs applies only to activity-based mobile source emission reduction measures as explained in 1997 document.
- October 24, 1997 memo on "Guidance on Incorporating Voluntary Mobile Source Emission Reduction Programs in State Implementation Plans (SIPs)" https://www.epa.gov/sites/default/files/2016-05/documents/vmep-gud.pdf

Questions?

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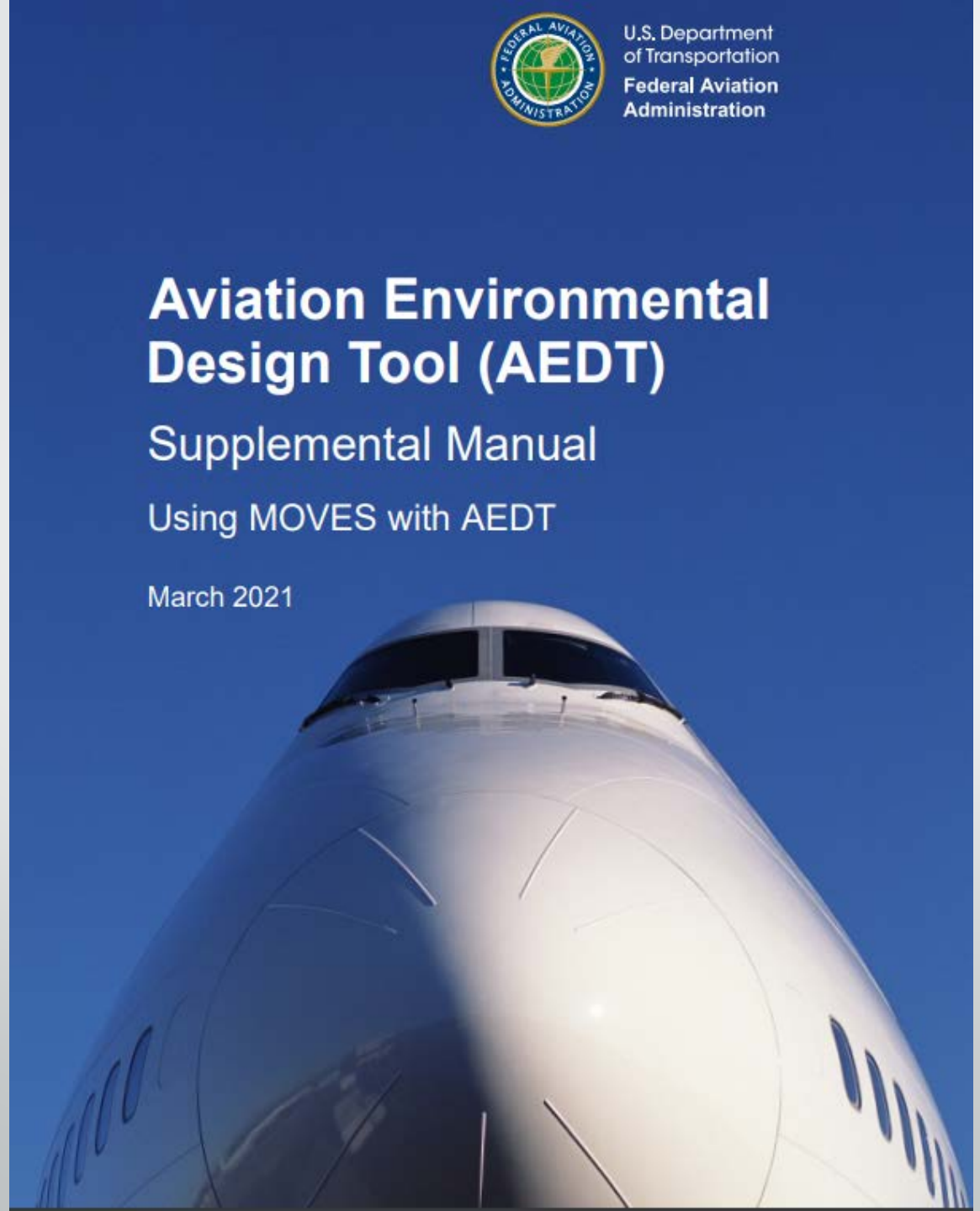
EXTRA SLIDES

Resources

- MOVES3 Technical Guidance – Using MOVES to Prepare Emission Inventories for SIPs and Transportation Conformity, EPA-420-B-20-052 (Nov 2020). https://www.epa.gov/sites/default/files/2020-11/documents/420b20052.pdf
- Air Quality Planning (MDE) SIP Documents: https://mde.maryland.gov/programs/air/airqualityplanning/pages/index.aspx
- Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources, 1992 https://www3.epa.gov/ttn/naaqs/aqmguide/collection/cp2/19921201_oaqps_epa-420_r-92-009_ei_preparation_mobile_sources.pdf
- Aviation Environmental Design Tool (AEDT) Supplemental Manual Using MOVES with AEDT, March 2021. https://aedt.faa.gov/Documents/AEDTSupplemental_Using_MOVES_with_AEDT_3d.pdf
- Incorporating Voluntary Mobile Source Emission Reduction Programs (VMEPs) in State Implementation Plans (SIPs) https://www.epa.gov/state-and-local-transportation/incorporating-voluntary-mobile-source-emission-reduction-programs (October 25, 1997)


U.S. Department of Transportation
Federal Aviation Administration
Aviation Environmental Design Tool (AEDT)
Supplemental Manual
Using MOVES with AEDT
March 2021

May 2023