

V. Development of Emission Factors

This section summarizes how EPA's MOBILE6.2 emissions model was used to develop emission factors for use in this conformity determination.

MOBILE6.2 is the latest version of EPA's emissions model. It is currently the model approved for use to estimate emissions for transportation conformity assessments. MOBILE6.2 is a computer program that estimates hydrocarbon (HC), carbon monoxide (CO), oxides of nitrogen (NO_x), exhaust particulate matter (which consists of several components), tire wear particulate matter, brake wear particulate matter, sulfur dioxide (SO₂), ammonia (NH₃), six hazardous air pollutant (HAP), and carbon dioxide (CO₂) emission factors for gasoline-fueled and diesel-fueled highway motor vehicles, and for certain specialized vehicles such as natural-gas-fueled or electric vehicles that may replace them. The emission factors produced by the model are measured in grams per mile associated with vehicle type, vehicle speed, roadway type (freeway, arterial, local and freeway ramp), and calendar year (from 1952 to 2050). The methodologies incorporated into MOBILE6.2 for estimating emissions are based on methods and research conducted by EPA.

MOBILE6.2 emission estimates depend on various conditions such as maximum and minimum daily temperatures, humidity level, speed, fuel volatility, and vehicle age distribution. Those conditions are modeled in MOBILE6.2 through a series of user-coded input parameters. For this conformity determination, PM_{2.5}, VOC, and NO_x emission factors were derived for seven analysis years: 2011 (existing condition), 2014 (the TIP year), 2015 (used for consistency with Johnstown's analysis), 2018 (ozone budget year), two interim years (2025 and 2035), and 2040 (long range transportation plan horizon year). Separate NO_x, VOC, and PM_{2.5} emission factors were developed for areas of the region included in the vehicle Inspection and Maintenance (I/M) program, and for areas exempt from the I/M requirement. The input parameters used in the MOBILE6.2 model runs are presented in Appendix D. Default values provided with MOBILE6.2 were used for several of the parameters.

Program control information and data are input to MOBILE6.2 to describe the scenarios for which emission factors are to be estimated. The following discussion describes the program control information used in Southwestern Pennsylvania's conformity process.

Emissions are calculated separately within MOBILE6.2 for fifteen classes of gasoline-fueled vehicles and thirteen types of diesel-fueled vehicles. The emission factor calculations incorporate estimates by vehicle age and vehicle type of both the average annual mileage accumulation and the vehicle registration distribution. A composite emission factor is then computed which is determined by the percentage of total VMT accumulated by each vehicle type. The MOBILE6.2 control record "Vehicle Miles Traveled Fractions" requires a set of sixteen fractional values, representing the fraction of total highway VMT accumulated by each of sixteen composite vehicle types. The "Registration Distribution" control record provides the age distribution of vehicles for each of sixteen composite vehicle types.

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For each vehicle type, a set of 25 values is required to represent the fraction of all vehicles of the given type that are of a given age (from 1 to 25 years old). Local vehicle age distribution information was provided for six light-duty vehicle types. National defaults were used for the ten heavy-duty vehicle types. These VMT fractions and vehicle age distribution records used for this conformity assessment reflect the most recent data available. The VMT fractions for each analysis year are based on 2005 statewide PennDOT data. The vehicle registration distribution used for all scenarios is based on Pennsylvania motor vehicle data for 2005 by county.

Depending on the particular model run, other control records requested that PM_{2.5}, NO_x, or VOC exhaust emission factors be calculated and output by MOBILE6.2.

MOBILE6.2 accounts for the more stringent tailpipe emission standards mandated by the CAAA 90 for new cars beginning with the 1995 model year. In addition, MOBILE6.2 also accounts for the new NO_x emission standard for heavy-duty diesel vehicles (HDDV) that became effective in 2004.

The I/M control file contains information used by MOBILE6.2 to account for vehicle inspection and maintenance (I/M) programs. A basic I/M program was begun by Pennsylvania in 1984 and applied to virtually all light-duty gasoline powered cars and trucks newer than the 1967 model year that were registered within designated areas of the state. A computerized analysis of vehicle tailpipe exhaust emissions with the engine idling (idle test) was performed annually. The test was conducted by licensed inspection facilities where repairs on inspected vehicles could also be performed. Within the Southwestern Pennsylvania region, the basic I/M program applies only to pre-1981 model year vehicles registered in four counties (Allegheny, Beaver, Washington and Westmoreland). Estimates of failure rates, test waiver rates, and compliance rates for the basic I/M program are also specified in the I/M file.

Pennsylvania implemented an enhanced I/M program in 1997 for the Southwestern Pennsylvania region. That program applies to virtually all gasoline powered cars and trucks between model years 1981 and 1995 that are registered in Allegheny, Beaver, Washington and Westmoreland counties. The enhanced I/M program employs a more precise emissions test. As with basic I/M, the test is conducted annually by licensed inspection facilities where repairs to inspected vehicles could also be performed. The test measures tailpipe emissions at two engine speeds. One test is made while the engine is idling and the second test occurs after completion of a 30 second, 2500 rpm cycle. Estimates of failure rates, test waiver rates and compliance rates for the enhanced I/M program also appear in the I/M file.

Further enhancements to the I/M program were implemented in 2003 for the Southwestern Pennsylvania region. That new program utilizes On-Board Diagnostics (OBD) technology and applies to 1996 model year and newer gasoline powered cars and light trucks. This annual test is conducted by licensed inspection facilities where repairs to inspected vehicles could also be performed. When a vehicle is taken to a service center or repair shop, the diagnostic trouble codes stored in the vehicle's computer memory are retrieved. The diagnostic trouble codes identify failures, malfunctions, or deterioration of the vehicle's emissions control components.

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Estimates of failure rates, test waiver rates, and compliance rates for the OBD I/M program also appear in the I/M file.

Scenarios that specify the enhanced or OBD I/M programs also include an “ATP Record” that describes the anti-tampering component of the I/M programs. The anti-tampering program consists of a visual inspection of the emissions control system components to detect tampering and other damage. The program mandates the repair or replacement of defective or missing components. The vehicle components covered by the anti-tampering program, as well as the compliance rate and covered vehicle types and model years appear on the “ATP Record.” The ATP program is also included in the “non-I/M” counties for all analysis years beyond 2004.

The Pennsylvania Clean Vehicles (PCV) Program, adopted in 1998, incorporated the California Low Emission Vehicle Program (CA LEV II) by reference although it allowed automakers to comply with the National Low Emission Vehicle (NLEV) program as an alternative to this Pennsylvania program until model year (MY) 2006. Beginning with MY 2008, “new” passenger cars and light-duty trucks with a gross vehicle weight rating (GVWR) of 8,500 pounds or less that are sold or leased and titled in Pennsylvania must be certified by the California Air Resources Board (CARB) or be certified for sale in all 50 states. For this program, a “new” vehicle is a qualified vehicle with an odometer reading less than 7,500 miles. PaDEP and PennDOT worked with the automobile manufacturers, dealers, and other interested business partners and finalized procedures for complying with these new requirements. PaDEP is focusing on its outreach with the manufacturers and dealers on what they can offer for sale and how to certify that the vehicles are compliant. PennDOT’s role is to ensure paperwork procedures for title and registrations include these certifications of compliance or that the vehicle owner qualifies for an exemption to the requirements. In all cases, PaDEP will use information obtained during PennDOT’s title and registration process to oversee and audit, as needed, certain vehicle title transactions to determine compliance to the program. The impacts of this program are modeled for all analysis years beyond 2008.

Mobile source emissions were estimated using MOBILE6.2 according to the methodology described in section 7.4.1 of “Technical Guidance on the Use of MOBILE6.2 for Emissions Inventory Preparation” published by EPA’s Office of Transportation and Air Quality (OTAQ) in August 2004. Inputs into the mobile source emission model assume full compliance with the requirements of the PCV Program.

The annual emission estimates required to demonstrate conformity to the annual PM_{2.5} standard are derived by producing emission factors for each of the twelve months. MOBILE6.2 user-supplied parameters that vary by month include maximum and minimum temperature, absolute humidity, and information about fuel volatility and its regulation in the geographic area of interest.

The daily emissions estimates needed to demonstrate conformity for each of the daily PM_{2.5} nonattainment areas and for each of the 8-hour ozone nonattainment and maintenance areas are based on these user-supplied parameters for the month of July.

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Other information needed by MOBILE6.2 includes facility, area, and county designations; roadway speed and capacity; daily traffic volumes; the vehicle miles traveled on each combination of facility and area type. This information is developed by the SPC travel model for use by the MOBILE6.2 emissions model.