DOCUMENTATION FOR AIRCRAFT, COMMERCIAL MARINE VESSEL, LOCOMOTIVE, AND OTHER NONROAD COMPONENTS OF THE NATIONAL EMISSIONS INVENTORY - Volume 1 Methodology

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Volume I - Methodology

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1.0 INTRODUCTION

1.1 What is the National Emission Inventory?

The National Emission Inventory (NEI) is a comprehensive inventory covering all criteria pollutants and hazardous air pollutants (HAPs) for all areas of the United States. The NEI was created by the U.S. Environmental Protection Agency's Emission Factor and Inventory Group (EFIG) in Research Triangle Park, North Carolina.

This report presents an overview of how emission estimates for the aircraft, commercial marine vessel (CMV), locomotive, and other nonroad engine components of the NEI were compiled. The other nonroad engines and equipment include a diverse list of portable equipment not included in any of the other mobile source categories, such as: lawn and garden equipment, construction equipment, engines used in recreational activities, portable industrial, commercial, and agricultural engines. Note, the equipment included in this category are equipment and engine types included in the NONROAD model.

The NEI will be used to support air quality modeling and other activities. To this end, the EPA established a goal to compile comprehensive emissions data in the NEI for criteria and HAPs for mobile, point, and nonpoint sources.

1.2 Why Did the EPA Create the NEI?

The Clean Air Act (CAA), as amended in 1990, includes mandates for the EPA related to criteria and hazardous air pollutants. The CAA defines criteria pollutants as being one of the following air pollutants:

- ♦ Carbon monoxide (CO);
- ♦ Sulfur oxides (SO_x);

- Nitrogen oxides (NO_x);
- Ozone; and
- Particulate matter (PM).

Ammonia (NH_3) is an important precursor to PM fine formation. However, NH_3 is not included in any sources covered in this documentation, though states may have provided estimates for this pollutant, these states submitted estimates have been incorporated into the NEI.

Hazardous air pollutants are also delineated in the CAA, see *http://www.epa.gov/ttn/atw/188polls.html* for a complete list of regulated pollutants and their chemical abstract service [CAS] numbers. Note, estimates were not developed for mercury and arsenic, in light of uncertainty associated with the emission estimates methods used in previous NEI data sets.

The CAA requires the EPA to identify emission sources of these pollutants, quantify emissions, develop regulations for the identified source categories, and assess the public health and environmental impacts after the regulations are put into effect. The NEI is a tool that EPA can use to meet the CAA mandates. In this report, criteria and HAP emission estimates are discussed for aircraft, CMV, locomotives and other nonroad mobile sources (HAP pollutants for 1990, 1996, and 1999 only).

1.3 How is the EPA Going to Use This Version of the NEI?

It is anticipated that the emission inventory developed from this effort will have multiple end uses. The data have been formatted according to protocols established for the EPA's NEI submittals. The common data structure on which the NEI platform is based will allow the NEI emission data to be transferred to multiple end-users for a variety of purposes.

The criteria and HAP emission estimates developed for the NEI will be incorporated into the annual EPA publication entitled *National Emissions Trends Report,* which is used to evaluate air pollution trends over time. The NEI is also a critical component of the EPA's national Air Toxics Program (as described in EPA's July 19, 1999 Federal Register notice, 64 FR 38706). The initial objective is to make the data available for air quality modeling use in the National Air Toxics Assessment (NATA).

1.4 Report Organization

Note this report updates the February 4, 2005 version to include the revised emission estimates provided by States for all source categories for 2002.

Following this introduction, Section 2.0 provides information on how the national aircraft, CMV, locomotive, and other nonroad emission estimates were developed, and how state and local inventory data were incorporated. This inventory effort was coordinated by the EPA’s Office of Transportation and Air Quality (OTAQ) and EFIG. Section 3.0 provides information on how the inventory data were compiled into a common data structure. Section 4.0 discusses the limitations of the data.

The appendix were created to provide technical details on how the national emissions were developed and how state and local inventory data (when provided) were incorporated into the national estimates. Appendix A provides details on how aircraft criteria and HAP emissions were estimated. Appendix B provides details on how criteria and HAP emissions were developed for CMVs. Appendix C includes the criteria and HAP estimating methodologies used for locomotives. Appendix D documents the methods used to estimate HAP emissions from other nonroad engine sources. Appendix E provides summaries of the submitted state and local data. Appendix F presents the complete NEI pollutant code dictionary of HAPs.

2.0 DEVELOPMENT OF THE AIRCRAFT, COMMERCIAL MARINE VESSEL, LOCOMOTIVE AND OTHER NONROAD COMPONENTS FOR THE NEI

The NEI was developed to include all point, nonpoint (area), and mobile sources. The approaches used in the point and nonpoint source categories are documented in other reports. Table 2-1 summarizes the approaches used to estimate emissions from all nonroad sources included in the NEI program. Those source categories and years that are included in this report are noted in bold.

The scope of this inventory component of the NEI was to compile criteria and HAP emissions data for aircraft, CMV, and locomotives and HAP emissions for other nonroad engines operating in the United States. In this effort, national emission estimates were often developed for each of the above source categories and allocated to counties based on available Geographic Information System (GIS) data. For some pollutants associated with the other nonroad source category, county-level (instead of national) data were used to estimate emissions. The methodologies used to estimate emissions and the procedures used to spatially allocate them to the county-level are discussed in greater detail in this section, with supplemental data provided in Appendices A, B, C, and D. In Volume 2 of this report, reference material used in this inventory effort that are unpublished or difficult to locate are provided.

Concurrent with the development of the national emission estimates, state and local agencies developed and provided to the EPA, emissions inventory data for their areas based on local knowledge and activity information. These state and local agency data replaced the national emission estimates when the pollutant, source category, and emission type matched with the national estimates. Submitted state and local data that did not match the nationally-derived data were retained along with the national estimates. State and local data were used as provided and never adjusted to better match the national data. It should be noted that state data that were not provided in the appropriate NIF format could not be incorporated into the NEI.

Table 2-1. Methods Used to Develop Annual Emission Estimates for Nonroad Mobile Sources

(categories included in this report are noted in bold print)

Category	Base Year	Pollutant(s)	Estimation Method*
NONROAD Categories			
Nonroad Gasoline, Diesel, LPG, CNG	2002	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$, NH_3, & HAPs	Emission estimates for NONROAD model engines were developed using EPA's National Mobile Inventory Model (NMIM), which incorporates NONROAD2004. Where states provided alternate nonroad inputs, these data replaced EPA default inputs. State-supplied emissions data also replaced default EPA emission estimates.
	1999	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Using emission estimates from two emission inventories including: 1) a 1996 county-level inventory, developed using EPA's October 2001 draft NONROAD model; and 2) an updated 1999 national inventory, based on EPA's draft Lockdown C NONROAD model (dated May 2002). Using the 1996 county-level emission estimates, seasonal and daily county-to-national ratios were then developed for application to updated national estimates per season estimated from the Lockdown C model. Replaced State-submitted data for California for all NONROAD model categories; Pennsylvania for recreational marine and aircraft ground support equipment, and Texas for select equipment categories.
	1996, 1997, 1998, 2000 & 2001	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Using emission estimates from two emission inventories including: 1) a 1996 county-level inventory, developed using EPA's October 2001 draft NONROAD model; and 2) updated year-specific national and California inventories, based on EPA's draft Lockdown C NONROAD model (dated May 2002). Using the 1996 county-level emission estimates, seasonal and daily county-to-national ratios and California county-to-state ratios were then developed for application to updated national estimates per season estimated from the Lockdown C model. California results replace the diesel equipment emissions generated from prior application of county-to-national ratios.
	1991-1995	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$, NH_3	Using 1990 and 1996 county-level emissions inventories, estimated emissions using linear interpolation of national emissions between 1990 and 1996. From these emissions, calculated the average annual growth rate for each pollutant/SCC combination for each year, and then applied the growth factors to 1990 county-level emissions to estimate 1991-1995 emissions.

Table 2-1. Methods for Developing Annual Emission Estimates for Nonroad Mobile Sources (Continued)
(categories included in this report are noted in bold print)

Category	Base Year	Pollutant(s)	Estimation Method*
Nonroad Gasoline, Diesel, LPG, and CNG (Continued)	1990	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Using emission estimates from two emission inventories including: 1) a 1996 county-level inventory, developed using EPA's October 2001 draft NONROAD model; and 2) updated 1990 national inventory, based on EPA's draft Lockdown C NONROAD model (dated May 2002). Using the 1996 county-level emission estimates, seasonal and daily county-to-national ratios were then developed for application to updated national estimates per season estimated from the Lockdown C model.
	1986, 1988, & 1989	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$, NH_3	Using 1985 and 1990 county-level emissions inventories, estimated emissions using linear interpolation of national emissions between 1985 and 1990. From these emissions, calculated the average annual growth rate for each pollutant/SCC combination for each year, and then applied the growth factors to 1985 county-level emissions to estimate 1986-1989 emissions.
	1987	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Using EPA's draft Lockdown C NONROAD model (dated May 2002), developed updated national emissions for 1987 by running 4 seasonal NONROAD model runs to estimate annual criteria pollutant emissions. Also performed national NONROAD model runs to estimate typical summer weekday emissions.
	1985	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Using emission estimates from two emission inventories including: 1) a 1996 county-level inventory, developed using EPA's October 2001 draft NONROAD model; and 2) updated 1985 national inventory, based on EPA's draft Lockdown C NONROAD model (dated May 2002). Using the 1996 county-level emission estimates, seasonal and daily county-to-national ratios were then developed for application to updated national estimates per season estimated from the Lockdown C model.
	1970, 1975, 1978, & 1980	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Using EPA's draft Lockdown C NONROAD model (dated May 2002), developed updated national emissions for all years by running 4 seasonal NONROAD model runs to estimate annual criteria pollutant emissions. Also performed national NONROAD model runs to estimate typical summer weekday emissions.

Table 2-1. Methods for Developing Annual Emission Estimates for Nonroad Mobile Sources (Continued)
(categories included in this report are noted in bold print)

Category	Base Year	Pollutant(s)	Estimation Method*
Nonroad Gasoline, Diesel, LPG, and CNG (Continued)	1996, 1997, 1998, 1999, 2000, & 2001	NH_3	Obtaining national fuel consumption estimates from the Lockdown C NONROAD model, multiplying by NH_3 emission factors, and distributing to counties using 1996 inventory, based on October 2001 draft NONROAD. NH_3 emissions for California were also recalculated using updated diesel fuel consumption values generated for California-specific runs, and assuming the 1996 county-level distribution.
	1985 & 1990	NH_3	Obtaining national fuel consumption estimates from the Lockdown C NONROAD model, multiplying by NH_3 emission factors, and distributing to counties using 1996 inventory, based on October 2001 draft NONROAD.
	1987	NH_3	Obtaining 1987 national fuel consumption estimates from Lockdown C NONROAD model and multiplying by NH_3 emission factors.
	1970, 1975, 1978, & 1980	NH_3	Obtaining national fuel consumption estimates from the Lockdown C NONROAD model and multiplying by NH_3 emission factors.
	1990, 1996, & 1999	**HAPs**	**Speciation profiles applied to county VOC and PM estimates. Metal HAPs were calculated using fuel and activity-based emission factors. Some state data were provided and replaced national estimates. (2003)**
Aircraft			
Commercial Aircraft	**2002**	**Criteria and HAPs**	**Federal Aviation Administration (FAA) Emissions and Dispersion and Modeling System (EDMS) was run for criteria pollutants, VOC and PM emissions were speciated into HAP components. (2004)**
	1990, 1996, 1999, 2000, 2001	**VOC, NO_x, CO, SO_X**	**Input landing and take-off (LTO) data into FAA EDMS. National emissions were assigned to airports based on airport specific LTO data and BTS GIS data. State data replaced national estimates. (2003)**
	1970-1998	VOC, NO_x, CO, SO_X	Estimated emissions for interim years using linear interpolation between available base years. (2003)
	1990, 1996, 1999	**HAPs**	**Speciation profiles were applied to VOC estimates to get national HAP estimates. State data replaced national estimates. (2003)**

Table 2-1. Methods for Developing Annual Emission Estimates for Nonroad Mobile Sources (Continued)

(categories included in this report are noted in bold print)

Category	Base Year	Pollutant(s)	Estimation Method*
General Aviation, Air Taxis	**1978, 1987, 1990, 1996, 1999, 2000, 2001, & 2002**	**VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$**	**Used FAA LTO data and EPA approved emission factors for criteria estimates. Speciation profiles were applied to VOC estimates to get national HAP estimates. State data replaced national estimates. (2004)**
	1970-1998	VOC, NO_x, CO, SO_X, PM_{10}, $PM_{2.5}$	Estimated emissions for interim years using linear interpolation between available base years. (2003)
	1990, 1996, 1999, & 2002	**HAPs**	**Used FAA LTO data and EPA approved emission factors for criteria estimates. Speciation profiles were applied to VOC estimates to develop national HAP estimates. (2004)**
	1990, 1996, 1999, & 2002	**Pb**	**Used Department of Energy (DOE) aviation gasoline usage data with lead concentration of aviation gasoline. (2004)**
	1996	NH_3	Applied NH_3 emissions factors to 1996 national jet fuel and aviation gasoline consumption estimates.
Military Aircraft	**1978, 1987, 1990, 1996, 1999, 2000, 2001, & 2002**	**VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$**	**Used FAA LTO data and EPA approved emission factors for criteria estimates. Representative HAP profiles were not readily available, therefore HAP estimates were not developed. State data replaced national estimates. (2004)**
	1970-1998	VOC, NO_x, CO, SO_X, PM_{10}, $PM_{2.5}$	Estimated emissions for interim years using linear interpolation between available base years. (2003)
Auxiliary Power Units	1985-2001	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Grew 1996 emissions to each year using LTO operations data from the FAA. Estimation methods prior to 1996 reported in EPA, 1998.
Unpaved Airstrips[1]	1985-2001	PM_{10}, $PM_{2.5}$	Grew 1996 emissions to each year using SIC 45-Air Transportation growth factors, consistent with the current draft version of EGAS. Estimation methods prior to 1996 reported in EPA, 1998.
Aircraft Refueling[1]	1985-2001	VOC	Grew 1996 emissions to each year using SIC 45-Air Transportation growth factors, consistent with the current draft version of EGAS. Estimation methods prior to 1996 reported in EPA, 1998.
Commercial Marine Vessel (CMV)			
All CMV Categories	**2002**	**VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$**	**2001 Estimates carried over. Used state data when provided. (2004)**
		HAPs	**1999 Estimates carried over. Used state data when provided. (2004)**

Table 2-1. Methods for Developing Annual Emission Estimates for Nonroad Mobile Sources (Continued)

(categories included in this report are noted in bold print)

Category	Base Year	Pollutant(s)	Estimation Method*
CMV Diesel	**1978, 1987, 1990, 1996, 1999, 2000, & 2001**	**VOC, NO_x, CO, SO_x, PM_{10}, & $PM_{2.5}$,**	**Used criteria emission estimates in the background document for marine diesel regulations for 2000. Adjusted 2000 criteria emission estimates for other used based on fuel usage. Emissions were disaggregated into port traffic and underway activities. Port emissions were assigned to specific ports based on amount of cargo handled. Underway emissions were allocated based on Army Corp of Engineering waterway data. State data replaced national estimates. (2003)**
	1970-1998	VOC, NO_x, CO, SO_X, PM_{10}, $PM_{2.5}$	Estimated emissions for interim years using linear interpolation between available base years. (2003)
	1990, 1996, 1999	**HAPs**	**VOC and PM emission estimates were speciated into HAP components. State data replaced national estimates. (2003)**
	1996	NH_3	Applied NH_3 emissions factors to 1996 distillate and residual fuel oil estimates (i.e., as reported in EIA, 1996).
	1990-1995	NH_3	Estimation methods reported in EPA, 1998.
CMV Steam Powered	**1978, 1987, 1990, 1996, 1999, 2000, & 2001**	**VOC, NO_x, CO, SO_x, PM_{10}, & $PM_{2.5}$**	**Calculated criteria emissions based on EPA SIP guidance. Emissions were disaggregated into port traffic and under way activities. Port emissions were assigned to specific ports based on amount of cargo handled. Underway emissions were allocated based on Army Corp of Engineering waterway data. State data replaced national estimates. (2003)**
	1970-1998	VOC, NO_x, CO, SO_X, PM_{10}, $PM_{2.5}$	Estimated emissions for interim years using linear interpolation between available base years. (2003)
	1990, 1996, & 1999	HAPs	VOC and PM emission estimates were speciated into HAP components. State data replaced national estimates. (2003)
Military Marine	1997-2001	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Applied EGAS growth factors to 1996 emissions estimates for this category.
CMV Coal,[2] CMV, Steam powered, CMV Gasoline[2]	1997-1998	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Applied EGAS growth factors to 1996 emissions estimates for this category.
CM Coal, CMV, Steam powered, CMV Gasoline, Military Marine	1991-1995	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Estimation methods reported in EPA, 1998.

Table 2-1. Methods for Developing Annual Emission Estimates for Nonroad Mobile Sources (Continued)

(categories included in this report are noted in bold print)

Category	Base Year	Pollutant(s)	Estimation Method*
Locomotives			
Class I, Class II, Commuter, Passenger, and Yard Locomotives	**1978, 1987, 1990, 1996, 1999, 2000, 2000, & 2002**	**VOC, NO_x, CO, PM_{10}, $PM_{2.5}$**	**Criteria pollutants were estimated by using locomotive fuel use data from DOE EIA and available emission factors. County-level estimates were obtained by scaling the national estimates with the rail GIS data from DOT. State data replaced national estimates. (2004)**
	1978, 1987, 1990, 1996, 1999, 2000, 2001, & 2002	**SO_2**	**SO_x emissions were calculated by using locomotive fuel use and fuel sulfur concentration data from EIA. County-level estimates were obtained by scaling the national estimates with the county level rail activity data from DOT. State data replaced national estimates. (2004)**
	1970-1998	VOC, NO_x, CO, SO_X, PM_{10}, $PM_{2.5}$	Estimated emissions for interim years using linear interpolation between available base years. (2003)
	1990, 1996, 1999, & 2002	**HAPs**	**HAP emissions were calculated by applying speciation profiles to VOC and PM estimates. County-level estimates were obtained by scaling the national estimates with the county level rail activity from DOT. State data replaced national estimates. (2004)**
	1997-1998	NH_3	Grew 1996 base year emissions using EGAS growth indicators.
	1996	NH_3	Applied NH_3 emissions factors to diesel consumption estimates for 1996.
	1990-1995	NH_3	Estimation methods reported in EPA, 1998.

Notes:

* Dates included at the end of Estimation Method represent the year that the section was revised.

1 Emission estimates for unpaved airstrips and aircraft refueling are included in the area source NEI, since they represent non-engine emissions.

2 National Emission estimates for CMV Coal and CMV Gasoline were not developed though states and local agencies may have submitted estimates for these source categories.

EPA, 1998. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Emission Factors and Inventory Group, *National Air Pollutant Emission Trends, Procedures Document*, 1900–1996, EPA-454/R-98-008. May 1998.

The target inventory area includes every state in the United States and every county within a state. There are no boundary limitations pertaining to traditional criteria pollutant nonattainment areas or to designated urban areas. The pollutants inventoried included all criteria pollutants (except for the other nonroad source category which addressed only HAPs in this report) and the 188 HAPs identified in Section 112(b) of the CAA. Some state or local agencies provided emissions information on more HAPs than those delineated in the CAA, only the federally regulated HAPs are included in the NEI.

Some state and local inventories did not provide estimates for all of the pollutants included in the nationally-derived emission estimates; in these cases, the submitted state and local data were used and the national estimates were included only for the missing pollutants. It should be noted that if state or local agency's submitted VOC or PM estimates, these state and local estimates were **not** speciated into their HAP components. In cases where, state and local agency's provided estimates for pollutants not included in the nationally-derived inventory, these state and local estimates were retained as long as the additional pollutants were one of the listed 188 regulated HAPs.

States and local agency's occasionally provided emissions for only one emission type (annual or ozone season daily). Where data overlapped with nationally-derived estimates, the national emission estimates were replaced with the state and local emission estimates. The submitted state and local data were **not** used to calculate other emission types. For example, if ozone season daily estimates were provided, annual emissions were not developed based on the ozone season daily estimates. State and local data were used as provided, such that, the emission estimates for a given state or county may be a mixture of nationally and locally-derived emission estimates.

For the 2002 inventory, states submitted aircraft emission estimates in the airport facility point source file. These data were retained in the point source file, but the associated aircraft emission are summarized in this report. It should also be noted, where point source aircraft/airport data were provided, the EPA-developed aircraft emission estimates for the associated counties were replaced with the State submitted data.

In addition to numerous specific chemical compounds, the list of 188 HAPs includes several compound groups [e.g., individual metals and their compounds, polycyclic organic matter (POM) and Dioxin/Furan Cogeners]; the NEI includes emission estimates for the individual compounds wherever possible. Many of the uses of the NEI depend upon data (e.g., toxicity) for individual compounds within these groups rather than aggregated data on each group as a whole. Appendix F lists all of the specific pollutants and compound groups included in the NEI along with their Chemical Abstract Services (CAS) numbers (for individual compounds).

POM includes a large number of individual compounds, too numerous to include in this inventory effort. Emission test data are readily available for several polycyclic aromatic hydrocarbons (PAHs). PAHs are a chemical subset of POM. The PAH compounds most commonly tested are listed below and referred to as the 16-PAHs. The 7-PAH compounds (marked with asterisks) are a subset of the 16-PAH and have been determined by the International Agency for Research on Cancer (IARC) to be animal carcinogens. In this inventory, individual estimates were developed for each of the 16 PAH species except for CMV steam ships where POM estimates are provided as aggregate 7- and 16-PAH. Some states submitted estimates based on aggregated 7- and 16-PAH.

Acenaphthene
Acenaphthylene
Anthracene
Benzo(a)anthracene*
Benzo(a)pyrene*
Benzo(b)fluoranthene*
Benzo(ghi)perylene
Benzo(k)fluoranthene*
Chrysene*
Dibenz(a,h)anthracene*
Fluoranthene
Fluorene
Indeno(1,2,3-cd)pyrene*
Naphthalene
Phenanthrene
Pyrene

Data submitted by each state for the 1996, 1999, and 2002 inventory are discussed in each of the following emission methodology sections, along with comments on any difficulties encountered or assumptions that had to be made when incorporating the state data into the NEI. Appendix E contains summaries of the data that were provided for each state. Note, mercury and arsenic emission estimates submitted by state and local agencies were retained but not used in the inventory until a definitive methodology for estimating emissions from these pollutants can be developed.

The intent in presenting the following emission inventory methodologies is to provide sufficient and transparent documentation such that states and local agencies can use these approaches, in conjunction with their specific local activity data to develop more accurate and comparable emission estimates in future submittals.

2.1 Aircraft

2.1.1 What are Aircraft Sources?

The aircraft source category includes all aircraft types used for public, private, and military purposes. This includes four types of aircraft (EPA, 1992):

- ♦ Commercial;
- ♦ Air Taxis;
- ♦ General Aviation; and
- ♦ Military.

Commercial aircraft include those used for transporting passengers, freight, or both. Commercial aircraft tend to be larger aircraft powered with jet engines and frequent large municipal airports. These aircraft are involved in domestic as well as international traffic. Air taxis carry passengers, freight, or both, but usually are smaller then commercial air carriers aircraft and typically only provide domestic travel. The national air taxi fleet includes both jet and propeller-driven aircraft. General aviation includes most other aircraft used for recreational flying and personal transportation. Aircraft that support business travel, usually on an unscheduled basis, are included in the category of general aviation. Most of the general aviation fleet is made up of propeller-driven aircraft, though smaller business jets can also be found in this category. Military aircraft cover a wide range of aircraft types such as training aircraft, fighter jets, helicopters, and jet- and propeller-driven cargo planes of varying sizes.

It should also be noted that this inventory effort includes criteria emission estimates for aircraft support vehicles and engines typically found at airports, such as aircraft refueling vehicles, baggage handling vehicles, and equipment, aircraft towing vehicles, passenger buses, larger portable generators, and other airport vehicles as derived form the NONROAD model (see Section 2.4).

2.1.2 What Pollutants are Included in the National Emission Estimates for Aircraft?

OTAQ identified the criteria pollutants and HAPs for which data were available to develop inventory estimates (Cook, 1997; Cook, 1998). Criteria pollutants include VOC, NO_x, CO, SO_x, PM_{10}, and $PM_{2.5}$. The HAPs that are included in the national aircraft inventory are listed below and are based on available test data and accepted emission estimation procedures:

1,3-Butadiene	PAH
2,2,4-trimethylpentane	Phenol*
Acetaldehyde	Propionaldehyde
Acrolein	Styrene
Formaldehyde	Toluene
Lead	Xylene
Benzene	n-Hexane
Ethyl Benzene	

* Added to 2002 Inventory

2.1.3 How Were Aircraft Emissions Estimated?

EPA has developed guidance for inventorying aircraft emissions associated with an aircraft's landing and takeoff (LTO) cycle. The cycle begins when the aircraft approaches the airport on its descent from its cruising altitude, lands, taxis to the gate, and idles during passenger deplaning. The LTO cycle continues as the aircraft idles during passenger boarding, taxis back out onto the runway for subsequent takeoff, and ascent (climbout) to cruising altitude. Thus, the five specific operating modes in an LTO cycle are (EPA, 1992):

- Approach;
- Taxi/idle-in;
- Taxi/idle-out;
- Takeoff; and
- Climbout.

The LTO cycle provides a basis for calculating aircraft emissions. During each mode of operation, an aircraft engine operates at a fairly standard power setting for a given aircraft model. Emissions for one complete cycle are calculated using emission factors for each operating mode for each specific aircraft engine combined with the typical period of time the aircraft is in the operating mode. Criteria emission estimates are presented here for four different aircraft types: commercial air carrier, air taxis, general aviation, and military. HAP emission estimates were developed for all aircraft types except military aircraft. Because of the diversity of military aircraft operations, representative HAP emission factors could not be identified or developed.

Emissions of criteria pollutants from commercial air carriers were calculated differently than the other three aircraft categories (See Figure 2-1). Criteria pollutant emissions were

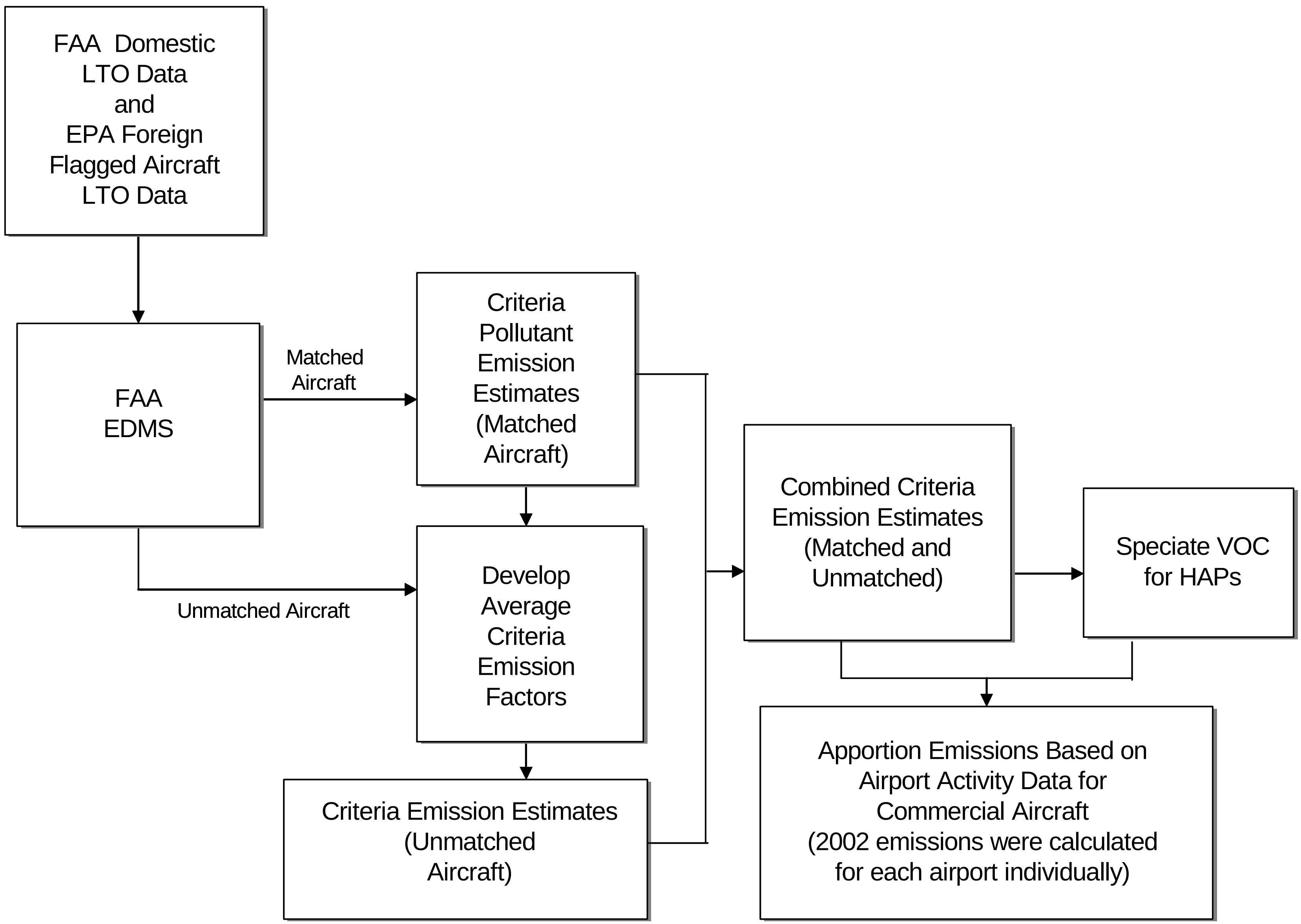

Figure 2-1. Procedures for Estimating Emissions from Commercial Air Carriers

estimated for commercial aircraft by applying aircraft specific activity data from FAA's *Airport Activity Statistics of Certificated Route Air Carriers* to FAA's *Emissions and Dispersion Modeling System (EDMS), Version 4.0* (DOT, 2001). For 2002 the FAA's T100 Segment data obtained from the Bureau of Transportation Statistics (BTS) were used in conjunction with the EDMS model. The FAA's airport activity statistics for certified air carriers only documents activity of American flagged carriers. EPA/OTAQ provided national data for foreign flagged air carriers. For 2002, emissions were increased by 2 percent at each airport to account for the foreign flagged air carriers. It is recognized that this may under estimate activity at the larger airports that provide international services and over estimate activity at the small airports.

EDMS generates estimates for hydrocarbons (HC), NO_x, CO, and SO_x. The HC estimates were converted to VOC (EPA, 1992). In this effort, all of the default time-in-mode (TIM) values incorporated in the EDMS were used. EDMS did not have a default TIM value for the period that an aircraft is taxiing and idling. In this effort, a TIM value of 26 minutes was used for taxing and idling; this value was obtained from EPA State Implementation Plan (SIP) guidance on estimating aircraft emissions (EPA, 1992).

In previous years not all of the aircraft included in the FAA activity report could be matched to the aircraft in the EDMS. For those aircraft that could not be matched directly, their LTOs were applied to an average LTO emission factor developed from the aircraft data that could be matched directly. In 2002 all aircraft were matched.

Criteria pollutant emission estimates for air taxis, general aviation, and military aircraft were calculated by combining aircraft operations data from FAA's *Air Traffic and Activity Data System (ATADS)* (DOT, 2001a) and EPA criteria emission factors (See Figure 2-2) (EPA, 1992).

HAP emission estimates for all aircraft were estimated by applying speciation profiles to national level VOC or PM_{10} emissions estimates. Note, for the 2002 inventory, PM emission factors were developed for commercial air carriers and the HAP profiles were updated using the

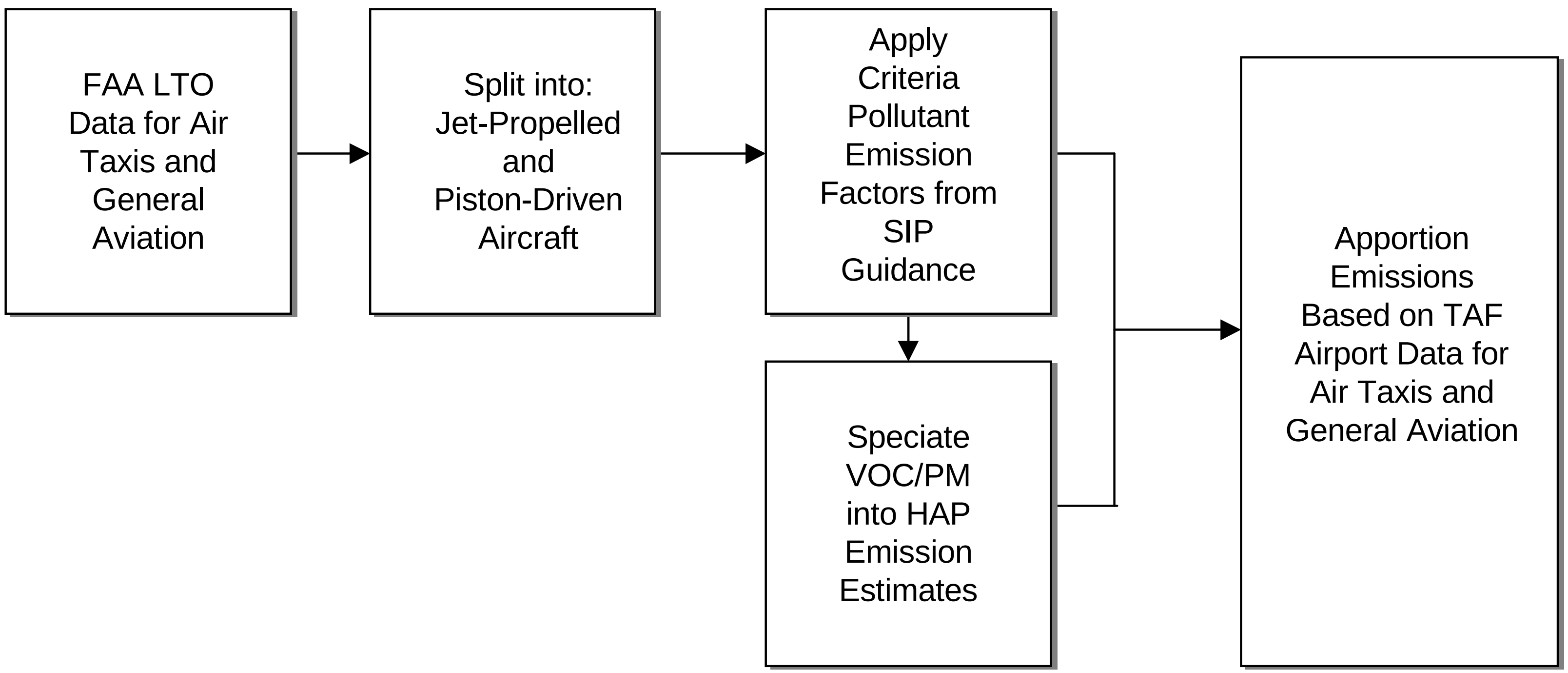

Figure 2-2. Procedures for Estimating Emission from Air Taxis and General Aviation

latest test data. The speciation profiles used are noted in Appendix A. Lead emission estimates were handled differently. Lead emissions are primarily associated with leaded aviation fuel used in piston driven aircraft associated with general aviation. The lead estimates developed in this inventory were derived by combining DOE annual aviation gasoline usage data with the lead content of aircraft fuel (assumed to be 2.0 g/gal.), and applying a 75% retention value to reflect the lead that is retained in the engine or exhaust system, as was calculated in the *Lead Locating and Estimating Document* (EPA, 1998). It should be noted that this approach over estimates emission as it would include emissions associated in the fuel combusted during cruise mode.

Appendix A contains detailed documentation of how emissions were estimated for all aircraft types. The documentation is <u>not</u> meant to provide an exhaustive analysis on the derivation of all the inputs. For example, an emission factor used for a national estimate may be given in the appendix, but the source test data that were evaluated to obtain this factor may not be presented or discussed. The goal of the documentation provided is to show in a brief and concise manner how a given estimate was derived. Volume 2 of this report contains copies of documents not readily available that may help the reader to better appreciate the data sources used to calculating emissions for this inventory effort.

2.1.4 How Were National Emissions Allocated to Individual Counties?

For the 2002 inventory, emissions were individually estimated for each airport - therefore, there was no need to use a surrogate approach to spatially allocate emissions. For all other inventory years, national aircraft emission estimates were allocated to individual counties using airport activity data derived from the FAA Terminal Area Forecast System (TAF) database of over 2,000 airports in the United States (DOT, 2001c). A GIS database obtained from the BTS (DOT, 2001d) contained airport-level LTO data with latitude and longitude coordinates. These two data sources were matched to identify the county in which each airport is located. These county determinations were compared to a study implemented by the EPA identifying airports that appear in multiple counties, noting the county were the aircraft activity is most significant.

Where necessary county codes were changed to match the results from this study. These data are noted in the mobile source supplemental data set currently available at the EPA's NEI web site and 2001 inventories.

For 1990, 1996, 1999, and 2000 NEI, the percentage of national activity was then calculated for each airport for each aircraft type (i.e., commercial, air taxis, general aviation, and military), as noted in the following equation.

$$\textit{Airport i Percentage of National LTO by aircraft type} = \frac{\textit{LTO at airport i by aircraft type}}{\textit{National LTO by aircraft type}}$$

National aircraft emissions for each aircraft type were allocated to specific airports by using the LTO percentages (see equations below):

$$\textit{Airport i Emissions} = \textit{Airport i Percentage by Aircraft Type} * \textit{Pollutant by Aircraft Type}$$

Where there were multiple airports in a given county, these emissions were simply summed to provide a county level emissions estimate. In the future, individual airports may be included along with their latitude and longitude coordinates.

For the 1978 and 1987 inventories, only annual national emission estimates were required, therefore, spatial allocations were not developed for these inventories.

2.1.5 Data Provided by States

Where states provided their own emission estimates, their data were given priority over all other data. EPA did not adjust or revise any data submitted by state or local agencies - the data were used as submitted. For example if a state submitted only ozone season daily estimates these values were <u>not</u> multiplied by 365 to estimate annual emissions. Note, state emission estimates may differ significantly with EPA emission estimates. Table 2-2 summarizes the states that submitted 1996, 1999, and 2002 data for inclusion into this version of the NEI, and information about how the data were handled in order to be incorporated into the NEI.

Puerto Rico did provide estimates for 1996. Note, emission estimates for San Juan International airport were developed in the same fashion as emission estimates for mainland airports. FAA aircraft activity data were available for 1999, 2001, 2002; therefore, nationally-derived estimates were used in NEI for these years for Puerto Rico. Appendix E contains individual summary sheets for each state that submitted aircraft data.

Table 2-2. Summary of State Submitted Aircraft Data

State	Criteria	HAPs	Comments
1996			
Puerto Rico and Virgin Islands		✔	Replaced national estimates with state submitted data.
South Carolina		✔	Replaced national estimates with state submitted data.
1999			
California	✔	✔	Replaced national estimates for military, commercial aircraft, and general aviation with State submitted data. HAP data submitted for pollutants other than the 188 were not incorporated.
Louisiana	✔		Replaced national estimates for military, commercial, general aviation, and air taxis with State submitted data for VOC and NO_x, for one county.
Maryland		✔	Replaced national estimates with state submitted data.
Minnesota		✔	Replaced national estimates with state submitted data for 28 HAPs.
Nebraska	✔		Replaced national estimates with state submitted data for VOC, NO_x, CO, SO_x, PM_{10} for one county.
Pennsylvania	✔		Replaced national ozone season daily estimates with state submitted data.
South Carolina	✔		Replaced national estimates with state submitted data for HC, NO_x, CO and SO_x. HC was converted to VOC.
Tennessee	✔		Replaced national estimates for military, commercial, general aviation, and air taxis with state submitted data for HC, NO_x, CO, SO_x, for one county. HC was converted to VOC.
Texas	✔		Replaced commercial aircraft and general aviation estimates with state submitted data.
Utah	✔		Replaced national estimates with state submitted data for VOC, NO_x, CO, SO_x, PM_{10}, and NH_3.
Wisconsin	✔		Replaced national estimates with state submitted data for VOC, NO_x and CO.

Table 2-2. Summary of State Submitted Aircraft Data (Continued)

State	Criteria	HAPs	Comments
2002			
Alabama	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.
Arkansas	✔	✔	Replaced national estimates with state data for CO, NH_3, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, VOC, and Lead (only HAP).
Arizona (Maricopa County)	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.
California	✔	✔	Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, VOC, and 26 HAPs.
Colorado	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.
Connecticut	✔		Replaced national estimates with state data for CO, and VOC.
Delaware	✔	✔	Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, VOC, and 24 HAPs.
Florida (Pinellas County)	✔	✔	Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, PM-PRI, SO_2, VOC, and 30 HAPs. SCCs were updated to reflect current EPA SCCs.
Georgia	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.
Idaho	✔		Replaced national estimates with state data for CO, NO_x, PM-PRI, SO_2, and VOC. SCCs were updated to reflect current EPA SCCs.
Kentucky (Jefferson County)	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.
Massachusetts	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.

Table 2-2. Summary of State Submitted Aircraft Data (Continued)

State	Criteria	HAPs	Comments
Maryland	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, SO_2, and VOC
Michigan	✔		Replaced national estimates with state data for CO, NO_x, SO_2, and VOC.
Mississippi	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.
North Carolina	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.
New Hampshire	✔	✔	Replaced national estimates with state data for CO, NO_x, SO_2, VOC, and 13 HAPs.
New Jersey	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.
Nevada (Clark County)	✔		Replaced national estimates with state data for CO, NO_x, PM-PRI, SO_2, and VOC. Pollutants were updated to reflect current EPA pollutant codes.
Oregon	✔	✔	Replaced national estimates with state data for NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, VOC, and 27 HAPs.
Rhode Island	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, SO_2, and VOC.
Tennessee	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.
Texas	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-FIL, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.
Utah	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC. Pollutants were updated to reflect current EPA pollutant codes.
Virginia	✔		Replaced national estimates with state data for CO, NO_x, SO_2, and VOC.
Wisconsin	✔	✔	Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, VOC, and 24 HAPs.

Table 2-2. Summary of State Submitted Aircraft Data (Continued)

State	Criteria	HAPs	Comments
West Virginia	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.

2.1.6 What are the Results?

Table 2-3 summarizes the emission estimates for all aircraft types for criteria pollutants. Table 2-4 summarizes the aircraft emission estimates for individual HAPs compounds. Both tables include data for all states including Puerto Rico. The estimates provided in Tables 2-3 and 2-4 include the state-submitted data. As noted earlier, where states had data for pollutants included in the 188 HAP list, but not in the national emission estimates, these data were retained such that the list of HAPs for the NEI for this category include additional pollutants than those calculated at the national level.

Table 2-3. Aircraft Criteria Emission Estimates 1978-2002 (TPY)

Pollutant	Year							
	1978	1987	1990	1996	1999	2000	2001	2002
VOC	61,487.38	25,507.44	30,508.02	31,104.31	44,289.46	26,536.32	21,153.19	50,323.22
NO_X	59,864.68	71,797.47	69,759.96	74,082.25	95,389.26	88,100.43	80,911.78	92,275.84
CO	206,491.29	221,164.37	239,055.43	248,124.16	357,908.05	270,094.89	257,368.05	532,236.63
SO_2	6,446.32	7,354.03	7,350.69	7,502.83	8,071.90	8,507.25	7,595.32	7,909.64
PM_{10}-PRI	2,325.73	3,024.05	3,206.68	3,219.87	6,419.75	3,517.45	3,470.38	24,558.77
$PM_{2.5}$-PRI	1,604.75	2,086.60	2,212.61	2,221.71	5,107.28	2,427.04	2,394.56	18,026.86
PM-PRI								74.21
NH_3								0.36

Table 2-4. Aircraft HAP Emission Estimates 1990-2002 (TPY)

Pollutant	1990	1996	1999	2002
1,3-butadiene	544.97	561.26	827.56	553.32
2,2,4-trimethylpentane	14.05	14.48	43.13	29.65
Acenaphthene	1.53	1.61	1.72	4.29
Acenaphthylene	8.65	9.11	9.66	23.99
Acetaldehyde	1,331.33	1,368.76	2,028.25	898.62
Acrolein	638.57	656.13	972.89	408.91
Anthracene	1.80	1.89	2.01	5.00
Benzene	711.37	736.81	1,107.84	958.57
Benzo(a)anthracene	0.21	0.22	0.24	0.59
Benzo(a)pyrene	0.21	0.22	0.24	0.59
Benzo(b)fluoranthene	0.25	0.27	0.28	0.71
Benzo(ghi)perylene	0.55	0.58	0.61	1.53
Benzo(k)fluoranthene	0.25	0.27	0.28	0.71
Cadmium			1.58	1.19
Chlorine			1.59	1.53
Chromium			16.71	12.62
Chrysene	0.21	0.22	0.24	0.59
Cobalt			0.01	0.01
Cumene			1.16	0.77
Dibenzo(a,h)anthracene				0.01
Ethyl Benzene	108.09	113.20	174.65	222.84
Fluoranthene	1.93	2.03	2.16	5.31
Fluorene	3.17	3.34	3.54	8.79
Formaldehyde	4,329.85	4,452.75	6,579.74	3,606.71
Hexane	28.76	30.58	52.34	88.35
Indeno(1,2,3-cd)pyrene	0.17	0.18	0.18	0.48

Table 2-4. Aircraft HAP Emission Estimates 1990-2002 (TPY) (Continued)

Pollutant	1990	1996	1999	2002
Lead and compounds			11.36	138.41
Manganese			0.01	0.01
Methyl Ethyl Ketone			1.02	0.68
Methyl Tert-Butyl Ether			3.78	2.51
Naphthalene	364.08	379.56	459.28	643.47
Nickel			1.59	1.20
o-Xylene			65.08	48.01
Phenanthrene	5.43	5.72	6.05	14.83
Phenol			43.99	51.42
POM				0.03
Propionaldehyde	269.56	277.06	410.16	270.27
Pyrene	2.63	2.77	2.92	7.23
Selenium			1.58	1.19
Styrene	124.72	128.64	192.37	124.43
Toluene	573.51	604.51	907.35	1,381.71
Xylene	375.59	394.49	472.48	785.42

2.1.7 Aircraft References:

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2.2 Commercial Marine Vessels

2.2.1 What are Commercial Marine Vessels?

The commercial marine vessel (CMV) source category includes all boats and ships used either directly or indirectly in the conduct of commerce or military activity. These vessels range from 20-foot charter boats to large tankers and military vessels which can exceed 1,000 feet in length (EPA, 1989). In spite of the broad range of vessels represented by this category, a number of common characteristics allow for the use of simple emission estimation methods.

The majority of vessels in this category are powered either by diesel engines or steam turbines. The predominant fuel used is oil, both distillate (diesel) and residual grades. In general, it can be assumed that CMVs powered by diesel engines predominantly use distillate fuel oil or higher grade residual oils, and those powered by steam turbines use residual fuel oil.

The CMV source category does not include recreational marine vessels, which are vessels less than 100 feet in length, most being less than 30 feet, and powered by either inboard or outboard engines (EPA, 1989). Emissions from recreational marine vessels are included in the other nonroad source category.

2.2.2 What Pollutants are Included in the National Emission Estimates for CMVs?

OTAQ identified the criteria pollutants and HAPs for which data were available to develop inventory estimates (Cook, 1997; Cook, 1998). Criteria pollutants include VOC, NO_x, CO, SO_x, PM_{10}, and $PM_{2.5}$. The HAPs, listed below, were identified based on available test data and accepted emission estimation procedures.

2,2,4 Trimethylpentane	Ethylbenzene	Propionaldehyde
Acetaldehyde	Formaldehyde	Selenium
Acrolein	Lead	Styrene
Benzene	Manganese	Toluene
Beryllium	n-Hexane	Xylene
Cadmium	Nickel	
Chromium	PAH	

2.2.3 How Were the CMV Emissions Estimated?

The CMV emission estimates provided here were developed using a “top-down” approach. This means that the estimates were developed at the national level and allocated to individual counties using appropriate surrogates. Figure 2-3 provides an overview of the approach used to estimate and spatially allocate CMV emissions.

For marine diesel engines, the emission estimates for all criteria pollutants, except SO_x, were obtained from background documents that support recent marine diesel emission regulations. Criteria pollutant emissions for steam powered vessels and SO_x for marine diesel engines were calculated based on fuel usage data and available EPA emission factors (EPA, 1989). The fuel usage data were provided by the EPA, and were derived from documents that support recent marine diesel rules (*40 CFR Part 943 - Federal Register Volume 67 No. 103, May 29, 2002*).

HAP speciation profiles were applied to the VOC and PM emission estimates. Unfortunately, there are very few data available to characterize HAP emissions from CMVs, therefore “alternative” speciation profiles were used in this inventory effort. For diesel-powered vessels, the speciation profiles were for heavy-duty diesel vehicles (HDDV) and were obtained from information in *Evaluation of Factors That Affect Diesel Exhaust Toxicity* (Truex and Norbeck, 1998). For steam-driven vessels, speciation profiles for stationary industrial and commercial boilers were considered to be appropriate surrogates. The boiler speciation data

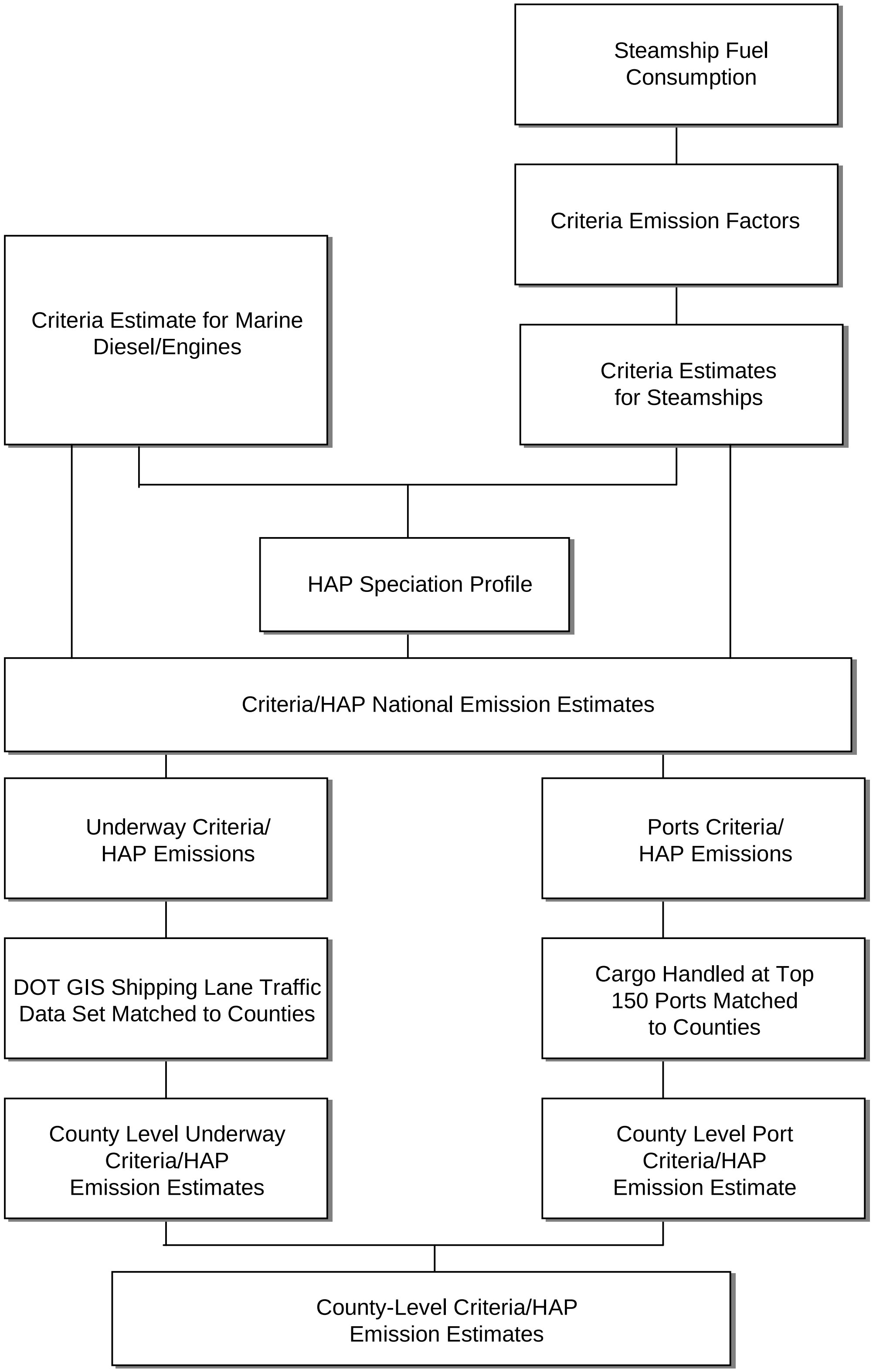

Figure 2-3. Procedures for Estimating Emissions for CMV

were obtained from the EPA's Industrial Combustion Coordinated Rulemaking (ICCR) program (Porter, 1998; EPA, 1996).

For PAH emissions for diesel marine engines, speciation profiles were developed by OTAQ (Cook, 2001) to individually estimate emissions for the 16-PAH compounds. For distillate oil-fueled CMVs, PAH/$PM_{2.5}$ speciation profiles were obtained from Colorado's Northern Front Range Air Quality Study (NFRAQS) report, and are based on test data for heavy duty diesel vehicles. For steamships, speciated PAH data are not currently available, therefore aggregate 7-PAH and 16-PAH emission factors were used.

National criteria pollutant and HAP emissions were disaggregated into port and underway emission estimates, based on assumptions used in the EPA's SIP guidance that 75% of distillate fuel and 25% of residual fuel is consumed within the port, the remaining fuel is consumed while underway (EPA, 1989).

More detailed documentation on how the emission estimates were prepared is provided in Appendix B of this report. The documentation identifies the key input data and procedures that were used in the calculation of emissions for CMVs. The documentation is <u>not</u> meant to provide an exhaustive analysis on the derivation of all the inputs. For example, an emission factor used to calculate emissions may be given in the appendix, but the source tests that were evaluated to obtain this factor may not be presented or discussed. The goal of the documentation provided is to show in a brief and concise manner how an emission estimate was derived. Volume 2 of this report contains copies of several important and hard-to-locate references that may help the reader better appreciate the data sources used in developing the CMV estimates.

2.2.4 How Were National Emissions Allocated to Individual Counties?

National port emissions were assigned to the 150 largest U.S. ports based on activity data obtained from the *Waterborne Commerce of the United States, Part 5-Waterways and Harbors*

National Summaries (U.S. Army Corps of Engineers, 2001) the data may also be obtained from the following website http://www.iwr.usace.army.mil/ndc/wcsc/pdf/wcusnatl99.pdf. This reference included data for Puerto Rico and the Virgin Islands. The percentage of total traffic for each port was calculated by dividing the port-level traffic by the total traffic. This approach will slightly over estimate port emissions for the 150 ports included in this inventory as emissions are not allocated to smaller ports not included in this list.

Underway emissions were allocated to counties by applying county-specific waterway activity factors expressed as thousand ton miles (BTS, 2000) to the national estimate. Using GIS software, county borders were overlaid with the U.S. waterway network to determine the waterway length in each county. Each county was then assigned a weighting factor by summing the product of the waterway length (miles) in the county and the waterway-cargo traffic (tons) for each segment of the waterway, and then dividing this sum by the national total. It is recognized that there are some inconsistencies with the BTS's GIS data for other inventory years, therefore the 1999 weight factors were used for all inventory years.

To allocate emissions to ports with underway emissions, two methods were employed. Where shorelines intersected with counties, emissions were assigned based upon shoreline length. Where this was not possible, a weighted average of tonnage miles was divided equally among the counties that had a shipping lane. For example, underway emissions along the Mississippi River were split between counties located on the eastern and western shorelines based on the length of the shipping lane attributed to a given county. Underway emissions were then added to in-port emissions to get a total county-level CMV emission estimates.

2.2.5 State Provided Data

Where states provided their own CMV emission estimates for this source category, their data were given priority over all other data. Table 2-5 summarizes the states that submitted 1996, 1999, and 2002 data for inclusion into the NEI. EPA did not adjust or revise any data

Table 2-5. Summary of State Submitted CMV Data

State	Criteria	HAPs	Comments
1996			
Alaska		✔	Replaced national estimates with state submitted data..
Puerto Rico and Virgin Islands		✔	Replaced national estimates with state submitted data.
1999			
Alabama	✔		Replaced national estimates with State submitted data for VOC, NO_x, and CO.
California	✔	✔	Replaced national estimates with state submitted data for VOC, NO_x, CO, SO_x, PM_{10}, $PM_{2.5}$ and HAPs. HAP data for pollutants other than the 188 were not incorporated.
Maryland		✔	Replaced national estimates with state submitted data.
Minnesota		✔	Replaced national estimates with state submitted data for 36 HAPs.
Pennsylvania	✔		Replaced Ozone Season Daily (OSD) estimates with state submitted estimates for VOC, NO_x, CO. Only OSD emission estimates submitted by State.
Texas	✔		Replaced national estimates with state submitted data..
Wisconsin	✔		Replaced national estimates with state submitted data for VOC, NO_x and CO.
2002			
Alabama	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.
Arkansas	✔		Replaced national estimates with state data for CO, NH_3, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.
California	✔	✔	Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, VOC, and 32 HAPs. SCCs were updated to reflect current EPA SCCs.
Connecticut	✔		Replaced national estimates with state data for CO, NO_x, and VOC. SCCs were updated to reflect current EPA SCCs.

Table 2-5. Summary of State Submitted CMV Data (Continued)

State	Criteria	HAPs	Comments
Delaware	✔	✔	Replaced national estimates with state data for CO, NH_3, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, VOC, and 31 HAPs.
Florida (Pinellas County)	✔	✔	Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, VOC, and 36 HAPs.
Georgia	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.
Indiana	✔		Replaced national estimates with state data for CO, NH_3, NO_x, PM_{10}-PRI, PM_{25}-PRI, PM-PRI, SO_2, and VOC. SCCs were updated to reflect current EPA SCCs.
Kentucky (Jefferson County)	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.
Massachusetts	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC. SCCs were updated to reflect current EPA SCCs.
Maryland	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, SO_2, and VOC. SCCs were updated to reflect current EPA SCCs.
Maine	✔	✔	Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, VOC, and 35 HAPs.
Michigan	✔		Replaced national estimates with state data for CO, NH_3, NO_x, PM_{10}-PRI, PM_{25}-PRI, PM-PRI, SO_2, and VOC. SCCs were updated to reflect current EPA SCCs. Pollutants were updated to reflect current EPA pollutant codes.
Mississippi	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.
North Carolina	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.

Table 2-5. Summary of State Submitted CMV Data (Continued)

State	Criteria	HAPs	Comments
New Jersey	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC. SCCs were updated to reflect current EPA SCCs.
New York	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC. Pollutants were updated to reflect current EPA pollutant codes.
Ohio	✔		Replaced national estimates with state data for CO, NH_3, NO_x, PM_{10}-PRI, PM_{25}-PRI, PM-PRI, SO_2, and VOC. SCCs were updated to reflect current EPA SCCs. Pollutants were updated to reflect current EPA pollutant codes.
Oregon	✔	✔	Replaced national estimates with state data for NO_x, PM_{10}-PRI, PM_{25}-PRI, VOC, and 11 HAPs. SCCs were updated to reflect current EPA SCCs. Pollutants were updated to reflect current EPA pollutant codes.
Rhode Island	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, SO_2, and VOC. SCCs were updated to reflect current EPA SCCs.
Tennessee	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.
Texas	✔	✔	Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, VOC, and 22 HAPs. SCCs were updated to reflect current EPA SCCs.
Virginia	✔		Replaced national estimates with state data for CO, NO_x, and VOC. SCCs were updated to reflect current EPA SCCs.
Washington	✔		Replaced national estimates with state data for CO, NH_3, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.
Wisconsin	✔	✔	Replaced national estimates with state data for CO, NH_3, NO_x, PM_{10}-PRI, PM_{25}-PRI, PM-PRI, SO_2, VOC, and 14 HAPs.

Table 2-5. Summary of State Submitted CMV Data (Continued)

State	Criteria	HAPs	Comments
West Virginia	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.

submitted by state or local agencies - the data were used as submitted. For example if a state submitted only ozone season daily estimates these values were not multiplied by 365 to estimate annual emissions. In some cases state or local agency's submitted estimates where PAH or metal HAPs were not disaggregated into individual species, as was done in the nationally-derived estimates. In such cases, both the state or local estimates and the national estimates were retained (e.g., *nickel* and *nickel and nickel* compounds; the *nickel* estimates are nationally-derived estimates while the *nickel and nickel compounds* are state derived estimates). It is recognized that a small amount of double counting may occur by taking this approach. Note, state emission estimates may differ significantly with EPA emission estimates. Appendix E contains individual summary sheets for each state that submitted CMV data.

2.2.6 What are the Results?

Table 2-6 summarizes the emission estimates for CMVs for criteria pollutants. Table 2-7 summarizes the emission estimates for individual HAPs. Both tables provide data for all states, including Puerto Rico and the Virgin Islands. CMV emission estimates for Puerto Rico and the Virgin Islands were developed using the same approach used to estimate emissions of the states. Note, the estimates provided in these tables include the state-submitted data.

Note, criteria estimates for 2002 were carried over from the preliminary estimates for 2001. Similarly, HAP emission estimates for 2002 were carried over from 1999, excluding state submitted data.

Table 2-6. Commercial Marine Vessel Criteria Emission Estimates 1978-2002 (TPY)

Pollutant	Year							
	1978	1987	1990	1996	1999	2000	2001	2002
VOC	28,579.58	33,760.66	31,354.27	33,062.10	29,999.38	31,513.07	31,617.63	35,970.84
NO_X	914,284.54	1,080,037.82	1,003,048.79	1,057,651.39	855,992.23	1,008,175.24	1,011,475.90	1,065,685.97
CO	120,415.50	142,243.77	132,106.16	139,308.82	116,114.01	132,768.04	133,215.40	140,923.39
SO_2	148,496.62	180,319.59	167,212.91	159,076.50	175,503.97	162,910.19	160,361.62	227,274.69
PM_{10}-PRI	39,342.85	46,490.27	43,162.49	45,436.17	44,391.13	43,472.84	43,529.54	49,912.76
$PM_{2.5}$-PRI	36,195.43	42,771.05	39,709.49	41,801.28	40,882.33	39,995.01	40,047.18	46,113.25
PM-PRI								2,288.96
NH_3								142.81

Table 2-7. Commercial Marine Vessel HAP Emission Estimates 1990-2002 (TPY)

Pollutant	1990	1996	1999	2002
1,3-butadiene			5.69	7.93
2,2,4-Trimethylpentane	12.52	13.20	21.06	26.21
Acenaphthene	1.06	1.11	1.06	1.05
Acenaphthylene	4.98	5.08	4.98	4.91
Acetaldehyde	2,325.49	2,452.48	2,378.35	2,545.45
Acrolein	109.54	115.52	98.85	114.91
Anthracene	2.05	2.13	2.05	2.02
Antimony			0.36	0.51
Benzene	636.71	671.48	648.31	705.61
Benzo(a)anthracene	1.37	1.45	1.37	1.35
Benzo(a)pyrene	0.42	0.45	0.42	0.42
Benzo(b)fluoranthene	0.40	0.42	0.40	0.39
Benzo(ghi)perylene	0.31	0.32	0.31	0.30
Benzo(k)fluoranthene	0.38	0.41	0.38	0.38
Beryllium	0.01	0.01	0.01	0.01
Cadmium & Compounds	0.12	0.12	0.31	0.39
Chlorine			0.71	1.04
Chlorobenzene			0.07	0.07
Chromium & Compounds			0.05	0.07
Chromium III	0.25	0.25	0.25	0.25
Chromium VI	0.13	0.13	0.13	0.13
Chrysene	0.33	0.34	0.33	0.32
Cobalt			0.16	0.02
Cumene			0.60	0.77
Ethyl Benzene	62.59	66.01	63.08	69.48
Fluoranthene	1.36	1.41	1.36	1.34
Fluorene	2.87	2.98	2.87	2.83

Table 2-7. Commercial Marine Vessel HAP Emission Estimates 1990-2002 (TPY) (Continued)

Pollutant	1990	1996	1999	2002
Formaldehyde	4,683.40	4,939.06	4,744.43	5,130.12
Indeno(1,2,3-cd)pyrene	0.05	0.06	0.05	0.05
Lead & Compounds	1.83	1.89	1.88	2.00
Manganese & Compounds	1.00	0.99	1.12	1.24
Methanol			0.90	2.28
Methyl Ethyl Ketone			44.32	50.59
Methyl Tert-Butyl Ether				3.33
m-Xylene			18.98	29.52
Naphthalene	65.74	68.76	65.61	68.21
n-Hexane	172.13	181.53	154.94	165.24
Nickel & Compounds	26.92	26.31	28.46	31.22
o-Xylene			10.66	14.87
Phenanthrene	7.11	7.25	7.11	7.00
Phosphorus			0.32	0.45
POM as 16-PAH	0.05	0.05	0.05	0.10
POM as 7-PAH	4.8E-04	4.7E-04	4.8E-04	8.82E-04
Propionaldehyde	190.91	201.34	194.58	205.10
p-Xylene			2.99	3.41
Pyrene	2.20	2.28	2.20	2.17
Selenium & Compounds	0.22	0.21	0.24	0.26
Styrene	65.72	69.31	58.78	61.31
Toluene	100.15	105.62	133.31	155.49
Xylene	150.22	158.43	135.57	134.68

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2.3 Locomotives

2.3.1 What are Locomotive Sources?

The locomotive source category includes railroad locomotives powered by diesel-electric engines. A diesel-electric locomotive uses 2-stroke or 4-stroke diesel engines and an alternator or a generator to produce the electricity required to power its traction motors. The locomotive source category does not include locomotives powered by electricity or steam. Emissions associated with the operation of electric locomotives would be included in the point source utility emission estimate. It is believed that the number of wood or coal driven steam locomotives is currently very small; therefore, these types of locomotives are not included in this inventory.

The locomotive source category is further divided up into five categories: line haul class I, class I yard, line haul class II/III, passenger, and commuter. The national rail estimates were divided up between the subcategories based on ratios calculated from fuel data obtained from the American Association of Railroads for each subcategory. California locomotive emission estimates were handled separately from the rest of the United States because of their use of low sulfur locomotive diesel fuels.

2.3.2 What Pollutants are Included in the National Emission Estimates for Locomotives?

All of the criteria pollutants, VOC, CO, NO_x, SO_x, PM, and $PM_{2.5}$, are included in the locomotive component of the NEI. OTAQ identified the HAPs for which data were available to develop inventory estimates (Scarbro, 2001). The HAPs, listed below, were identified based on available test data and accepted emission estimation procedures.

1,3-Butadiene	Chromium (Hexavalent)	n-Hexane
2,2,4-Trimethylpentane	Chromium (Trivalent)	Nickel
Acetaldehyde	Ethyl Benzene	PAH Propionaldehyde
Acrolein	Formaldehyde	Styrene
Benzene	Lead	Toluene
Beryllium	Manganese	Xylenes
Cadmium	Napthalene	

2.3.3 How Were Locomotive Emissions Estimated?

Figure 2-4 provides an overview of the approaches used to estimate criteria and HAP emissions from locomotives. This section of the report describes the emission estimating methods used in general terms while Appendix C provides more details on how emissions were developed and includes critical data used in calculating these estimates.

Criteria pollutant emissions were estimated by applying emission factors to the total amount of distillate fuel oil used by locomotives. Emission factors for the criteria pollutants were obtained from *Emission Factors for Locomotives* (U.S. EPA, 1997). The locomotive fuel oil usage data were obtained from DOE, EIA for all inventory years except 2001. Data for 2001 was not available at the time the inventory was being developed, therefore, fuel data for the previous six years (i.e., 1995-2000) were averaged to approximate fuel usage for 2001. Fuel data for 2002 were provided by OTAQ and was derived from DOE data. SO_x emissions were estimated by multiplying the percent sulfur in fuel by the amount of fuel used in railroad operations (Scarbro, 2001). It should be noted that since California uses low sulfur diesel fuel and emission factors specific for California railroad fuels were available, calculations of the state's emissions were done separately from the other states.

HAP emissions were estimated in two ways. First, HAP emission factors were combined with the amount of distillate fuel oil used by locomotives. The HAP emission factors were obtained from *Diesel Fuel Effects on Locomotive Exhaust Emissions* (Fritz, 2000) and from

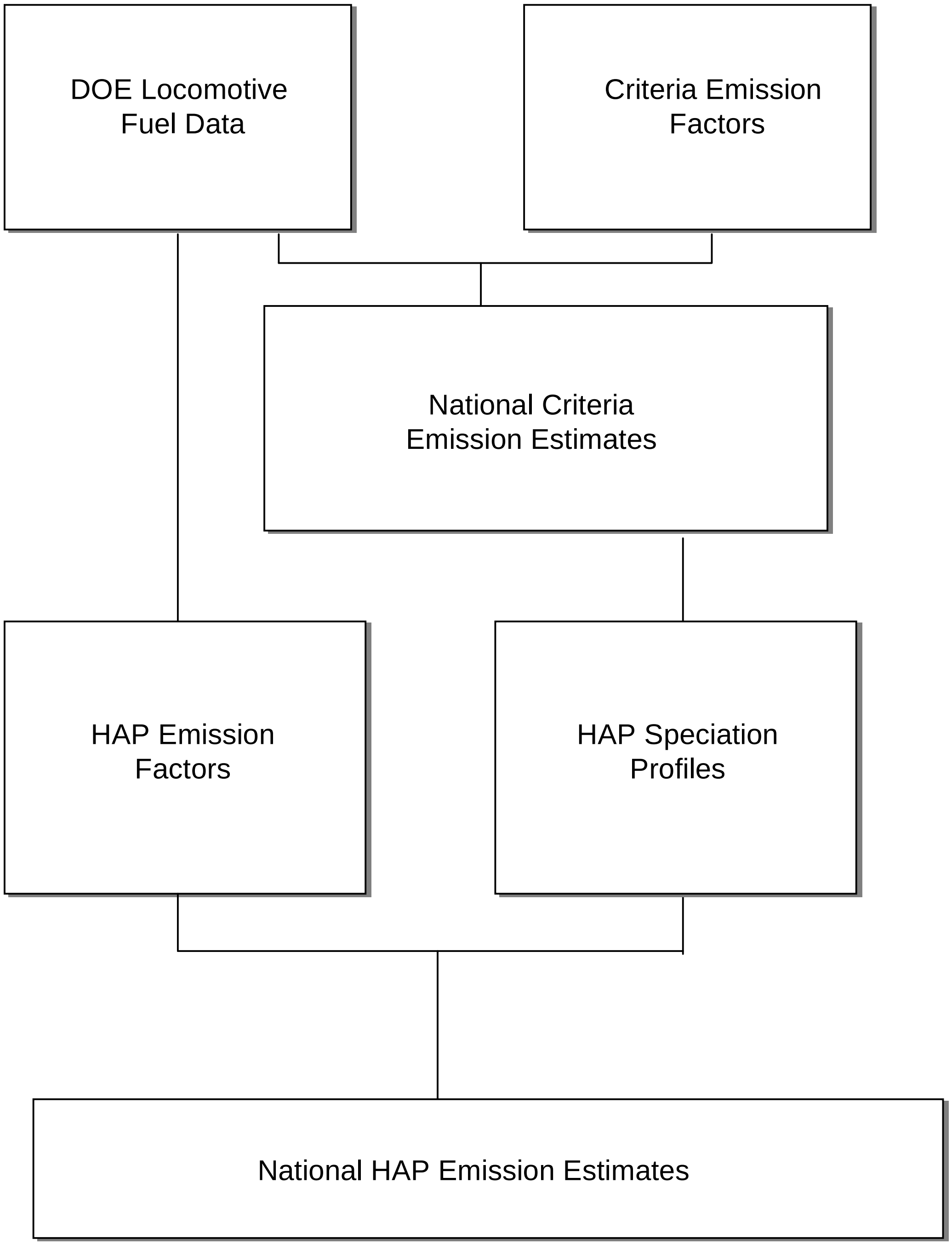

Figure 2-4. Overview of Approach Used to Estimate National Criteria Pollutant and HAP Emissions

Baseline Emission Inventory of HAP Emissions from MACT Sources - Interim final Report, 1998 (Porter, 1998).

Where emission factors are not available, HAP emissions were estimated by applying speciation profiles to the VOC or PM estimates. The speciation profiles were derived from *Evaluation of Factors that Affect Diesel Exhaust Toxicity* Steve,(Truex and Norbeck, 1998), and data provided by OTAQ (Scarbro, 2001 and 2002).

More detailed documentation on the emission factors and speciation profiles used are provided in Appendix C. The documentation is <u>not</u> meant to provide an exhaustive analysis on the derivation of all the inputs. For example, an emission factor used may be given in the appendix, but the source tests that were evaluated to obtain this factor may not be presented or discussed. The goal of the documentation provided is to show in a brief and concise manner how an emission estimate was derived. Included in Volume 2 of this report are copies of hard-to-locate references that may help the reader better appreciate the data sources used in developing their local emission estimates.

2.3.4 How Were National Emissions Allocated to Individual Counties?

The locomotive criteria pollutant and HAP emissions were allocated to the county level by using 1999 county-specific railroad traffic data (ton miles) obtained from the Department of Transportation (BTS, 2000). Using GIS software, county borders were overlaid with the US railroad network in order to determine the rail activity in each county for the specific SCCs. Each county was then assigned a weighted emissions factor by summing the product of the rail activity and the track-specific loading factor for each track, and then dividing this sum by the national total. GIS activity data for each county were available for each of the railroad category used in this inventory except yard locomotives. It is recognized that there was some inconsistencies with the BTS GIS data for other inventory years, therefore, the 1999 weight factors were used in all inventory years. Inventories of yard locomotive activities have not been developed recently, therefore emissions for this category were spatially allocated to urban counties which had Class I railroad activity based on the level of railroad activity occurring in the county.

2.3.5 State Provided Data

In this version of NEI, state and local agencies provided locomotive data that replaced the estimates based on national fuel consumption. Table 2-8 lists the states that made submittals and includes comments about how their data were handled. EPA did not adjust or revise any data submitted by state or local agencies - the data were used as submitted. For example if a state submitted only ozone season daily estimates these values were not multiplied by 365 to estimate annual emissions. Note, state emission estimates may differ significantly with EPA emission estimates. Appendix E contains individual summary sheets for each state that submitted locomotive data. Estimates were not provided by Puerto Rico and the Virgin Islands. Locomotive estimates were not developed for these territories, as fuel and track activity data are not readily available.

2.3.6 What are the Results?

Tables 2-9 and 2-10 summarize the locomotive mobile source emission estimates. Note, the estimates provided in these tables include state-submitted data. Note, Puerto Rico has a very small amount of rail lines in operation, primarily for hauling sugar cane. Unfortunately, sufficient data are not available to quantify emissions. The Virgin Islands have no rail lines.

Table 2-8. State Submitted Locomotive Data

State	Criteria	HAPs	Comments
1996			
Alabama		✔	Removed railroad emissions for specified counties that do not have active rail lines.
Alaska		✔	
California-Lake County		✔	
Utah		✔	
1999			
Alabama	✔		Replaced national estimates with state data for CO, NO_x, and VOC.
California	✔	✔	Replaced national estimates with state data for CO, NO_x, $PM_{2.5}$, PM_{10}, SO_x, VOC, and available HAPs.
Louisiana	✔		Replaced national estimates with state data for NO_x and VOC.
Maryland		✔	Replaced national estimates with state data for provided HAPs (no POM data was included).
Minnesota		✔	Replaced national estimates with state submitted data for 38 HAPs.
Nebraska	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}, SO_x, and VOC.
Pennsylvania	✔		Replaced national daily estimates with state data for CO, NO_x, and VOC.
Tennessee	✔		Replaced national estimates with state data for CO, NO_x, and VOC.
Texas		✔	Replaced national estimates with state data for provided HAPs (no POM data were included) and CO, NO_x, VOC - nonattainment counties.
Utah	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}, SO_x, and VOC.

Table 2-8. State Submitted Locomotive Data (Continued)

State	Criteria	HAPs	Comments
Wisconsin	✔		Replaced national estimates with state data for CO, NO_x, and VOC.
2002			
Alabama	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC. SCCs were updated to reflect current EPA SCCs.
Arkansas	✔		Replaced national estimates with state data for CO, NH_3, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC. SCCs were updated to reflect current EPA SCCs.
Arizona (Maricopa County)	✔		Replaced national estimates with state data for CO, NH_3, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC. SCCs were updated to reflect current EPA SCCs.
California	✔	✔	Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, VOC, and 30 HAPs. SCCs were updated to reflect current EPA SCCs.
Colorado	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.
Connecticut	✔		Replaced national estimates with state data for CO, NO_x, and VOC. SCCs were updated to reflect current EPA SCCs.
District of Columbia	✔		Replaced national estimates with state data for CO, NO_x, PM-PRI, SO_2, and VOC. Pollutants were updated to reflect current EPA pollutant codes.
Delaware	✔	✔	Replaced national estimates with state data for CO, NH_3, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, VOC, and 40 HAPs
Florida (Pinellas County)	✔	✔	Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, PM-PRI, SO_2, VOC, and 34 HAPs. SCCs were updated to reflect current EPA SCCs.

Table 2-8. State Submitted Locomotive Data (Continued)

State	Criteria	HAPs	Comments
Georgia	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.
Idaho	✔		Replaced national estimates with state data for CO, NO_x, PM-PRI, SO_2, and VOC. SCCs were updated to reflect current EPA SCCs.
Indiana	✔		Replaced national estimates with state data for CO, NH_3, NO_x, PM_{10}-PRI, PM_{25}-PRI, PM-PRI, SO_2, and VOC. Pollutants were updated to reflect current EPA pollutant codes.
Illinois	✔		Replaced national estimates with state data for CO, NH_3, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC. SCCs were updated to reflect current EPA SCCs.
Kentucky (Jefferson County)	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.
Massachusetts	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC. SCCs were updated to reflect current EPA SCCs.
Maryland	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC. SCCs were updated to reflect current EPA SCCs.
Mississippi	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.
Fort Peck Tribe	✔	✔	Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, VOC, and 1 HAP. SCCs were updated to reflect current EPA SCCs.
North Carolina	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.
New Hampshire	✔	✔	Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, VOC, and 20 HAPs. SCCs were updated to reflect current EPA SCCs.

Table 2-8. State Submitted Locomotive Data (Continued)

State	Criteria	HAPs	Comments
New Jersey	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC. SCCs were updated to reflect current EPA SCCs.
Nevada (Clark County)	✔		Replaced national estimates with state data for CO, NO_x, PM-PRI, and VOC. SCCs were updated to reflect current EPA SCCs. Pollutants were updated to reflect current EPA pollutant codes.
Ohio	✔		Replaced national estimates with state data for CO, NH_3, NO_x, PM_{10}-PRI, PM_{25}-PRI, PM-PRI, SO_2, and VOC. Pollutants were updated to reflect current EPA pollutant codes.
Oregon	✔	✔	Replaced national estimates with state data for NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, VOC, and 33 HAPs. SCCs were updated to reflect current EPA SCCs. Pollutants were updated to reflect current EPA pollutant codes.
Rhode Island	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, SO_2, and VOC. SCCs were updated to reflect current EPA SCCs.
Tennessee	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.
Texas	✔	✔	Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, VOC, and 2 HAPs. SCCs were updated to reflect current EPA SCCs.
Utah	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC. Pollutants were updated to reflect current EPA pollutant codes.
Virginia	✔		Replaced national estimates with state data for CO, NO_x, and VOC. SCCs were updated to reflect current EPA SCCs.
Washington	✔	✔	Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, VOC, and 36 HAPs.

Table 2-8. State Submitted Locomotive Data (Continued)

State	Criteria	HAPs	Comments
Wisconsin	✔	✔	Replaced national estimates with state data for CO, NH_3, NO_x, PM_{10}-PRI, PM_{25}-PRI, PM-PRI, SO_2, VOC, and 27 HAPs.
West Virginia	✔		Replaced national estimates with state data for CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC.

Table 2-9. Locomotive Criteria Estimates 1978-2002 (TPY)

	Year							
Pollutant	**1978**	**1987**	**1990**	**1996**	**1999**	**2000**	**2001**	**2002**
VOC	49,736.10	33,791.29	36,874.81	40,881.63	39,366.93	39,008.82	36,036.24	42,331.72
NO_X	1,275,333.57	866,716.25	944,653.08	1,048,317.96	940,581.56	1,000,596.82	924,348.50	1,024,235.99
CO	126,367.26	85,876.16	93,612.66	103,872.89	99,651.37	99,140.65	91,585.85	109,183.27
SO_2	78,579.71	53,409.84	55,714.00	59,649.31	58,486.88	55,919.34	51,548.31	60,700.75
PM_{10}-PRI	31,711.60	21,550.93	23,490.11	26,066.75	23,468.84	24,879.81	22,983.90	26,170.89
$PM_{2.5}$-PRI	28,540.44	19,395.83	21,141.10	23,460.07	21,284.01	22,391.83	20,685.51	23,583.67
PM-PRI								2,965.48
NH_3								103.04

Table 2-10. Locomotive HAP Emission Estimates 1990-2002 (TPY)

Pollutant	1990	1996	1999	2002
1,3-butadiene	109.94	122.06	111.43	105.23
2,2,4-Trimethylpentane	82.69	91.68	87.23	82.05
Acenaphthene	0.68	0.76	0.70	0.66
Acenaphthylene	9.68	10.74	10.04	9.47
Acetaldehyde	646.87	718.22	815.15	795.67
Acrolein	108.79	120.80	128.25	110.02
Anthracene	2.29	2.54	2.37	2.23
Antimony			0.16	0.17
Benzene	87.88	97.57	139.10	138.74
Benzo(a)anthracene	0.37	0.41	0.39	0.35
Benzo(a)pyrene	0.07	0.08	0.07	0.06
Benzo(b)fluoranthene	0.15	0.16	0.15	0.14
Benzo(ghi)perylene	0.08	0.08	0.08	0.07
Benzo(k)fluoranthene	0.12	0.13	0.13	0.12
Beryllium & Compounds	0.65	0.72	0.68	0.63
Cadmium & Compounds	0.65	0.72	0.76	0.72
Chlorine			0.32	0.34
Chromium & Compounds			0.02	0.03
Chromium III	0.05	0.06	0.10	0.05
Chromium VI	0.10	0.11	0.05	0.09
Chrysene	0.27	0.30	0.29	0.26
Cobalt			0.01	0.01
Cumene			0.55	0.59
Ethyl Benzene	73.75	81.76	86.00	77.14
Fluoranthene	1.73	1.92	1.80	1.68
Fluorene	3.17	3.52	3.28	3.08
Formaldehyde	1,480.35	1,643.56	1,817.85	1,779.14

Table 2-10. Locomotive HAP Emission Estimates 1990-2002 (TPY) (Continued)

Pollutant	1990	1996	1999	2002
Indeno(1,2,3-cd)pyrene	0.06	0.07	0.07	0.06
Lead & Compounds	1.96	2.17	2.08	1.98
Manganese & Compounds	0.05	0.05	0.09	0.10
Methanol			0.82	0.89
Methyl Ethyl Ketone			40.31	43.95
m-Xylene			16.61	18.12
Naphthalene	59.26	65.75	60.29	58.30
n-Hexane	202.81	224.85	217.63	191.32
Nickel & Compounds	0.15	0.17	0.20	0.17
o-Xylene			9.26	10.10
Phenanthrene	12.83	14.24	13.30	12.56
Phosphorus			0.14	0.15
POM				0.03
Propionaldehyde	224.94	249.38	224.72	235.72
p-Xylene			2.72	2.97
Pyrene	2.43	2.69	2.52	2.36
Selenium			0.01	0.01
Styrene	77.44	85.85	83.06	73.01
Toluene	118	130.82	164.12	152.33
Xylene	177	196.23	201.20	172.19

2.3.7 Locomotive References:

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2.4 Other Nonroad Mobile Sources

2.4.1 What are Other Nonroad Mobile Sources?

The other nonroad mobile source category includes vehicles and equipment that normally are not operated on public roads nor provide transportation and are not considered aircraft, CMVs, or locomotives. Note, the individual source categories included in this group parallel the source categories included in the NONROAD model. This includes categories such as lawn and garden equipment, agricultural equipment, logging equipment, construction equipment, airport service vehicles, locomotive maintenance vehicles, and recreational equipment (including recreational vehicles and marine equipment).

The other nonroad vehicles and equipment include both diesel-powered and gasoline-powered engines. Gasoline-powered engines can further be characterized into two engine categories, specifically 2- and 4-stroke engines.

2.4.2 What Pollutants are Included?

OTAQ identified the HAPs for which data were available to develop inventory estimates (Scarbro, 2001; Cook, 1998a; Cook, 1997). These HAPs, listed below, were identified based on available test data and accepted emission estimating procedures.

1,3-Butadiene	Dioxins/Furans	Nickel
2,2,4-Trimethylpentane	Ethylbenzene	PAH
Acetaldehyde	Formaldehyde	Propionaldehyde
Acrolein	Lead	Styrene
Benzene	Manganese	Toluene
Chromium (Hexivalent)	Methyl Tert-Butyl Ether	Xylenes
Chromium (Trivalent)	n-Hexane	

2.4.3 How Were the Other Nonroad Vehicle and Equipment Emissions Estimated?

The other nonroad emission estimates provided in this inventory were derived using a mixture of "top down" and "buttom up" approaches. Figure 2-5 provides an overview of the approaches used to estimate emissions from this source category. Submitted state data replaced the nationally-developed estimates.

The emission estimates for metal HAPs, excluding lead, were developed by applying emission factors to vehicle activity or fuel consumption data. For these metal HAP estimates, it was necessary to combine the 2- and 4-stroke engine-type categories into one category, called gasoline engines. Thus, metal HAP emissions for all gasoline engines, regardless of type, were based on the same metal emission factor. A national estimate of other nonroad lead emissions was obtained by multiplying the average lead content of mobile fuel with the amount of fuel used nationally and the fraction of the fuel used by other nonroad sources. Note, the lead content of fuel is very small and represents trace compounds in the extracted crude oil.

The emission estimates for organic HAPs were developed by applying HAP/VOC speciation profiles to county-level VOC estimates. A number of different fuels are used in onroad vehicles. It was assumed that these same fuels were used in other nonroad applications, these fuels included:

- ♦ Baseline gasoline, conventional lead-free fuel;
- ♦ Winter oxygenated gasoline with methyl tertiary butyl ether (MTBE) or tertiary amyl methyl ether (TAME);

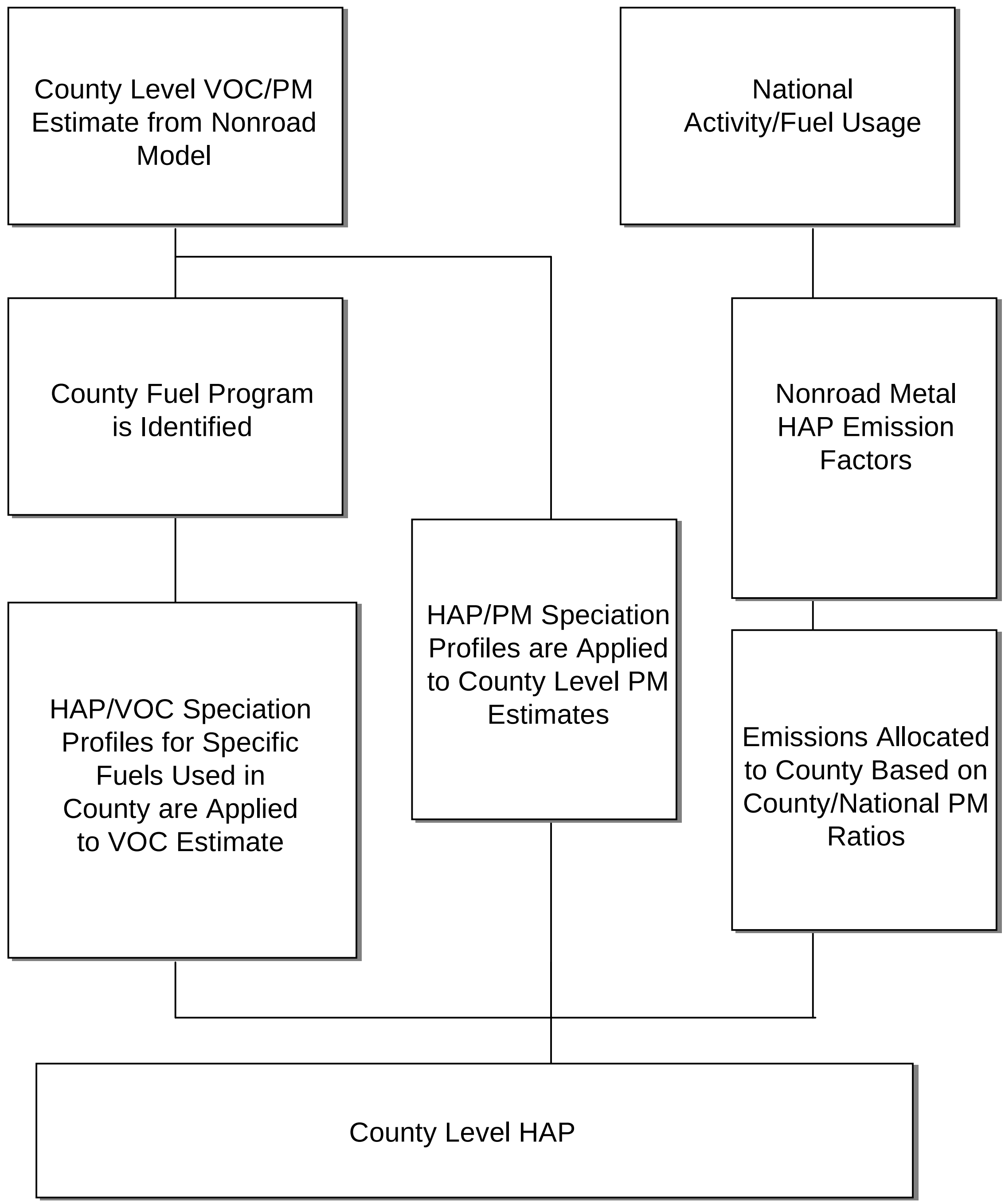

Figure 2-5. Overview of Methods Used to Estimate County Level HAP Emission from Nonroad Mobile Sources

- Winter oxygenated gasoline with ethanol;
- Reformulated fuels with MTBE or TAME;
- Reformulated fuels with ethanol; and
- Diesel.

Note, there are some nonroad fuels that are developed specifically for special nonroad applications such as agricultural operations and recreational marine.

In this inventory, attempts were made to account for the use of these different fuels. Information was obtained from OTAQ that indicated the percentage of the year each gasoline fuel type was used in each county. These data were based on individual county participation in the Federal Reformulated Gasoline Program and State Oxygenated Fuel Programs. A listing of these counties, as well as the percentage of the year each gasoline fuel type was used, can be found in Volume 2.

The fuel usage data were considered in assigning appropriate speciation profiles to each county. These profiles matched engine type, fuel type, and emission type, and were applied to the other nonroad criteria estimates for each county to calculate the county-specific HAP emissions. As mentioned earlier, there are three possible engine types (diesel, 2-stroke gasoline, 4-stroke gasoline) and six possible fuel types. Additionally, the emissions can be either exhaustive or evaporative for gasoline engines. It was assumed that diesel fuels have negligible evaporative emissions.

In some cases it was possible to obtain engine-specific HAP/VOC speciation profiles for certain pollutants. The speciation profiles used can be found in Appendix D. When specific HAP/VOC speciation profiles could not be obtained, average speciation profiles for each nonroad engine type (i.e., 2-stoke, 4-stroke, and diesel) were developed and used. These profiles were based on recent test studies published in peer-reviewed journals, as well as profiles compiled in the EPA's SPECIATE database (EPA, 1995).

It should be noted that different HAP/VOC speciation profiles for acetaldehyde, acrolein, formaldephyde, propionaldehyde, and 2, 2, 4-trimethylpentane were used to estimate other nonroad diesel emissions in California to account for the reformulated diesel fuel used in that state (Scarbro 2002).

County-level VOC estimates were derived from 1999 NONROAD model runs (Thesing, 2002) using the "lockdown C (May 2002)" version. The other nonroad county-level VOC estimates were provided as exhaust and evaporative exhaust emissions. These county level VOC estimates were applied to the fuel specific speciation profiles matched to each county to estimate the organic HAP emissions.

Diesel PAH speciation profiles were derived differently from the gasoline PAH profiles. In the case of diesel PAH profiles, additional data on highway diesel fuel usage in nonroad diesel fuel operations were available. Therefore, the nonroad diesel PAH speciation profiles were derived by applying the ratio of the percent of highway fuel usage and onroad diesel PAH data profiles to nonroad fuel consumption and nonroad diesel PAH data.

The documentation included in Appendix D provides details on how emissions were estimated and identifies the key input data that were used in the calculation of speciation profiles. The documentation is not meant to provide an exhaustive analysis on the derivation of all the inputs. For example, a speciation profile used for a national estimate may be given in the appendix, but the source tests that were evaluated to obtain this factor may not be presented or discussed. The goal of the documentation provided is to show in a brief and concise manner how a given estimate was derived. Included in Volume 2 of this report are copies of hard-to-locate references that may help the reader better appreciate the data sources used in developing their local emission estimates.

2.4.4 How Were National Emissions Allocated to Individual Counties?

National estimates of metal HAP emissions from other nonroad vehicles and equipment were distributed to individual counties using the county proportion of other nonroad PM_{10} emissions, provided from the NONROAD model, versus total national PM_{10} emissions.

All other nonroad vehicle and equipment HAP estimates were calculated at the county level by multiplying the appropriate speciation profile by their county level VOC estimates or PM estimates as obtained from the NONROAD model.

2.4.5 State Provided Data

Where states provided their own nonroad HAP emission estimates, their data were given priority over all other data. In this version of NEI, two states, California and Texas provided nonroad HAP data (see Table 2-2). The state data submitted replaced the estimated emissions developed from national data. EPA did not adjust or revise any data submitted by state or local agency's - the data were used as submitted. For example if a state submitted only ozone season daily estimates these values were not multiplied by 365 to estimate annual emissions. Note, that in some cases state or local agency's submitted estimates where PAH or metal HAPs were not disaggregated into individual species, as was done in the nationally-derived estimates. In such cases, both the state or local estimates and the national estimates were retained (e.g., *Nickel* and *Nickel and Nickel compounds*; the *nickel* estimates are nationally-derived estimates while the *nickel and nickel compounds* are state derived estimates). It is recognized that a small amount of double counting may occur by taking this approach. Note, state emission estimates may differ significantly with EPA emission estimates. Appendix E contains individual summary sheets for each State that submitted nonroad data.

Puerto Rico and the Virgin Islands did provide estimates for 1996, but not any other year. New runs of the nonroad model have recently been completed for criteria pollutants for 1999, such that the 1996 HAP estimates may not necessarily be consistent with the 1999 criteria estimates. At the time this report was being developed, the NONROAD model did not generate emissions for these two U.S. territories and the 1996 estimates were used for NEI HAP purposes.

Table 2-11. Summary of State Submitted Other Nonroad Data

State	Criteria	HAPs	Comments
1996			
Puerto Rico and Virgin Islands		✔	Replaced national data with state submitted estimates.
Tennessee - Davidson County		✔	Replaced national data with state submitted estimates.
1999			
California		✔	Replaced national data with state total data for available pollutants. Removed pollutants not included on the list of regulated HAPs.
Texas		✔	Replaced national data with state data for available pollutants. Quarterly data was combined to get annual estimates.

2.4.6 What Are the Results?

Table 2-12 summarizes the other nonroad vehicle and equipment emission estimates developed for each HAP. Table 2-13 summarizes the other nonroad vehicle and equipment emission estimates developed for POM. Note, the estimates in these tables include state provided estimates. Emission estimates for Puerto Rico and the Virgin Islands were provided for 1996 by using populations to scale the other nonroad emission estimates from Hawaii. These estimates were applied to 1999.

Table 2-12. Other Nonroad HAP Emissions Estimates for 1990-1999

Pollutant	1990	1996	1999
1,3-Butadiene	9,415.32	10,493.58	8,979.06
2,2,4-Trimethylpentane	91,327.56	105,118.19	94,394.79
2,3,7,8-TCDD TEQ	1.5E-04	1.8E-04	1.97E-04
Acetaldehyde	15,360.93	17,705.88	18,877.04
Acrolein	1,525.24	1,764.54	1,983.32
Antimony			1.96
Benzene	70,805.26	77,578.86	65,747.14
Cadmium			0.95
Chlorine			285.81
Chromium			2.16
Chromium & Compounds		0.361	1.53
Chromium (VI)	0.27	0.29	0.29
Chromium III	0.53	0.57	0.57
Cobalt			2.10
Cumene			68.36
Ethyl Benzene	45,569.98	50,279.27	43,813.03
Formaldehyde	36,453.02	41,735.44	44,377.97
Hexane	31,918.61	35,493.61	29,637.76
Lead			0.42
Lead & Compounds	1.34	1.25	1.19
m-Xylene			5,757.99
Manganese			2.34
Manganese & Compounds	0.48	0.95	2.29
Methanol			887.33
Methyl Ethyl Ketone			487.81
Methyl Tert-Butyl Ether	19,757.35	47,428.94	24,333.75
Nickel			2.24
Nickel & Compounds	0.90	1.20	1.80
o-Xylene			2,041.31
p-Xylene			27.87
Phosphorus			1.74
Propionaldehyde	3,861.36	4,309.96	4,004.03
Selenium			0.07
Styrene	2,406.59	2,741.71	3,985.23
Toluene	209,919.50	237,002.35	209,889.93
Xylenes (Mixture of o, m, and p Isomers)	184,726.35	208,889.90	189,985.11
16-PAH		0.877	2.73
7-PAH		0.445	1.38

Table 2-12. Other Nonroad HAP Emissions Estimates for 1990-1999 (Continued)

Pollutant	1990	1996	1999
Acenaphthene	25.47	25.24	22.59
Acenaphthylene	49.49	50.75	41.36
Anthracene	9.50	10.41	8.77
Benz[a]Anthracene	2.60	3.00	2.86
Benzo[a]Pyrene	2.27	2.62	2.46
Benzo[b]Fluoranthene	1.76	1.97	1.74
Benzo[g,h,i,]Perylene	7.86	9.23	8.92
Benzo[k]Fluoranthene	1.63	1.81	1.59
Chrysene	2.17	2.42	2.24
Dibenzo[a,h]Anthracene	0.05	0.06	0.66
Fluoranthene	23.57	26.71	25.16
Fluorene	42.79	45.40	41.62
Indeno[1,2,3-c,d]Pyrene	2.39	2.80	2.70
Naphthalene	727.30	741.44	672.20
Phenanthrene	80.22	82.06	74.28
Pyrene	25.70	29.53	27.55

2.4.7 Other nonroad Mobile Source References:

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3.0 COMPILING THE INVENTORY DATA INTO THE NEI DATABASE

One of the goals of compiling the NEI was to process all the national and state supplied inventory data into a common structure with consistently defined data fields. A common data structure will help end users define standardized approaches to reviewing and using the data. The NEI Input Format (NIF) version 3.0 as designed by EPA allows for a variety of data transfer mechanisms to be used and is flexible enough to be supported by many different database programs. More detailed information about the NIF can be found at *http//www.epa.gov/ttn/chief/nif/index.html*.

Several processing and screening steps were initially performed on the state databases as they were received. These steps included:

- Converting any files submitted in NIF version 1.2 and version 2.0 to version 3.0;
- Manually setting primary keys on each table;
- Performing quality control (QC) checks on the files, including running EFIG's NIF QA software on each file;
- Removing duplicate records;
- Removing records that had null and zero emissions;
- Screening for records that contain pollutants on the list of the 188 CAA HAPs;
- Adding state abbreviation based on FIPS code;
- Correcting referential integrity violations;
- Checking/correcting miscellaneous data codes such as emission release point type, emission type, and emission unit numerator; and
- For state submitted data, the data source flag will be noted as S and where EPA data are retained, the flag will be E. The flags can be found in the data source field.

4.0 WHAT ARE THE LIMITATIONS OF THIS AIRCRAFT, COMMERCIAL MARINE VESSEL, LOCOMOTIVE, AND OTHER NONROAD INVENTORY?

As with the development of any emissions inventory, the accuracy of the final estimates varies considerably. Given the methods used to calculate the estimates, the most important factor influencing the quality of the estimate is the validity of the emission factors and speciation profiles used, both in terms of absolute accuracy, as well as representativeness for each source type. For criteria pollutants, this is less of an issue as the emission factors are derived from extensive study and testing. For example, the criteria estimates for CMV and rail sources are derived from studies that support recent regulatory efforts. Criteria pollutant estimates for aircraft are also based on extensive emission testing incorporated into the FAA's EDMS model.

The situation for HAPs is very different, as few HAP emission factors or speciation profiles have been developed for these sources. The majority of available HAP emission factors and speciation profiles data were either old and/or very limited in terms of coverage. This lack of data may be because the HAPs have not always been viewed as significant; therefore, little testing has been performed. This means that a very limited number of data points were available to characterize an entire engine type, without the benefit of knowing what the variability may be. In this version of the NEI, a number of significant revisions have been made to incorporate recent data and improve the accuracy of the inventory. Where there were no test data for a specific engine type, surrogate data from a related source had to be used to estimate emissions. While not optimal, this approach was necessary in order to provide as complete an inventory of emission sources as possible.

The activity data can also affect the quality of emissions estimates, but activity data are usually easier to obtain and often have more credibility.

When interpreting the emission estimates in this study at the local or state level, it is important to appreciate that the estimates use a "top-down" approach, such that national emissions are allocated to individual counties using appropriate surrogates. This approach may underestimate emissions in some counties and may overestimate emissions in other counties depending upon the specific types of fuel or equipment used. The county-level estimates are considered only a rough approximation of actual emissions. State or local data are considered to be more accurate for the counties they represent than the disaggregated national estimates. Unfortunately, few states and local agencies have developed aircraft, CMV, locomotive and other nonroad emission inventories. The EPA strongly recommends that states and local agencies under take data collection to provide more accurate emission estimates.

As with most inventory efforts, improvements in methods and data can often be made in order to enhance the accuracy of the emission estimates or enhance the usefulness of the data. The following areas of improvement have been identified and EPA staff will be working on these improvements as resources permit.

Aircraft

- Develop better methodologies that rely on available activity data for the diverse aircraft included in the military aircraft category.

- States and local agencies should be encouraged to develop airport specific emission estimates using the new FAA EDMS emission estimating tool in conjunction with local aircraft specific activity data. (This is particularly important for smaller municipal airports and private landing strips)

- In the current version of the aircraft component of NEI, some states provided aircraft emission estimates in their point source file. These data were retained in the point source data set and the nationally derived aircraft emissions for the associated counties were removed. In the future it is recommended that the adjustment for double counting be done at the airport level, not the county-level. This will be highly dependent upon the states' submittal schedule, as sufficient time is needed to match individual airports in the nationally developed data set with those provided by the state.

- States are requested to review the supplemental data to insure that the latitude and longitude coordinates associated with the airports included in this inventory are correct.

- States are requested to review the supplemental data to insure that the latitude and longitude coordinates associated with the airports included in this inventory are correct.

- As new and more representative HAP profiles become available, these data should be incorporated into NEI, specifically, methodologies should be developed to estimate mercury and arsenic emissions from aircrafts.

Commercial Marine Vessels

- States should be encouraged to develop emission estimates for their ports based on the latest emission factors used in regulatory rulemaking.

- It is recognized that there are some inconsistencies with the BTS GIS data for other inventory years, therefore, the 1999 weight factors were used in all other inventory years until BTS has revised their GIS data files.

- Port emissions were assign to the top 150 ports based on cargo handling, a more complete list of ports along with appropriate traffic data would improve the quality of the port-level emission estimates.

- OTAQ has developed port specific inventory estimates that can be incorporated directly into the NEI. Methods need to be developed that adjust these port data for the different inventory years used in NEI

- As new and more representative HAP profiles become available, these data should be incorporated into NEI, specifically, methodologies should be developed to estimate mercury and arsenic emissions from CMVs.

Locomotive

- State and local agencies can play an important role in developing inventories of railroad activity that occurs in their geographic areas, especially with regard to the smaller Class II/III and commuter railroad operations. In developing these railroad inventories it is recommended that emission factors developed in support of recent rulemaking activities be used in these local locomotives emission inventories.

- Inventories of yard locomotives have not been updated in many years. It is recommended that states inventory these locomotives and provide criteria and HAP emission estimates based on emission factors developed in recent locomotive rulemaking.

- It is recognized that there are some inconsistencies with the BTS GIS data for other inventory years, therefore, the 1999 weight factors were used in all other inventory years until BTS has revised their GIS data files.

- As new and more representative HAP profiles become available, these data should be incorporated into NEI, specifically, methodologies should be developed to estimate mercury and arsenic emissions from locomotives.

It is important that states and local agencies provide accurate and complete data. The EPA intends to use the aircraft, CMV, locomotive and other nonroad data as submitted. The submitted data will not be manipulated to fill data gaps; therefore, states and local agencies need to provide complete data sets, with correct pollutant identification codes (e.g., HC, TOG, ROG emission estimates can be provided but only VOC data will be used). It is also important that states use the most recent SIC listing.

5.0 QUALITY ASSURANCE PROCEDURES

5.1 Introduction

The aircraft, CMV, locomotive, and other nonroad components of the NEI comprise the largest data set currently incorporated in the NEI. At this time, this nonroad data set contains over 14 million records, stored in more than 2 gigabytes of memory. This large and complex data set matches emission factors for approximately 40 HAPs associated with 10 different fuels to approximately 230 individual source categories for each of the 3,141 counties included in this inventory, based on the type of fuel used. Given the inherent complexity of this emission inventory, it is critical that quality checks be performed throughout the inventory process. This chapter discusses the quality checks that are performed, not only to provide documentation of the quality assurance procedures used in the NEI, but also to provide state, local and tribal (S/L/T) agencies with insights that may lead to improved local data submittals.

The quality assurance procedures for the nonroad NEI are dis-aggregated into the following checks:

- Quality checks performed on nationally-derived emission estimates;
- Quality checks performed on S/L/T submitted emission estimates;
- Quality checks performed on the NEI database structure;
- Peer review of draft emission estimates;
- Development of final emission estimates; and
- Quality checks performed on S/L/T output HAP data files.

In implementing these multiple quality checks and data comparisons, considerable insight is developed concerning the consistency and reasonableness of the emission estimates provided in this inventory. In many ways, the process of quality checking the data helps the emission inventory staff validate the data used and validate the calculated emission estimates. The specific objectives and procedures implemented for each of the above quality assurance activities are discussed in greater detail in this chapter.

5.2 Quality Checks Performed on Nationally-Derived Emission Estimates

In developing the national emission estimates for the nonroad mobile source categories, quality checks are performed to insure that the emission estimating procedures used are appropriate and correctly implemented. The procedures discussed in detail in the appendix have been developed and reviewed by staff from EPA's EFIG and the OTAQ. Data sets of emission factors and speciation profiles are maintained for each of the nonroad source categories included in this report. These data sets are reviewed to determine if they have been compiled correctly. Similarly, the activity data and spatial allocation files used in this inventory effort are also reviewed to insure that the values are reasonable and complete. Other data sets, such as the county fuel parameter data set and GIS spatial allocation files, used to match nonroad source category emission factors and geographic information with individual counties, are checked for errors. These and other checks performed on the national emission estimates are discussed in greater detail below.

5.2.1 Evaluate Emission Estimating Procedures

The calculation procedures used to estimate emissions are checked to make sure that the units cancel out, correctly providing emissions in terms of tons of a specified HAP emitted per year. The emission calculations are also reviewed to insure that no mathematical errors have occurred. Where spreadsheets are used, the equations are evaluated to make sure that the correct cells are included in the spreadsheet formula, and that the formula has been applied correctly in the spreadsheet. Where databases are used, the update queries are reviewed to make sure that the steps implemented match the procedures included in the documentation and the data files are properly linked and include the correct equations. Lastly, all units are checked to insure that erroneously reported (e.g., pounds or milligrams are not reported as tons). All of these checks on the emission estimating procedures are performed by senior staff members who are familiar with the source category and procedures, but were not directly involved in the calculations. This allows for an independent evaluation of the emission estimating procedure.

5.2.2 Review Emission Factors and Speciation Profiles

Emission factors and speciation profiles used in this report are compiled from a large number of references recommended by OTAQ staff. Prior to actually using these factors and profiles in the calculations, they are entered into separate data sets for each of the source categories included in this report. Most of the factors and profiles are obtained from hard copy reports and entered manually into database tables and spreadsheets. These data are independently reviewed to insure that the correct values have been entered. Special attention has been paid to the units (e.g., mg/VMT, lbs/gal, VOC fraction) associated with the emission factors to insure that the units reported in the documentation match the units in the original report. If errors are encountered, the project supervisor is notified and the factors or profiles are corrected.

5.2.3 Activity Data

As with the emission factors and speciation profiles, activity data are obtained from a variety of sources in a variety of formats. Prior to using the activity data in the emission estimating procedures, the data are incorporated into database tables or spreadsheets and quality checked. In some cases, the data may be provided as a hard copy or in an electronic format. The hard copy data are independently evaluated to insure that the correct data have been incorporated into the inventory database table or spreadsheet. If the data are obtained in an electronic format, the file size of the original data set and inventory data set are compared as are the number of records transferred to indicate whether the data transfer was complete. Individual values may be compared to identify any differences between the two data sets. If differences have been identified, the inventory data set is revised to include the correct activity data.

5.2.4 Check Other Input Data

Other input data files such as the county fuel usage data files and data files used to spatially allocate emissions to individual counties are reviewed in the same manner as the emission factor and activity data. These data tend to be provided as electronic files, such that the main concern is correctly transferring the data from the original electronic format to an appropriate database table or spreadsheet. The database tables and spreadsheets are compared and incorrect data are revised prior to use in the emission estimating procedures.

5.2.5 Check Output Data

After the emissions have been calculated and draft inventory data files developed, these data files are reviewed to insure that the correct number of sources categories, counties, and pollutants are included. If counties, source categories, or pollutants appear to be missing, the output data set is evaluated to determine whether there are errors in the emission equations, emission factors, speciation profiles, activity data, or spacial allocation factors. In some cases, the source category for which the emissions are estimated may not necessarily be in all counties. For example, not all counties have active railroad operations or navigable waterways, and therefore not all counties should have locomotive or CMV emission estimates. Because different onroad and nonroad fuels are used in the individual counties, the emission profile for a given county may legitimately exclude or include pollutants found in an adjacent county. For these reasons, it is important to evaluate missing output data elements carefully. If errors are encountered, the original inventory data table (e.g., emission factor/speciation profile, activity, spatial allocation) should be modified and update queries or calculations rerun. It is important not to correct the output data file itself.

5.2.6 Identify Outliers

Once the output data file have been quality checked, the emissions data can be evaluated to identify outliers in the emission estimates. This includes identification of emission estimates that are unexpectedly high or low. It is helpful to perform these comparisons using GIS tools to evaluate spatial aspects of emissions by source category. For example, CMV emissions should be limited to waterways and locomotive emissions should be closely associated with maps of railway lines.

Another helpful quality assurance tool is ranking emissions for each HAP for each source category. Comparing emission rankings within a source category can highlight possible errors in activity data and emission factors, especially for pollutants that may be orders of magnitude larger or smaller than anticipated. If the emission factors and activity data are correct, it is important to highlight these differences during the peer review process.

5.2.7 Compare with Historical Data

After emission estimates have been developed and allocated to individual counties, the data are summarized and checked with historical emission estimates to insure that the estimates are reasonably consistent from year to year. This comparison is performed using national emission estimates that do not include S/L/T data, allowing for comparison of emission estimates that have been developed with similar methodologies.

If historical estimates vary by more than 10 percent from year to year, these values are flagged and investigated further. This investigation includes review of the emission factors and activity data used between the two years. Where the emission factors or activity data used in the inventory are incorrect, the estimates are revised and new spatially allocated estimates are developed.

In some cases, emissions can vary from year to year for legitimate reasons. For example, the introduction or discontinuation of reformulated fuels tend to be associated with significant changes in annual emission trends. Similarly, the phase out of leaded-fuels is linked with a significant decline in historical onroad and nonroad lead emissions.

5.3 Quality Checks Performed on S/L/T Submitted Emission Estimates

Once a S/L/T agency submits their data, a number of quality checks are performed to insure that the data are in the correct format, use appropriate NIF codes, and contain reasonable emission estimates. S/L/T data are not incorporated into the NEI until all quality checks have been implemented and any errors addressed. The checks performed on the submitted data are discussed in greater detail below.

5.3.1 Evaluate Database Structure

After verifying that the S/L/T submitted database can be opened, it is necessary to determine whether the data are in an appropriate format. The preferred format is an Access® relational database as these databases tend to provide relatively compact data files that are easy to use. However, flat ASCII files can also be submitted. These ASCII files must be converted into appropriate database tables using the latest version of NEI File format (i.e., 3.0) prior to initiating the following quality checks.

During the process of evaluating the S/L/T submitted database structure, records with duplicate primary keys are identified, such situations indicate the possibility of double counting of emission sources. These issues of duplicate records tend to occur where local inventory staff have not defined primary keys in their relational database or when working with ASCII data files.

If the data file can not be opened or the data are provided in an inappropriate format or duplicate values are identified, the S/L/T contact is notified and a revised file is requested.

5.3.2 Identify Inappropriate Codes

To insure that the S/L/T data files can be incorporated into the NEI, the codes used in the submitted data file are checked to insure that they correspond to current NEI codes. It is particularly important that S/L/Ts use the correct pollutant codes and SCC codes. In some cases, S/L/Ts may have aggregated SCC codes that the nationally-derived emission estimates have dis-aggregated; where this has occurred, these S/L/T data files are flagged and quality checks are performed individually to account for the unique aggregation of source categories.

Some S/L/Ts provided emission estimates for unusual time periods such as “average summer weekday.” The use of these unusual reporting periods, suggest that an incorrect emission type code may have been unintentionally used. If questionable or inappropriate codes have been submitted, S/L/T agencies are contacted and a corrected data file is requested.

5.3.3 Removal of Non-Criteria Pollutants and HAPs

NEI only addresses Federally regulated criteria pollutants and HAPs. Some S/L/Ts provided estimates for HAPs of local concern that are not included on the 188 HAP list. These additional HAPs are identified and removed from the S/L/T data files prior to inclusion into NEI.

5.3.4 Compare Submitted Estimates for Consistency

The reasonableness of the S/L/T submitted data is evaluated prior to including the data into the NEI. For example, if a S/L/T agency has provided PM_{10} and $PM_{2.5}$ emission estimates, these values are compared to insure that the $PM_{2.5}$ estimates are always less than the PM_{10} values. Organic HAP emission estimates are totaled and compared with VOC estimates to insure that the VOC values are always larger than the total organic HAP values. If the submitted emission estimates do not pass these data consistency tests, then the S/L/T agency is contacted and a correct data file requested.

5.3.5 Comparison with Nationally-Derived Emission Estimates

Lastly, the S/L/T submitted data are compared with the nationally-derived emission estimates to flag emission values that vary more than an order of magnitude. Where such differences have been identified, S/L/T agencies are contracted and the findings discussed. Because S/L/T agencies are able to utilize more accurate local activity data, their emission estimates tend to be of better quality than the nationally derived estimates that have been spatially allocated to counties using surrogate data. The point of this quality check is to allow S/L/Ts an opportunity to review their data submittal prior to inclusion into the NEI. If the S/L/T agency is confident in their estimates, then their data will be incorporated into the NEI. If the S/L/T agency agrees that an error has been made then they can resubmit their data. If time allows, it may be incorporated into NEI after all quality checks have again been implemented.

5.4 Quality Checks Performed on NEI Database

Once the S/L/T data have been incorporated into the national emission estimates, it is necessary to evaluate the aggregated NEI data set to insure that the data set is complete and correctly populated. The database is also evaluated to insure that all required data elements needed for generating output in the latest NIF file format have been included.

5.4.1 Identify Data Gaps

In some case, S/L/T agencies provide emission estimates for a limited number of HAPs, for specific source categories, or specific counties. Where the nationally derived emission estimates have been developed for additional pollutants, source categories, or counties, these values are used to fill data gaps in the S/L/T submittals.

5.4.2 Insure Data Fields are Correctly Populated

As noted above, S/L/T agencies may develop emission estimates for source categories that have been dis-aggregated in the nationally derived emission estimates. Where this occurs, the nationally derived emission estimates are fully reviewed and appropriate data removed from NEI to avoid double counting of emission estimates.

5.5 Peer Review of Draft Final Emission Estimates

All components of the aircraft, CMV, locomotive, and other nonroad inventory undergo independent peer review by senior staff at the EFIG and the OTAQ. Peer reviewers are provided summaries of the national emission estimates (with and without S/L/T data), the compiled emissions data set, and associated NEI documentation. This peer review is implemented to insure that the correct procedures were followed and input data were used correctly. EFIG and OTAQ staff members review the emission totals to make sure that they are consistent and make sense.

Because OTAQ staff are familiar or involved with newly developed regulations, part of this check is to insure that the emission estimates presented in the NEI agree with emission estimates in the regulatory background documents or properly account for introduction of new control technologies or fuels to comply with mobile source regulations.

5.6 Development of Final Emission Estimates

Once the national emission estimates have been checked, the submitted S/L/T data have been incorporated, and external peer reviewers have completed their assessment of the data, necessary corrections or changes are made to the final data set. In some instances, peer reviewers may request additional review once the changes have been made. This sometimes leads to additional changes. The inventory documentation is reviewed once all of the peer reviewer comments have been address to insure that all changes made to the data are reflected in the documentation.

5.7 Quality Checks Performed on S/L/T Output Data Files

One of the last steps in developing the aircraft, CMV, locomotive, and other nonroad inventory is to dis-aggregate the NEI HAP data set into individual data sets for each of the S/L/Ts. These individual HAP data sets need to be checked to insure that they are complete and no data were unintentionally dropped during the process. Some of the checks that are implemented are discussed below.

5.7.1 Check Record Counts

A S/L/T data set usually consists of a mixture of S/L/T submitted data and nationally derived emission estimates, these records are flagged separately in the compiled NEI data files and compared to the individual state files. If the number of records in NEI associated with a state do not match the number of records in the individual state file, then a revised state file is created and the record numbers are again checked to insure that all of the data have been correctly transferred.

5.7.2 Insure That All States are Included

Once all of the state files have been created, then the states are checked to insure that there is a state file for all 50 states, the District of Columbia, Puerto Rico, and the Virgin Islands. If a state file is missing, a new state file must be obtained from the NEI.

6.0 INFORMATION QUALITY GUIDELINES

6.1 Overview

The U.S. Environmental Protection Agency (EPA) developed its Information Quality Guidelines (IQG) in response to guidelines issued by the Office of Management and Budget (OMB) under Section 515(a) of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (P.L. 106-554; H.R. 5658). The *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by the Environmental Protection Agency* (the Guidelines) embody the following performance goals:

- Disseminated information should adhere to a basic standard of quality, including objectivity, utility, and integrity;
- Principles of information quality should be integrated into each step of EPA's development of information, including creation, collection, maintenance, and dissemination;
- Administrative mechanisms for correction should be flexible, appropriate to the nature of and timeliness of the disseminated information and incorporated into EPA's processes.

These guidelines apply to "information" that EPA "disseminates" to the public. Such information includes any communication or representation of knowledge such as facts or data, in any medium or form, including web sites, FTP sites, brochures, data flat files, scientific studies etc. However, the guidelines DO NOT apply to all products distributed by EPA. EPA must sponsor or initiate the distribution of the information and EPA must adopt or endorse this information as defined below:

- "EPA initiates a distribution of information if EPA prepares the information and distributes it to support or represent EPA's viewpoint, or to formulate or support a regulation, guidance or the agency decision or position."

- "EPA initiates a distribution of information or EPA distributes information prepared or submitted by an outside party in a manner that reasonably suggests that EPA endorses or agrees with it; if EPA indicates in its distribution that the information supports or represents EPA's viewpoint; or if EPA in its distribution proposes to use or uses the information to formulate or support a regulation, guidance, policy, or other Agency decision or position."

- "Agency-sponsored distribution includes instances when EPA reviews and comments on information distributed by an outside party in a manner that indicates EPA is endorsing it, directs the outside party to disseminate it on EPA's behalf, or otherwise adopts or endorses it."

Information that is not meant for public distribution is not subject to the guidelines. This includes responses to FOIA requests and information intended for government contractors. Products considered "ephemeral" in nature (e.g., press releases, press conferences etc.) are also not subject to the guidelines.

See *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by the Environmental Protection Agency* for more details. (http://www.epa.gov/oei/qualityguidelines/).

6.2 Purpose of the National Emission Inventory

The Clean Air Act (CAA), as amended in 1990, includes mandates for the EPA related to criteria and hazardous air pollutants. The CAA requires the EPA to identify emission sources of these pollutants, quantify emissions, develop regulations for the identified source categories, and assess the public health and environmental impacts after the regulations are put into effect. The NEI is a comprehensive inventory covering all criteria pollutants and HAPs for all areas of the United States and as such it is a tool that EPA can use to meet the CAA mandates. It is envisioned that the NEI will be used to support air quality modeling and other activities. To this end, the EPA established a goal to compile comprehensive emissions data in the NEI for criteria and HAPs for mobile, point, and nonpoint sources.

6.3 Potential Uses

It is anticipated that the emission inventory developed from this effort will have multiple end uses. The data have been formatted according to protocols established for the EPA's NEI submittals. The common data structure on which the NEI platform is based will allow the NEI emission data to be transferred to multiple end-users for a variety of purposes.

The criteria and HAP emission estimates developed for the NEI will be incorporated into the annual EPA publication entitled *National Emissions Trends Report*, which is used to evaluate air pollution trends over time. The NEI is also a critical component of the EPA's national Air Toxics Program (as described in EPA's July 19, 1999 Federal Register notice, 64 FR 38706). The initial objective is to make the data available for air quality modeling use in the National Air Toxics Assessment (NATA). The historical emissions data can also be used in support of the Government Performance Results Act (GRPA) assessments to quantify changes in emissions associated with implementation of government regulations and policies. S/L/T agencies can also use the NEI data as a starting point to develop or enhance local HAP emission inventories for use in risk assessments.

Based on the intended purpose and potential applications of the inventory data, it is necessary for the NEI to comply with the requirements of the IQG.

6.4 Pre-dissemination Checklist

The Pre-dissemination checklist summarizes the important aspects of the IQG and provides a list of specific actions essential to satisfying the requirements of the guidelines. This section presents each action in turn and discusses how it relates to the NEI.

6.4.1 EPA Information Quality Guidelines

The IQG generally reinforces existing EPA quality procedures. Specifically, it asks these questions of the information generator:

- Is the product subject to EPA peer review policy? This policy covers "major" products as defined in the *Science Policy Council Peer Review Handbook.*

- Does this product use environmental data? If so, the information product must have a Quality Assurance Plan (QAP).

- Did this product conduct an assessment of existing data when used to support agency decisions or other secondary purposes? Is this data of sufficient quality and quantity to meet the objectives of the product?

- Does this product fall under the guidelines of the EPA Risk Characterization Policy Handbook?

Only two of the items listed above apply to the NEI - the NEI must have a QAP and must determine whether the data assessed is of sufficient quality to meet NEI's objectives. These items are addressed below.

6.4.2 Product Content - Inputs, Methodologies, and Outputs

The mobile source emissions estimates discussed in this document are developed in two ways: 1) emissions are estimated at the national level and allocated to counties based on appropriate surrogates, or 2) the nationally-derived data can be replaced with data submitted by S/L/T agencies. Before incorporating either data into the NEI, a rigorous process of data review and standardization is implemented (see chapter 5).

The procedures used to estimate emissions from aircraft, CMVs, locomotives, and other non-road engines and equipment are described in detail in chapter 2 of this document and appendices A to D. The data used for the national mobile source emission estimates have been checked as described in the quality assurance procedures chapter. In the process of developing the national mobile emission estimates for NEI, the EPA routinely assesses data gaps and completeness. Intra-year comparison of the national data are performed to insure that emission estimates are historically consistent. OTAQ staff are involved in the final review of the national emissions data to insure that the procedures developed and used represent state-of-the-art knowledge and are consistent with emission estimates developed for associated regulatory programs.

All new S/L/T data sets are logged, checked for database integrity, assessed whether valid codes are used, and checked to identify duplicate. These data sets must conform to current NIF format. Each new data set is compared to the data in the national inventory to evaluate the reasonableness of the S/L/T submitted data and identify outlier or aberrant data. If gaps are detected, the S/L/T submittal is treated as a partial replacement set and the nationally-derived emission estimates are used to fill the data gaps. If there are concerns with the data provided or the format, then the S/L/T representative is contacted. If there are issues concerning the data provided, these are noted in the comment field of the State Database Summary Report tracking forms. The associated resolution is are also documented. These forms are included in Appendix E.

6.4.3 Transparency of Data Development Process

The IQG specifies that if a product is deemed influential, the author must demonstrate that the product is capable of being reproduced by a qualified third party according to commonly accepted scientific and technical standards.

The IQG uses the following definition of influential:

- Information disseminated in support of top agency actions (i.e., rules, substantive notices, policy documents, studies and guidance).
- Information distributed in support of economically significant actions (>$100 million impact annual or will adversely affect the economy in a material way).

- "Major" work products undergoing peer review according to EPA's Peer Review Policy (see Science Policy Peer Review Handbook).

- Case-by-case. The agency may determine that a product is influential if it deems that the product may have a clear and substantial impact on important policies or private sector decisions.

The NEI will be subject to peer review and as such will meet the definition of an "influential" product. The 1999 NEI will not be peer reviewed. However, it has gone through extensive rounds of public and agency review, comment, and revision.

The nonroad mobile source component of NEI has been developed to be transparent to and reproducible by a qualified third party user:

- Documentation that summarizes the procedures used, including all emission factors, speciation profiles, and other input data necessary to implement the recommended procedures are provided;

- Intermediate work products are provided that are essential to estimate or spatially allocate mobile source emissions, such as GIS data sets used to spatially allocate emissions and input file for MOBILE6.2;

- Logging and archiving of all original data submittals by S/L/T agencies with indication as to date of submittal, type of revision, and source;

- Incorporation of data elements in the output files that allow the user to determine the source of the record (EPA, or S/L/T agency) and the nature of a revised record (i.e., addition since last version, revision to last version, or original record) as well as the origin of defaulted data.

S/L/T agencies are encouraged to submit nonroad mobile source emission estimates based on local knowledge of sources and activity. To insure that each S/L/T agency's estimates are comparable, this document has been developed to be sufficiently transparent to allow S/L/T agencies to apply the methods used here in their own inventories.

In order to reproduce the emission estimates, detailed background data are required including input files, emission factors, speciation profiles, activity data and spatial allocation factors. All e-mails and or summaries of phone conversations relevant to this work effort are archived in individual working files. Much of this information is not required to estimate emissions, therefore these files are reviewed once the inventory has been finalized and relevant, but hard-to-locate data and project notes are identified and provided in Volume 2 of this report as scanned documents in their original format. Intermediate work products that are necessary to reproduce the emission calculation or spatial allocation approach are also provided at the EPA's air toxic website.

6.4.4 Data Ranking of the Emission Estimates

To provide users of the inventory with a measure of the overall quality of the emission estimate, a simplified rating scheme has been proposed for mobile sources that can be assigned to each estimate (on a scale of 1-6). This enhances the transparency of the data and also satisfies the requirement that EPA do an assessment of the data. This rating scheme will not be in-depth as other systems such as DARS (Data Attribute Rating System), but will consider the following factors in assigning a score:

Score	Description
6	The emission estimates have been developed using local data in conjunction with the NEI emission estimating procedures.
5	Local emission estimates have been developed using emission estimating procedures not included in the NEI.
4	National emission estimates have been developed based on equipment specific emission factors or speciation profiles and spatially allocated to individual counties using an appropriate surrogate.
3	National emission estimates have been developed based on aggregated emission factors for a given engine type or configuration (e.g., 2-stroke, 4-stroke, diesel,

marine diesel, steamship) and spatially allocated to individual counties using an appropriate surrogate.

2 National emission estimates have been developed based on aggregated emission factors for a source category without taking into consideration fuel type or engine configuration.

1 Emission estimates for an early inventory year were used.

Such a scoring system will help when comparing S/L/T submitted data with nationally derived emission estimates and will also help evaluate which source categories need improvement. Currently, the proposed rating scheme is being discussed and has not been implemented in this version of the inventory.

6.4.5 Product Limitations and Caveats

As with the development of any emissions inventory, the accuracy of the final estimates varies considerably. Given the methods used to calculate the estimates, the most important factor influencing the quality of the estimate is the validity of the emission factors and speciation profiles used, both in terms of absolute accuracy, as well as representativeness for each source type. For criteria pollutants, this is less of an issue as the emission factors are derived from extensive study and testing. For example, the criteria estimates for CMV and rail sources are derived from extensive studies that support recent regulatory efforts. Criteria pollutant estimates for aircraft are also based on extensive emission testing incorporated into the FAA's EDMS model.

The situation for HAPs is very different because few HAP emission factors or speciation profiles have been developed for these sources. The majority of available HAP emission factors and speciation data were either old and/or very limited in terms of coverage. This lack of data may be because HAPs from these sources have not always been viewed as significant. Therefore, little testing has been performed, such that a very limited number of data points were available to characterize an entire engine type, without the benefit of knowing what the actual variability may be. In this version of the NEI, a number of significant revisions have been made to incorporate recent data and improve the accuracy of the inventory. Where there were no test data for a specific engine type, surrogate data from a related source had to be used to estimate emissions. While not optimal, this approach was necessary in order to provide as complete an inventory of emission sources as possible.

The activity data can also affect the quality of emissions estimates, but activity data are usually easier to obtain and often have more credibility. Local activity data is often more accurate than nationally-derived activity, which is why S/L/T agencies are encouraged to develop their own criteria and HAP inventories for these sources.

When interpreting the emission estimates in this study at the local or state level, it is important to appreciate that the estimates use a "top-down" approach, such that national emissions are allocated to individual counties using appropriate surrogates. This approach may underestimate emissions in some counties and may overestimate emissions in other counties depending upon the specific types of equipment used. The county-level estimates are considered only a rough approximation of actual emissions. S/L/T data are considered to be more accurate for the counties they represent than the dis-aggregated national estimates. Unfortunately, few S/L/T agencies have developed aircraft, CMV, locomotive and other nonroad emission inventories. The EPA strongly recommends that S/L/T agencies undertake data collection to provide more accurate emission estimates.

As with most inventory efforts, improvements in methods and data can often be made in order to improve the accuracy of the emission estimates or enhance the usefulness of the data. For this version of NEI, the following areas of improvement have been identified and EPA staff will be working on these improvements as resources permit.

Aircraft

- Encourage S/L/T agencies to develop airport specific emission estimates using the new FAA EDMS emission estimating tool in conjunction with local aircraft specific activity data.

- Develop better methodologies that rely on available activity data for the diverse aircraft included in the military aircraft category.

- As new and more representative HAP profiles become available, these data should be incorporated into NEI, specifically, methodologies should be developed to estimate mercury and arsenic emissions from aircrafts.

Commercial Marine Vessels

- Encourage S/L/Ts to develop emission estimates for their ports based on the latest emission factors used in regulatory rule making.

- It is recognized that there are some inconsistencies with the BTS GIS data for other inventory years, therefore, the 1999 weight factors were used in all other inventory years until BTS has revised their GIS data files.

- Port emissions were assigned to the top 150 ports based on cargo handling. A more complete list of ports along with appropriate traffic data would improve the quality of the port-level emission estimates.

- As new and more representative HAP profiles become available, these data should be incorporated into NEI, specifically, methodologies should be developed to estimate mercury and arsenic emissions from CMVs.

Locomotive

- Inventories of yard locomotives have not been updated in many years. S/L/Ts should inventory these locomotives and provide criteria and HAP emission estimates based on emission factors developed in recent locomotive rulemaking.

- It is recognized that there are some inconsistencies with the BTS GIS data for other inventory years, therefore, the 1999 weight factors were used in all other inventory years until BTS has revised their GIS data files.

- S/L/T agencies can play an important role in developing inventories of railroad activity that occurs in their geographic areas, especially with regard to the smaller Class II/III and commuter railroad operations. In developing these railroad inventories it is recommended that emission factors developed in support of recent rulemaking activities be used in these local locomotives emission inventories.

- As new and more representative HAP profiles become available, these data should be incorporated into NEI, specifically, methodologies should be developed to estimate mercury and arsenic emissions from locomotives.

Nonroad

- National level emissions in NONROAD are allocated to the county level using surrogates, such as construction costs (to allocate emissions of construction equipment) and the number of employees in relevant manufacturing sectors (to allocate industrial equipment). Use of more specific local data on equipment populations and usage will result in more accurate inventory estimates. EPA strongly recommends that S/L/Ts undertake data collection to provide local data as is routinely done for highway motor vehicle activity and population.

- New emission factors need to be developed to characterize mercury and arsenic emissions.

- Naphthalene from evaporative sources should be dis-aggregated from the exhaust naphthalene.

It is important that S/L/T agencies provide accurate and complete data, the EPA intends to use the mobile data as submitted. The submitted data will not be manipulated to fill data gaps.

6.4.6 Contact Information

In order for NEI users to obtain more information about the nonroad mobile source component of the inventory and obtain answers for their questions, they should contact:

Laurel Driver
Emission Factor and Inventory Group (D205-01)
Emissions, Monitoring and Analysis Division
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711

6.4.7 EPA Disclaimer

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Appendix A

Aircraft Emission Estimation Methodology

Aircraft Emission Estimating Methods

This appendix documents the methods used to estimate aircraft emissions for commercial aircraft, air taxis, general aviation (GA) and military aircraft. Criteria emission estimates for commercial aircraft were developed using the FAA's Emissions and Dispersion Modeling System (EDMS), while air taxis, GA, and military aircraft criteria emissions were estimating using generic factors from EPA's SIP Guidance. These criteria emission estimates were speciated into HAP components using speciation profiles developed from the latest aircraft test data or obtain from the SPECIATE database and other published sources. The HAP speciation profiles for commercial air carriers noted in this section of the documentation was updated based on new aircraft speciation profiles and were used in the 2002 Inventory. The speciation profiles used in all other inventory years are included in Volume II - Aircraft - 2001 Aircraft References.

For the 2002 Inventory EDMS was run for each airport individual with these emission estimates begin attributed to the airports latitude and longitude coordinates. For all other inventory years, criteria and HAP emissions were allocated to individual airports based on airport-specific LTO data provided by the FAA in the Terminal Area Forecast System (U.S. Department of Transportation, 2001c). The allocations were made by aircraft type (i.e., commercial air carriers, air taxis, general aviation and military aircraft), such that emissions from large air carriers were assigned to airports with air carrier traffic and emissions from GA were allocated to airports that had documented GA activity.

Commercial Aircraft

To estimate emissions for commercial aircraft for all inventories not including the 2002 inventory, LTO data from Table 7 of *Airport Activity Statistics of Certificated Route Air Carriers* (DOT, 2001) was obtained from the FAA. This report is no longer published, so data were received electronically based on a formal request to the FAA. For the 2002 Inventory, activity data were downloaded directly from the FAA's website. These LTO data only include domestic air carriers.

The EPA provided LTO data for foreign flagged air carriers. These LTO data were combined and entered into the *FAA Emissions and Dispersion Modeling System (EDMS), Version 4.0* (DOT, 2001a), which was designed to calculate aircraft-specific emissions.

All time in mode (TIM) default values in EDMS were used in this inventory effort. EDMS did not have default TIM values for the period of time that aircraft are taxiing or idling. In this inventory a TIM value of 26 minutes was used for taxiing and idling; this value was the default recommended in other EPA guidance (EPA, 1992). EDMS generated emissions for HC, NO_x, CO and SO_x for aircraft included in the EDMS software. The national level criteria pollutant emission estimates generated from EDMS are shown below:

Table A-1. 1999 Criteria Pollutant: Matched Commercial Aircraft

Pollutant	Emissions (tons/yr)	Average Emission Factor (tons/LTO)
HC	20,015.34	0.002680
NO_x	75,945.09	0.009288
CO	91,513.39	0.011192
SO_x	7,285.96	0.000891

PM estimates for commercial aircraft for 2002 were developed using the emission factors summarized in Table A-2. These emission factors are per engine, in order to adjust these factors for the number of engines on a specific aircraft. The aircraft characterize data were extracted from the EDMS model.

Note that all commercial aircraft included in the 2002 FAA airport activity data could be matched to aircraft included in EDMS. On the other hand, emissions for 96 % of total LTOs for commercial air carriers could be matched in the 1999 Inventory. To compensate for the aircraft not included in the EDMS for the 1999, 1996, 1990, 1987, and 1978, average emission factors for a single LTO were developed (see Table A-1) and applied to unmatched LTOs. The equation below shows how these emissions were calculated.

Average Emission Factors (tons/LTO) x unmatched LTOs = Emissions from unmatched aircraft

Example: 0.00268 tons of HC/LTO * 312,427 (Unmatched LTOs) = Unmatched HC emissions
Matched LTOs

The emission estimates for matched and unmatched aircraft were combined to estimate total commercial aircraft emissions.

Note, for 2002 there was no need to gap fill for unmatched aircraft and therefore the above procedure was not needed for the 2002 estimates.

PM emissions were calculated differently that the other criteria pollutants. PM 10 emissions were based off of emission factors in lbs per hour for each of the four modes of operations. Based on the recommendation by OTAQ, the emission factors per mode of operations were obtained by averaging together the old AP-42 emission factors. Then by multiplying the emission factors by the average time aircraft are in each mode of operation and then summing the emission factors by LTO per engine were created (Table A-2). According to CARB, PM2.5 = 97.6% of PM10, which allowed for the creation of PM2.5 emission factors.

Table A-2. Commercial Aircraft PM Emission Factors

Mode	EF for PM10	EF for PM2.5	EF Units	Time (min)
Idle	6.140E-01	5.993E-01	lbs/hour	26
Takeoff	4.958E+00	4.839E+00	lbs/hour	0.7
Climb	3.548E+00	3.463E+00	lbs/hour	2.2
Approach	1.268E+00	1.238E+00	lbs/hour	4
Total	2.693E-04	2.628E-04	ton/LTO/engine	--

The HC estimate was speciated for individual HAPs using speciation profiles developed from recent test data (See Table A-3) (Billings, 2004) in the following equation. Note some of the recent test data is disaggregated by jet engine type (i.e., turbo fan and turbo props), engine type data for individual engines were obtained from the International Civil Aviation Organization Engine Emission Data Bank.

$$HC_{commercial} * Speciation\ Profile_i = HAP\ Emissions_{commercial\ i}$$

Where: $HC_{commercial}$ = Commercial aircraft HC estimate (tpy) for individual aircraft
i = Pollutant
$Speciation\ Profile_i$ = HC speciation fraction for pollutant i (Table A-2)
$Emissions_{commercial\ i}$ = Emission estimate for pollutant i (tpy)

Example: 1,478 tons of HC * 0.00203 styrene fraction for turbo fan = 3.00E-3 Tons of Styrene

Table A-3. Previous HAP/VOC Speciation Profiles for Commercial Aircraft

Pollutant	VOC Speciation profile
2,2,4-Trimethylpentane	0.0005
Acetaldehyde	0.0519
Acrolein	0.0253
Naphthalene (gas-phase)	0.0057
Styrene	0.0044

Table A-4. 2002 Commercial Aircraft HAP Speciation Profile for THC

Pollutant	Turbo Fan	Turbo Prop	Combined
1,3-Butadiene	1.44E-02	1.43E-02	
2,2,4-Trimethylpentane			5.47E-04
Acetaldehyde	4.77E-03	2.33E-03	
Acrolein	2.65E-03	4.01E-05	
Anthracene			4.43E-07
Benz[a]Anthracene	4.84E-07	4.91E-07	
Benzene	1.64E-02	1.86E-03	
Benzo[a]Pyrene	3.59E-07	3.65E-07	
Benzo[b]Fluoranthene	7.06E-07	7.05E-07	
Benzo[g,h,i,]Perylene			6.44E-09
Benzo[k]Fluoranthene	7.06E-07	7.05E-07	
Chrysene	4.90E-07	4.93E-07	
Dibenzo[a,h]anthracene	9.52E-07	9.50E-07	

Pollutant	Turbo Fan	Turbo Prop	Combined
Ethyl Benzene	1.36E-03	3.04E-04	
Fluoranthene			9.30E-07
Formaldehyde	9.61E-02	1.48E-02	
Indeno[1,2,3-c,d]Pyrene	7.65E-07	7.64E-07	
Naphthalene (Gas)	2.27E-03	4.27E-04	
Naphthalene			4.70E-04
Phenanthrene			4.15E-06
Phenol	2.03E-03	2.04E-04	
Propionaldehyde			1.16E-02
Pyrene			1.13E-06
Styrene	2.03E-03	3.69E-04	
Toluene	6.73E-03	1.02E-03	
Xylenes (Mixture of o, m, & p Isomers)	3.85E-03	7.18E-04	

Air Taxis

For air taxis, activity data were taken from the FAA Air Traffic and Activity Data System (DOT, 2001b). In this reference, each activity (i.e., a landing or take-off) is counted. For every LTO, there are two activities ("landing" and "take-off"); therefore, the FAA activity data were divided by two to estimate LTOs.

Example: *10,650,000 FAA aircraft operations/2 = 5,325,000 LTOs*

For all years, the aircraft-specific data used for commercial air carriers were reviewed to identify any smaller aircraft that would be considered air taxis. Emission estimates for these aircraft were retained in the commercial air carriers calculations, but their LTOs were subtracted from the FAA's air taxi LTO estimates to ensure that these aircraft activities were not double counted.

The adjusted LTO data were applied to the SIP emission factors (see Table A-5) using the following equations.

*Adjusted air taxi LTOs * criteria emission factor = Air taxi criteria emission estimate*

Example: 5,325,000 LTOs * 1.234 pounds HC/LTO * 1 ton/2,000 pounds = 3,285.53 tons of HC

The criteria emission factors for HC, NO_x, CO, and SO_x for air taxis were obtained from the EPA's *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources* (EPA, 1992). PM emission factors for air taxis were obtained from EPA's *National Air Pollution Emission Trends, Procedures Document for 1900-1996* (EPA, 1997). $PM_{2.5}$ emissions were derived by assuming 69% of PM_{10} is $PM_{2.5}$, as noted in the 1998 NET (*National Air Pollution Emission Trends Procedures document for 1900-1998* (EPA, 2000)).

Table A-5. Criteria Pollutant Emission Factors for Air Taxis for All Years

Pollutant	Emission Factor (lbs/LTO)
HC	1.234
NO_x	0.158
CO	28.13
SO_x	0.015
PM_{10}	0.60333

For the 2002 Emission Inventory HAP emissions were estimated using the speciation profiles noted in Table A-6.

A conversion factor from *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources* (EPA, 1992) was applied to the air taxi HC emission estimate to obtain a VOC estimate.

*Air taxi HC emissions * VOC/HC conversion factor = air taxi VOC estimate*

Example: 3,285.53 tons of HC * 0.9914 VOC/HC = 3,257.27 tons of VOC

Table A-6. Air Taxi Speciation Profiles

Pollutant	Turbine	Piston	Speciation Type
1,3-Butadiene	0.019192387	0.01198001	HC
2,2,4-Trimethylpentane	0.00043788	0.00043788	HC
Acenaphthene	0	0.00073	PM10
Acenaphthylene	0	0.00412	PM10
Acetaldehyde	0.05280984	0.00757919	HC
Acrolein	0.02518247	0.00073347	HC
Anthracene	4.41164E-07	0.00085	PM10
Benz[a]Anthracene	6.67767E-08	0.0001	PM10
Benzene	0.021881855	0.049509225	HC
Benzo[a]Pyrene	3.6563E-08	0.0001	PM10
Benzo[b]Fluoranthene	0	0.00012	PM10
Benzo[g,h,i,]Perylene	6.06464E-09	0.00026	PM10
Benzo[k]Fluoranthene	0	0.00012	PM10
Chrysene	6.2179E-08	0.0001	PM10
Ethyl Benzene	0.001833675	0.017970015	HC
Fluoranthene	9.22832E-07	0.00091	PM10
Fluorene	0	0.00151	PM10
Formaldehyde	0.17285443	0.032883905	HC
Hexane	0	0.00855715	HC
Indeno[1,2,3-c,d]Pyrene	0	0.00008	PM10
Naphthalene	0.000470721	0.0907	PM10
Naphthalene (Gas)	0.00558297	0.00558297	HC
Phenanthrene	4.10513E-06	0.00254	PM10
Propionaldehyde	0.01100205	0.00073347	HC
Pyrene	1.12754E-06	0.00124	PM10
Styrene	0.004523065	0.00415633	HC
Toluene	0.005990005	0.1271348	HC
Xylenes (Mixture of o, m, & p Isomers)	0.00537878	0.07163557	HC

For previous years, to estimate 1,3-butadiene, acetaldehyde, acrolein, benzene, formaldehyde, ethylbenzene, n-hexane, propionaldehyde, styrene, toluene, and xylene for air taxis, it was necessary to convert VOC to TOG as the speciation profiles are provided in terms of TOG. For all years, OTAQ provided separate conversion factors for air taxis powered by piston and turbine engines (Cook, 1997). Therefore, the VOC estimate needed to be disaggregated into turbine and piston powered air taxis as noted in the following equations based on the assumption that 73 percent of air taxi fleet are powered by piston engines and 27 percent of the fleet are powered by turbine engines (Cook, 1997).

VOC estimate for Turbine Engine Air Taxis:

*Air taxi VOC estimate * turbine powered fleet fraction = turbine powered VOC estimate*

Example: 3,257.27 tons of VOC * 0.27 = 879,4629 tons VOC

VOC estimate for Piston Engine Air Taxis:

*Air taxi VOC estimate * piston engine fleet fraction = Piston powered VOC estimate*

Example: 3,257.27 tons of VOC * 0.73 = 2,377.81 tons VOC

VOC estimates were converted into TOG estimates using the following equations.

TOG estimate for Turbine Engine Air Taxis:

*Turbine VOC estimate * TOG/VOC conversion factor = TOG emission estimate*

Example: 879,4629 tons of VOC * 1.1347 TOG/VOC = 997.93 tons TOG

TOG estimate for Piston Engine Air Taxis:

*Piston VOC estimate * TOG/VOC conversion factor = TOG emission estimate*

Example: 2,377.81 tons of VOC * 1.0738 TOG/VOC = 2,553.29 tons TOG

For previous years, these TOG values were applied to the speciation profiles included in Table A-7 and A-8. The 1,3-butadiene, acetaldehyde, acrolein, benzene, formaldehyde, and styrene fractions of TOG for turbine and piston air taxis were provided by OTAQ (Cook, 1997). The

TOC/PM Speciation Data System (EPA, 1995) was used to provide toxic fractions for ethylbenzene, naphthalene (gas-phase), propionaldehyde, styrene, toluene, and xylene. Profiles 1099 and 1313 were used for air taxis with turbine engines and air taxis with piston engines, respectively. These toxics fractions were applied to the above TOG values using the following equation.

$$TOG_{x} * Speciation\ Profile_{xi} = HAP\ Emission\ Estimate_{xi}$$

Where:

x = Engine type (Turbine/Piston)
i = Pollutant
Speciation Profile_{xi} = TOG speciation fraction for engine type x and pollutant i (Tables A-7 and A-8)
Emission Estimate_{xi} = Emission estimate for engine type x and pollutant i

Example: 997.93 tons of TOG * 0.0157 1,3-butadiene fraction = 15,6674 tons of 1,3-butadiene

Table A-7. Previous HAP/TOG Speciation Profiles for Air Taxis with Turbine Engines

Pollutant	TOG Speciation profile
1,3-Butadiene	0.0157
Acetaldehyde	0.0432
Acrolein	0.0206
Benzene	0.0179
Ethylbenzene	0.0015
Formaldehyde	0.1414
Propionaldehyde	0.0090
Styrene	0.0037
Toluene	0.0049
Xylene	0.0044

Table A-8. Previous HAP/TOG Speciation Profiles for Air Taxis with Piston Engines

Pollutant	TOG Speciation profile
1,3-Butadiene	0.0098
Acetaldehyde	0.0062
Acrolein	0.0006
Benzene	0.0405
Ethylbenzene	0.0147
Formaldehyde	0.0269
n-hexane	0.0070
Propionaldehyde	0.0006
Styrene	0.0034
Toluene	0.1040
Xylene	0.0586

The previous emission estimates for PAH compounds were developed for individual species (Cook, 2001). For PAHs, the VOC estimate was speciated for turbine engines, while the PM_{10} estimate was speciated for piston engines (Cook, 2001). The PAH emissions were estimated for turbine powered aircraft based on the following equations, note that the derivation from the VOC estimate for turbine powered air taxis is shown below. Table A-9 has the PAH speciation profiles.

PAH equation for Turbine Powered Aircraft:

$$VOC_{Turbine} * Speciation\ Profile_{Turbine\ i} = HAP\ Emission\ Estimate_{Turbine\ i}$$

Where:

i	= PAH species
$VOC_{Turbine}$	= VOC estimate for turbine powered aircraft (TPY)
Speciation $Profile_{Turbine\ i}$	= VOC speciation profile for species i (Table A-9)
Emission $Estimate_{Turbine\ i}$	= Turbine emission estimate for PAH species i (TPY)

Example: Pyrene estimate for Turbine Aircraft

Pyrene emissions = 879,4629 tons of VOC * 1.03 E-06 pyrene fraction = 9.06E-04 tons of pyrene

Table A-9. Previous PAH/VOC Speciation Profiles for Air Taxis with Turbine Engines

Pollutant	VOC Speciation profile
Benzo(a)anthracene	6.10 E-08
Benzo(a)pyrene	3.34 E-08
Chrysene	5.68 E-08
Anthracene	4.03 E-07
Benzo(ghi)perylene	5.54E-09
Fluoranthene	8.43E-07
Naphthalene (solid-phase)	4.30E-04
Phenanthrene	3.75E-06
Pyrene	1.03E-06

PAH Equation for Piston Powered Aircraft:

For all years, the PM_{10} emission estimate for piston engine air taxis was calculated using the following equation which is based on the assumption that 73 percent of the air taxi fleet is powered by piston engine aircraft.

*Air taxi PM_{10} estimate * piston engine fleet fraction = PM_{10} emission from piston air taxis*

Example: 1,606.37 tons of PM_{10} * 0.73 = 1,172.65 tons PM_{10}

The PAH emissions were estimated for piston powered air taxis based on the following equations.

$$PM_{10\ Piston} * speciation\ profile_{Piston\ i} = emission\ estimate_{Piston\ i}$$

Where:

i	= PAH species
$PM_{10\ \mathrm{Piston}}$	= PM_{10} estimate for piston powered aircraft (TPY)
Speciation $\mathrm{profile}_{\mathrm{Piston\ i}}$	= PM_{10} speciation profile for species i (Table A-10)
Emission $\mathrm{estimate}_{\mathrm{Piston\ i}}$	= Piston emission estimate of PAH species i (TPY)

Example: Pyrene estimate for Piston Aircraft

Pyrene emissions = 1,172.6 tons of $PM_{10\ \mathrm{Piston}}$ * 1.24 E-3 Pyrene Fraction = 1.45 Tons of Pyrene

Table A-10. Previous PAH/PM Speciation Profile for Air Taxis with Piston Engines

Pollutant	PM Speciation profile
Benzo(a)anthracene	1.00E-04
Benzo(a)pyrene	1.00E-04
Benzo(b)fluoranthene	1.20E-04
Benzo(k)fluoranthene	1.20E-04
Chrysene	1.00E-04
Indeno(1,2,3-cd)pyrene	8.00E-05
Acenaphthene	7.30E-04
Acenaphthylene	4.12E-03
Anthracene	8.50E-04
Benzo(ghi)perylene	2.60E-04
Fluoranthene	9.10E-04
Fluorene	1.51E-03
Naphthalene (solid phase)	9.07E-02
Phenanthrene	2.54E-03
Pyrene	1.24E-03

Since there were no speciation profiles for turbine engines for benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h,)anthracene, indeno(1,2,3-cd)pyrene, acenaphthene, acenaphthylene and fluorene, speciation profiles were developed only for piston engines for these pollutants.

General Aviation

For GA, activity data were taken from the FAA Air Traffic and Activity Data System (DOT, 2001b). In this reference, each activity unit (i.e., a landing or take-off) is counted. For every LTO there are two activities ("landing" and "take-off"); therefore, the FAA activity data were divided by two to estimate LTOs.

Example: *21,065,511 FAA aircraft operations / 2 = 10,532,755.5 LTOs*

To estimate GA emissions, these LTO data were applied to generic critiera GA emission factors (see Table A-11) using the following equations.

Example: *GA LTOs * criteria emission factor = criteria emission estimate*

Example: 10,532,755 LTOs * 0.394 pounds HC/LTO * 1 ton/2,000 pounds = 2,074.95 tons of HC

The criteria emission factors for HC, NO_x, CO, and SO_x for GA were obtained from the EPA's *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources* (EPA, 1992). PM emission factors for GA were obtained from EPA's *National Air Pollution Emission Trends, Procedures Document for 1900-1996* (EPA, 1997). $PM_{2.5}$ emissions were derived by assuming 69% of PM_{10} is $PM_{2.5}$, as noted in the 1998 NET.

Table A-11. Pollutant Specific Emission Factors for General Aviation for All Years

Pollutant	Emission Factor (lbs/LTO)
HC	0.394
NO_x	0.065
CO	12.014
SO_x	0.01
PM_{10}	0.2367

For the 2002 Emission Inventory HAP emissions were estimated using the speciation profiles noted in Table A-12.

A VOC/HC conversion factor from *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources* (EPA, 1992) was applied to the GA HC emission estimate to obtain a VOC estimate.

*GA HC emissions * VOC/HC conversion factor = GA VOC estimate*

Example: 2,074.95 tons of HC * 0.9708 VOC/HC = 2,014.36 tons of VOC

Table A-12. 2002 General Aviation Speciation Profiles

Pollutant	Turbine	Piston	Speciation Type
1,3-Butadiene	0.019291483	0.01198001	HC
2,2,4-Trimethylpentane	0.00043788	0.00043788	HC
Acenaphthene	0	0.00073	PM10
Acenaphthylene	0	0.00412	PM10
Acetaldehyde	0.05280984	0.00757919	HC
Acrolein	0.02518247	0.00073347	HC
Anthracene	4.41164E-07	0.00085	PM10
Benz[a]Anthracene	6.67767E-08	0.0001	PM10
Benzene	0.021881855	0.049509225	HC
Benzo[a]Pyrene	3.6563E-08	0.0001	PM10
Benzo[b]Fluoranthene	0	0.00012	PM10
Benzo[g,h,i,]Perylene	6.06464E-09	0.00026	PM10
Benzo[k]Fluoranthene	0	0.00012	PM10
Chrysene	6.2179E-08	0.0001	PM10
Ethyl Benzene	0.001833675	0.017970015	HC
Fluoranthene	9.22832E-07	0.00091	PM10
Fluorene	0	0.00151	PM10
Formaldehyde	0.17285443	0.032883905	HC
Hexane	0	0.00855715	HC
Indeno[1,2,3-c,d]Pyrene	0	0.00008	PM10
Naphthalene	0.000470721	0.0907	PM10
Naphthalene (Gas)	0.00558297	0.00558297	HC
Phenanthrene	4.10513E-06	0.00254	PM10
Propionaldehyde	0.01100205	0.00073347	HC
Pyrene	1.12754E-06	0.00124	PM10
Styrene	0.004523065	0.00415633	HC
Toluene	0.005990005	0.1271348	HC
Xylenes (Mixture of o, m, & p Isomers)	0.00537878	0.07163557	HC

For previous years, to estimate 1,3-butadiene, acetaldehyde, acrolein, benzene, formaldehyde, ethylbenzene, n–hexane, propionaldehyde, styrene, toluene, and xylene for GA, it was necessary to convert VOC to TOG as the speciation profiles were provided in terms of TOG. For all years, OTAQ provided separate correction factors for GA powered by piston and turbine engines (Cook, 1997). Therefore, the VOC estimates needed to be disaggregated into turbine and piston powered aircraft as noted in the following equations based on the assumption that 94 percent of the GA fleet are powered by piston engines and 6 percent of the fleet are powered by turbine engines (Cook, 1997).

VOC estimate for GA Turbine Engine:

*GA VOC estimate * turbine fleet fraction = turbine powered VOC estimate*

Example: 2,014.36 tons of VOC * 0.06 = 120.86 tons VOC

VOC estimate for GA Piston Engine:

*GA VOC estimate * piston engine fleet fraction = piston powered VOC estimate*

Example: 2,014.36 tons of VOC * 0.94 = 1,893.50 tons VOC

VOC estimates were converted into TOG estimates using the following equations.

TOG estimate for GA Turbine Engine:

*Turbine VOC estimate * TOG/VOC conversion factor = TOG emission estimate*

Example: 120.86 tons of VOC * 1.1347 TOG/VOC = 137.14 tons TOG

TOG estimate for GA Piston Engine:

*Piston VOC estimate * TOG/VOC conversion factor = TOG emission estimate*

Example: 1,893.50 tons of VOC * 1.0738 TOG/VOC = 2,033.24 tons TOG

For previous years, these TOG values were applied to the speciation profiles included in Tables A-13 and A-14. The 1,3-butadiene, acetaldehyde, acrolein, benzene, formaldehyde, and styrene fractions of TOG for turbine and piston GA were provided by OTAQ (Cook, 1997). The *TOC/PM Speciation Data System* (EPA, 1995) was used to provide toxics fractions for ethylbenzene, propionaldehyde, styrene, toluene and xylene. Profiles 1099, Aircraft Landing and Takeoff (LTO)-GA, and profile 1313, Average Exhaust from a Light Duty Gasoline Vehicle Operating on Industry Average Gasoline, were used for turbine engine GA and piston engine GA, respectively. These toxic fractions were applied to the above TOG values using the following equation.

$$TOG_x * speciation\ profile_{xi} = HAP\ emission\ estimate_{xi}$$

Where:

x = Engine type (Turbine/Piston)
i = Pollutant
Speciation $profile_{xi}$ = Speciation fraction for engine type x and pollutant i (Table A-11 and Table 12)
Emission $estimate_{xi}$ = Emission estimate for engine type x and pollutant i

Example: 293.31 tons of TOG * 0.0157 1,3-butadiene fraction = 4.6 tons of 1,3 butadiene

Table A-13. Previous HAP/TOG Speciation Profiles for General Aviation with Turbine Engines

Pollutant	TOG Speciation profile
1,3-butadiene	0.0157
Acetaldehyde	0.0432
Acrolein	0.0206
Benzene	0.0179
Ethylbenzene	0.0015
Formaldehyde	0.1414
Propionaldehyde	0.0090
Styrene	0.0037
Toluene	0.0049
Xylene	0.0044

Table A-14. Previous HAP/TOG Speciation Profiles for General Aviation with Piston Engines

Pollutant	TOG Speciation profile
1,3-butadiene	0.0098
Acetaldehyde	0.0062
Acrolein	0.0006
Benzene	0.0405
Ethylbenzene	0.0147
Formaldehyde	0.0269
N-hexane	0.0070
Propionaldehyde	0.0006
Styrene	0.0034
Toluene	0.1040
Xylene	0.0586

The previous emission estimates for PAH compounds from GA were developed for individual species (Cook, 2001). For PAHs, the VOC estimate was speciated for turbine engines, while the PM_{10} estimate was speciated for piston engines (Cook, 2001). The PAH emissions were estimated for turbine powered aircraft based on the following equations, note that the derivation of the VOC estimate for turbine powered GA is noted above.

PAH Equation for Turbine Powered Aircraft:

$$VOC_{Turbine} * speciation\ profile_{Turbine\ i} = HAP\ emission\ estimate_{Turbine\ i}$$

Where:

i = PAH species
$VOC_{Turbine}$ = VOC estimate for turbine powered aircraft (TPY)
speciation $\text{profile}_{\text{Turbine i}}$ = VOC speciation profile for species i (Table A-15)
emission $\text{estimate}_{\text{Turbine i}}$ = Turbine emission estimate for PAH species i (TPY)

Example: Pyrene emissions from Turbine Powered GA

Pyrene emissions = 258.49 Tons of VOC * 1.03 E-6 pyrene fraction = 2.662 E-4 tons of pyrene

Table A-15. Previous PAH/VOC Speciation Profile for General Aviation with Turbine Engines

Pollutant	VOC Speciation profile
Benzo(a)anthracene	6.10 E-08
Benzo(a)pyrene	3.34 E-08
Chrysene	5.68 E-08
Anthracene	4.03 E-07
Benzo(ghi)perylene	5.54E-09
Fluoranthene	8.43E-07
Naphthalene	4.30E-04
Phenanthrene	3.75E-06
Pyrene	1.03E-06

PAH Equation for Piston Powered Aircraft:

For the previous inventory, the PM_{10} emission estimate for piston engine GA was calculated using the following equation which is based on the assumption that 94 percent of the GA fleet is powered by piston engine aircraft.

$$GA\ PM_{10}\ estimate * piston\ fleet\ fraction = PM_{10}\ emission\ from\ piston\ GA$$

Example: 1,246.55 tons of PM_{10} * 0.94 = 1,171.76 tons PM_{10}

The PAH emissions were estimated for piston powered GA based on the following equations.

$$PM_{10\ Piston} * speciation\ profile_{Piston\ i} = HAP\ emission\ estimate_i$$

Where:

i	= PAH Species
$PM_{10\ Piston}$	= PM_{10} Estimate for Piston Powered Aircraft (TPY)
speciation $profile_{piston\ i}$	= PM_{10} speciation profile for Species i (Table A-16)
emission $estimate_{piston\ i}$	= Piston Emission Estimate of PAH Species i (TPY)

Example: 1,171.76 tons of $PM_{10\ Piston}$ * 1.24 E-3 pyrene fraction = 1.45 tons of pyrene

Table A-16. Previous PAH/PM Speciation Profile for General Aviation with Piston Engines

Pollutant	PM Speciation profile
Benzo(a)anthracene	1.00E-04
Benzo(a)pyrene	1.00E-04
Benzo(b)fluoranthene	1.20E-04
Benzo(k)fluoranthene	1.20E-04
Chrysene	1.00E-04
Indeno(1,2,3-cd)pyrene	8.00E-05
Acenaphthene	7.30E-04
Acenaphthylene	4.12E-03
Anthracene	8.50E-04
Benzo(ghi)perylene	2.60E-04
Fluoranthene	9.10E-04
Fluorene	1.51E-03
Naphthalene	9.07E-02
Phenanthrene	2.54E-03
Pyrene	1.24E-03

Since there were no speciation profiles for turbine engines for the compounds benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h,)anthracene, indeno(1,2,3-cd)pyrene, acenaphthene, acenaphthylene and fluorene, speciation profiles were used only for piston engines for these pollutants.

Military Aircraft

For military aircraft, activity data were taken from the FAA Air Traffic and Activity Data System (DOT, 2001b). In this reference, each activity (i.e., a landing or take-off) is counted. For every LTO there are two activities ("landing" and "take-off"); therefore, the FAA activity data were divided by two to estimate LTOs.

Example: *3,525,606 FAA aircraft operations / 2 = 1,762,803 LTOs*

Currently, there are no generic SIP criteria emission factors developed specifically for military aircraft, therefore the military LTO data were applied to generic SIPcriteria emission factors for air taxi using the following equations:

*Military LTOs * emission factor = emission estimate*

Example: 1,762,803 LTOs*1.234 pounds HC/LTO*1 ton/2,000 pounds=1,087.65 tons of HC

The criteria emission factors for HC, NO_x, CO, and SO_x for air taxis were obtained from the EPA's *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources* (EPA, 1992)(see Table A-17). PM emission factors for air taxis were obtained from EPA's *National Air Pollution Emission Trends, Procedures Document for 1900-1996* (EPA, 1997). $PM_{2.5}$ emissions were estimated by applying the same national percentage of $PM_{2.5}$ to PM_{10} that existed in the 1998 NET.

A VOC/HC conversion factor from *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources* (EPA, 1992) was applied to the military HC emission estimate to obtain a VOC estimate.

*Military HC emissions * VOC/HC conversion factor = Military VOC estimate*

Example: 1,087.65 tons of HC * 1.1046 VOC/HC = 1,201.42 tons of VOC

Table A-17. Pollutant Specific Emission Factors for Military Aircraft for All Years

Pollutant	Emission Factor (lbs/LTO)
HC	1.234
NO_x	0.158
CO	28.13
SO_x	0.015
PM_{10}	0.60333

Estimates for HAPs for military aircraft were not possible due to the lack of information concerning the make up of the military aircraft fleet and lack of available HAP emission factors and profiles.

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Appendix B

Commercial Marine Vessels Emission Estimation Methodology

Criteria Pollutant Emission Estimates

The criteria pollutant emission estimates for marine vessels were handled differently for diesel and steam-powered vessels. For diesel-powered vessels emission estimates used in the recent marine diesel regulatory background documentation were used in this inventory effort (*Draft Regulatory Impact Analysis Control of Emissions from Compression Ignition Marine Engines, EPA 1998*). The regulatory inventory was developed for the year 2000. The 2000 estimates where used directly in the NEI. To approximate emissions for 1999, the 2000 estimates were adjusted based on the growth factor (i.e., 0.5%) used in the diesel marine vessels regulatory background documents (See Table B-1). Fuel data for CMVs were obtained from DOE's Distillate Fuel Oil Vessel Bunkering Adjusted Sales data from the *1999 Fuel Oil and Kerosene Sales* Report published by the Energy Information Administration (EIA) of the Department of Energy (DOE). These data were converted from thousand gallons to tons. EPA provided fuel usage data in tons per year for diesel vessels that combusted residual fuel and steamships that operated on only residual fuel. From these data, percentages were calculated to determine the portion of vessel bunkered fuels each represented. These proportions were used to allocate bunkered fuel to vessel/fuel types for the other inventory years included in this effort.

Table B-1. Criteria Emission Estimates for Marine Diesel Engines (thousand short tons/year)

Base Year	Pollutant			
	VOC	NOx	PM	CO
2000	31.45	1,005.70	42.30	132.60
1999	31.29	1,000.67	42.09	131.94

For steam-powered vessels, also referred to as residual fueled vessels, fuel data were derived by OTAQ using data obtained form the diesel marine regulatory impact analysis. These fuel data were combined with available EPA emission factors recommend in ***Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources*** (US EPA, 1989) (See Table B-2) using the following equation.

Fuel consumption (1,000 gal/yr) x criteria emission factor (lb/1,000 gal) = criteria emission estimate lb/yr

Example: 82,808,405.51 gal of residual fuel/yr x 25.8 lbs PM_{10} /1,000 gal = 1,068 tons PM_{10}/yr

Table B-2. Emission Factors (lb/1,000 gal of fuel)

	Pollutant			
Base Year	**VOC**	**NOx**	**PM_{10}**	**CO**
Steamship	1.27	54.45	25.8	3.7

A similar approach was also used for diesel SO_2 emission estimates, where national diesel fuel usage was combined with sulfur concentration of marine diesel fuel and the EPA emission factors included in *Volume IV*. For the purpose of this study, fuel sulfur concentrations were assumed to be 0.25% for diesel fuel and 2.7% for residual fuel.

Note that $PM_{2.5}$ emissions were estimated by using the assumption made in TRENDS calculations that 92% of PM_{10} is $PM_{2.5}$.

HAP Emission Estimates

Marine diesel engines are able to use distillate, residual or a mixture of distillate and residual fuels. In developing the national criteria estimate for marine diesel engines, the EPA took this into consideration. Since the portions of residual fuel used in marine diesel engines needed to be handled separately in calculating HAP emissions, the EPA provided fuel usage estimates for three categories of CMV's - marine diesel engines that use distillate fuel, marine diesel engines that use residual fuel, and steamships that use residual fuel.

For diesel marine vessels using diesel fuel, speciation profiles developed for heavy-duty diesel vehicles (HDDV) were used to estimate emissions of 2, 2, 4-trimethylpentane, acetaldehyde, acrolein, benzene, ethylbenzene, formaldehyde, n-hexane, propionaldehyde, styrene, toluene, chromium, manganese, and nickel. The HDDV speciation profiles were obtained from information provided in *Evaluation of Factors That Affect Diesel Exhaust Toxicity* (Truex and Norbeck, 1998). The values given in this reference are in milligrams per brake horsepower-hours (mg/Bhp-hr). Speciation profiles were derived from these factors by using the following equation.

HAP hp-hr emission factor/VOC hp-hr emission factor = HAP/VOC speciation profile

Example: 2.14 acrolein weighted total (mg/Bhp-hr) / 604.91 (mg/Bhp-hr) VOC weighted total = 0.0035 tons acrolein/ton VOC

Note, chromium emissions were split into hexavalent and trivalent chromium based on an assumption that 34% of total chromium was hexavalent and the remaining 66% was trivalent.

The speciation profiles were applied to the VOC and PM_{10} emission estimates to calculate the associated HAP emissions using the following equation. This approach was also used for diesel marine engines using residual fuel to estimate organic HAP emissions. Table B-3 below lists the speciation profiles used to calculate the diesel HAP emissions.

$$VOC/PM_{10/2.5} * speciation\ profile_i = HAP\ emission\ estimate:$$

Where:

HAP emission estimate	= HAP Emission estimate (tons/year) for pollutant:
$VOC/PM_{10/2.5}$	= VOC or PM emission estimate (tons/year)
speciation $profile_i$	= VOC or PM speciation fraction for pollutant i (Tables B-3, B-4)

Table B-3. Diesel-powered Vessel Speciation Profiles

Pollutant	VOC Speciation profile
Acetaldehyde	0.074298
Acrolein	0.0035
Benzene	0.020344
Ethylbenzene	0.0020
Formaldehyde	0.1496
n-Hexane	0.0055
Propionaldehyde	0.0061
Styrene	0.0021
Toluene	0.0032
Xylene	0.0048
2, 2, 4-Trimethylpentane	0.0004
Pollutant	**PM_{10} Speciation profile**
Chromium	3.27E-06
Manganese	2.04E-06
Nickel	6.55E-06

Speciation profiles were developed for diesel marine engines using diesel fuel for the individual compounds that make up 16-PAH (Cook, 2001). Total $PM_{2.5}$ emissions were speciated for each of these compounds. $PM_{2.5}$ national level emissions were obtained by multiplying PM_{10} emissions by 92 percent. This approach was also used for diesel engines using residual fuel. Table B-4 lists the diesel speciation profiles for the PAH compounds.

Table B-4. Diesel-powered Vessel Speciation Profiles for 16-PAH Compounds

Pollutant	$PM_{2.5}$ Speciation profile
Benzo(a)anthracene	0.00004
Benzo(a)pyrene	0.000013
Benzo(b)fluoranthene	0.000011
Benzo(k)fluoranthene	0.000011
Chrysene	0.000007
Indeno(1,2,3-cd)pyrene	0.000001
Acenaphthene	0.000024
Acenaphthylene	0.000037

Table B-4. Diesel-powered Vessel Speciation Profiles for 16-PAH Compounds (Continued)

Pollutant	$PM_{2.5}$ Speciation profile
Anthracene	0.000037
Benzo(ghi)perylene	0.000009
Fluoranthene	0.000022
Fluorene	0.000049
Naphthalene	0.001401
Phenanthrene	0.000056
Pyrene	0.000039

Lead emissions from diesel marine engines fueled with diesel fuel were calculated using the following fuel-based emission factor included in the following equations.

$$\textit{Lead emissions} = \textit{Fuel usage} * \textit{Emission factor}$$

Example: lead emissions from diesel CMV

1.3E-06 lbs/gal * 2,064,590,000 gal/year = 2,683.97 lb lead/year

Given that HAP speciation profiles or emission factors have yet to be developed for steamships that use residual fuel, the emission factors that were used in this effort were derived from stationary industrial and commercial boilers. These boiler emission factors were obtained from the US EPA ICCR program (Porter, 1998; US EPA, 1996) and converted from lb/MMBtu to lb/gallon using a conversion factor of 140,0000 Btu/gallon. To estimate the steam-powered vessel emissions, the pollutant specific emission factors listed in Table B-5 were multiplied by the national steamship fuel data provided by the EPA as noted in the equation below. This approach was also used to estimate metal and PAH emissions from diesel powered vessels using residual fuel.

$$EF_{(HAP)} * \textit{ National Residual Oil Sales } = \textit{National Emissions for HAP}$$

Example: 1.05E-7 tons of benzene/1000 gal x 82,808.4 1,000 gal of residual fuel = 0.01 tons of benzene

Total chromium emissions were speciated into trivalent and hexavalent chromium based on the assumption that 66% of the total chromium was trivalent chromium and 34% of the total chromium was hexavalent chromium.

Table B-5. Steam-powered Vessel HAP Emission Factors

Pollutant	Emission factor (tons/1000 gallons)
Acetaldehyde	2.45E-06
Benzene	1.05E-07
Formaldehyde	1.68E-05
POM as 7-PAH	5.81E-09
POM as 16-PAH	5.88E-07
Beryllium	1.40E-08
Cadmium	1.96E-07
Chromium	4.20E-07
Lead	7.70E-07
Manganese	1.47E-06
Nickel	4.20E-05
Selenium	3.43E-07

The national emission estimates were disaggregated into port and underway emissions using the assumptions in *Volume IV*, that 75% of distillate fuel and 25% of residual fuel are consumed within the port area and the remaining emissions occur while the ship is underway. The national port emissions were assigned to the largest 150 ports based on the amount of freight handled as documented in *Waterborne Commerce of the United States, Part 5 – Waterways and Harbors National Summaries* (COE, 2001). The data may also be obtained from the following website http://www.iwr.usace.army.mil/ndc/wcsc/pdf/wcusnatl99.pdf. The traffic from the 150 ports listed was summed and applied to the individual port traffic totals to calculate the percentage of national traffic attributed to each port. These percentages were then applied to the national estimates to determine the port-level emissions.

Underway emissions were calculated by using a GIS dataset from the Department of Transportation which identified shipping lanes and estimated shipping activity in terms of ton miles. The shipping lanes with legitimate codes that could be matched to a county border were calculated. 91.6 percent of the tonnage miles for shipping lanes could be matched to a county in the United States. The county level tonnage miles were divided by the total shipping lanes in the United States, and then multiplied by the percentage of matching shipping lanes (91.6 percent) and the national level estimates for each pollutant to get a county level distribution as noted in the equation below.

*County X emissions = (0.916 *(∑ County level of shipping tons length / ∑ US shipping lanes with legitimate waterway codes and intersect county borders, including boundaries)) * Pollutant specific national level emissions estimate*

For those shipping lanes that could not be matched to a county border (8.4 percent), the state level shipping lanes in tonnage miles was divided by the total number of shipping lanes in tonnage miles and multiplied by the remaining 8.4 percent of emissions for each pollutant to get a county level allocation of non-matching emissions.

It is recognized that there are some inconsistencies with the BTS GIS data for other inventory years, therefore the 1999 weight factors are used in all inventory years until BTS had revised their GIS data files.

*County X emissions = (0.084 * (∑ State level shipping lanes in tons length) / ∑ Total shipping lanes in tons length) * Remaining emissions for each pollutant)*

Emissions for matched and unmatched shipping lanes were combined to estimate a county's total underway CMV emissions. County total CMV emissions combine the underway and port emission estimates.

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Appendix C

Locomotive Emission Estimation Methodology

Locomotive Emissions Estimating Methods

For the criteria pollutants, US distillate fuel oil sales (in gallons) for railroads was obtained from the Department of Energy (EIA, 2000) and EPA/OTAQ (EPA, 2003) and disaggregated into different railroad categories (e.g., Class I, Class II/III, commuter, and passenger), by dividing the EIA's national rail fuel data with SCC ratios calculated from data obtained by the U.S. EPA/OTAQ (Scarboro, 2002). Fuel data for 2001 was not available at the time the inventory was being developed, therefore, fuel data for the previous six years (i.e., 1995-2000) were averaged to approximate fuel usage for 2001. Fuel usage for 2002 was provided by EPA/OTAQ and is derived from DOE data. Fuel use associated with work trains were excluded in these fuel estimates to avoid double counting with railroad maintenance estimates included in the other nonroad source category. Note, California uses a low sulfur fuel which is different than typical railroad fuel; therefore, the California state emission estimates, though similar to the national emission estimates are calculated separately.

SCC Ratio = Railroad Category Fuel Use/Total National Fuel Use

Example: Line-haul Class I Ratio for US

Class I ratio = 3,468,220,900 gallons / 4,101,778,200 gallons = 0.8455

CO, NO_x, and PM emissions were calculated by multiplying fuel-based emission factors (see Table C-1) with the national railroad fuel sales data by SCC.

*Emission estimate = fuel data (gal/yr) * emission factor (g/gal)*

Example: National (excluding CA) Line Haul Class I CO estimate (tons/yr) = 2,508,718,766 gal/yr * 266 g CO/gal = 73,558.59 tons

VOC emissions were calculated by multiplying the emission factor for hydrocarbons with the fuel sales data and then converting the hydrocarbons into VOC using a conversion factor (U.S. EPA, 1992) as shown in the following equation.

*VOC = fuel(gal/yr) * emission factor (g HC/gal) *VOC/HC conversion factor*

Example: National Line Haul Class I (excluding CA) VOC = 2,508,718,766 gal/yr * 10 g HC/gal * 1.005 VOC/HC

= 27,791.87 tons VOC/yr

Table C-1. Criteria Pollutant Emission Factors

Pollutant	SCC	Emission Factor	Reference
VOC	2285002006	10 gram/gallon	(U.S. EPA 1997)
VOC	2285002007	10 gram/gallon	(U.S. EPA 1997)
VOC	2285002010	21 gram/gallon	(U.S. EPA 1997)
VOC	2285002009	10 gram/gallon	(U.S. EPA 1997)
VOC	2285002008	10 gram/gallon	(U.S. EPA 1997)
VOC/HC	All	1.005 VOC/HC	(U.S. EPA 1992)
CO	2285002006	26.6 gram/gallon	(U.S. EPA 1997)
CO	2285002007	26.6 gram/gallon	(U.S. EPA 1997)
CO	2285002010	38.1 gram/gallon	(U.S. EPA 1997)
CO	2285002009	26.6 gram/gallon	(U.S. EPA 1997)
CO	2285002008	26.6 gram/gallon	(U.S. EPA 1997)
NO_x	2285002006	270 gram/gallon	(U.S. EPA 1997)
NO_x	2285002007	270 gram/gallon	(U.S. EPA 1997)
NO_x	2285002010	362 gram/gallon	(U.S. EPA 1997)
NO_x	2285002009	270 gram/gallon	(U.S. EPA 1997)
NO_x	2285002008	270 gram/gallon	(U.S. EPA 1997)
PM_{10}	2285002006	6.7 gram/gallon	(U.S. EPA 1997)
PM_{10}	2285002007	6.7 gram/gallon	(U.S. EPA 1997)
PM_{10}	2285002010	9.2 gram/gallon	(U.S. EPA 1997)
PM_{10}	2285002009	6.7 gram/gallon	(U.S. EPA 1997)
PM_{10}	2285002008	6.7 gram/gallon	(U.S. EPA 1997)
$PM_{2.5}$	2285002006	6.03 gram/gallon	(U.S. EPA 1997)
$PM_{2.5}$	2285002007	6.03 gram/gallon	(U.S. EPA 1997)
$PM_{2.5}$	2285002010	8.28 gram/gallon	(U.S. EPA 1997)

Table C-1. Criteria Pollutant Emission Factors (Continued)

Pollutant	SCC	Emission Factor	Reference
$PM_{2.5}$	2285002009	6.03 gram/gallon	(U.S. EPA 1997)
$PM_{2.5}$	2285002008	6.03 gram/gallon	(U.S. EPA 1997)
SO_x (U.S. excluding CA)	All	16.88 gram/gallon	(Scarbro, 2002)
SO_x (California)	All	0.75 gram/gallon	(Scarbro, 2002)

The SO_2 emission factor was developed by multiplying the percent sulfur content in fuel, 0.27% for the U.S. except CA, and 0.012% for CA (Scarboro, 2002), by the molecular weight of SO_2, and by the density of the diesel fuel, which is 7.05 lbs/gallon (U.S. EPA, 1995), and by a conversion factor, 0.97753, (Scarboro, 2002) as noted in the equations below.

SO_2 emission factor = fuel sulfur concentration(weight %) fuel density (lbs/gal)* molecular weight of SO_2 * conversion factor*

Example: National (excluding CA) SO_x emission factor = 0.0027 * 7.05 lbs/gal * 2 * 0.97753 = 16.88 g SO_x/gal

These emission factors are included in Table C-1 for California and all states excluding California. These emission factors were applied to railroad fuel sales data in the same fashion as the other criteria estimates.

To calculate locomotive emission estimates for many metal HAPs, emission factors (Table C-2) were multiplied by the fuel oil data as noted in the following equation.

*HAP emissions = rail fuel usage (gal/yr) * emission factor (lb of HAP/gal)*

Example: Line Haul Class I Cadmium emission = 2,508,718,766 gal/yr * (4.2E-7) lb Cadmium/gal = 0.5268 tons Cadmium / year

Table C-2. Additional HAP Emission Factors

Pollutant	Emission Factor (lbs/gallon)	Reference
Beryllium	4.2E-07	(Porter, 1998)
Cadmium	4.2E-07	(Porter, 1998)
Lead	1.3E-06	(Porter, 1998)

A number of HAP locomotive emission factors were available by locomotive engine type: 2-stroke and 4-stroke (Table C-3). To use these emission factors in this inventory, the factors were combined into a composite emission factor based on the percent of 2-stroke and 4-stroke engines in operation in the United States (68.4% 2-stroke and 31.6% 4-stroke (U.S. EPA, 1998)). These composite factors were applied to the railroad fuels sales data as noted in the equation below.

*HAP emission = fuel (gal/yr) * (2-stroke emission factor (HAP g/gal) * percent 2-stroke +*
*4-stroke emission factor (HAPg/gal) * percent 4-stroke)*

Example: Railroad Acrolein emissions for all states except California (Line Haul Class I)

Acrolein emission estimate = 2,508,718,766 gal/yr * (0.684*0.0374 +0.316*0.0179) Acrolein g/gal = 86.392 tons Acrolein/yr

Table C-3. HAP Emission Factors for 2-stroke and 4-stroke Components

Pollutant	2-stroke Emission Factor (U.S. except CA)	4-stroke Emission Factor (U.S. except CA)	2-stroke Emission Factor (CA)	4-stroke Emission Factor (CA)	Reference
	grams/gallon				
1,3 Butadiene	0.02836	0.0413511	0.0246138	0.0349507	(Fritz, 2000)
Acetaldehyde	0.206756	0.1469518	0.2106938	0.1886544	(Fritz, 2000)
Acrolein	0.037413	0.0178725	0.0374129	0.0417025	(Fritz, 2000)
Benzene	0.018903	0.0409082	0.0147683	0.0422983	(Fritz, 2000)
Chromium	3.36E-05	5.864E-05	7.871E-05	4.387E-05	(Fritz, 2000)

Table C-3. HAP Emission Factors for 2-stroke and 4-stroke Components (Continued)

Pollutant	2-stroke Emission Factor (U.S. except CA)	4-stroke Emission Factor (U.S. except CA)	2-stroke Emission Factor (CA)	4-stroke Emission Factor (CA)	Reference
	grams/gallon				
Formaldehyde	0.454862	0.3852521	0.4194185	0.4487989	(Fritz, 2000)

Note: Chromium was later speciated into Chromium III and Chromium VI using the ratios 0.66 and 0.34 respectively.

California HAP emission estimates were calculated separately because a different railroad fuel has been used in California since 1995. There are different HAP emission factors associated with California's railroad fuel.

For other HAPs, speciation profiles (Table C-4 and C-5) were applied toVOC or PM_{10} emission estimates as noted below.

HAP/VOC Speciation

*HAP = VOC estimate (tons/year) * speciation profile (tons HAP/tons VOC)*

Example: Line Haul Class I styrene emissions

27,791.87 tons/yr VOC *0.0021 tons Styrene/VOC = 58.363 tons Styrene/yr

HAP = PM_{10} estimate (tons/yr) * speciation profile (tons HAP/tons PM_{10})

HAP/PM Speciation

Example: Line Haul Class I Chrysene emissions for all U.S. states except California

18,527.92 tons PM_{10}/yr * 0.0000119 tons Chrysene/ ton PM_{10} = 0.220 tons Chrysene /yr

Table C-4. HAP Speciation Profiles

Pollutant	Speciation Profile		Reference
2,2, 4 Trimethylpentane	0.00224	tons/VOC	Censullo, 1991, Newkirk and Bass 1995
Ethylbenzene	0.002	tons/VOC	(Truex, 1998)
n-Hexane	0.0055	tons/VOC	(Truex, 1998)
Propionaldehyde	0.0061	tons/VOC	(Truex, 1998)
Styrene	0.0021	tons/VOC	(Truex, 1998)
Toluene	0.0032	tons/VOC	(Truex, 1998)
Xylene	0.0048	tons/VOC	(Truex, 1998)
Manganese	2.04E-06	tons/PM_{10}	(Truex, 1998)
Nickel	6.55E-06	tons/PM_{10}	(Truex, 1998)

Table C-5. Separate Hazardous Air Pollutant Speciation Profiles for U.S and CA

Pollutant	Speciation Profile (U.S. except CA) (ton/PM_{10})	Speciation Profile (CA) (ton/PM_{10})	Reference
Benzo(a)anthracene	0.0000160	0.0000121	(Scarbro, 2001)
Benzo(a)pyrene	0.0000027	0.0000044	(Scarbro, 2001)
Benzo(b)fluoranthene	0.0000064	0.0000044	(Scarbro, 2001)
Benzo(k)fluoranthene	0.0000052	0.0000044	(Scarbro, 2001)
Chrysene	0.0000119	0.0000092	(Scarbro, 2001)
Dibenz(a,h)anthracene	0.0000000	0.0000000	(Scarbro, 2001)
Indeno(1,2,3-cd)pyrene	0.0000027	0.0000033	(Scarbro, 2001)
Acenaphthene	0.0000306	0.0000080	(Scarbro, 2001)
Acenaphthalene	0.0004275	0.0002182	(Scarbro, 2001)
Anthracene	0.0001009	0.0000535	(Scarbro, 2001)
Benzo(ghi)perylene	0.0000031	0.0000044	(Scarbro, 2001)
Fluoranthene	0.0000746	0.0000601	(Scarbro, 2001)
Fluorene	0.0001407	0.0000619	(Scarbro, 2001)
Napthalene	0.0025756	0.0018505	(Scarbro, 2001)
Phenanthrene	0.0005671	0.0002822	(Scarbro, 2001)
Pyrene	0.0001054	0.0000771	(Scarbro, 2001)

Where speciation profiles were available that characterized California railroad fuels these profiles were used to estimate emissions for California only. If California-specific speciation profiles were not available for a specific pollutant, then the speciation profiles included in Table C-4 were used to estimate California's emissions.

Emissions were spatially allocated to individual counties based on the railroad traffic data provided by the Department of Transportation. Because California uses a different locomotive fuel, its emission estimates were allocated separately.

The activity data for each county was then divided by the total activity by railroad type, to develop the county ratio, as noted in the following equation.

County ratio by SCC = county SCC activity level / total SCC activity

Example: FIP State 0X County 00Y for Class I railroad
Class I county length density for 0X-00Y = 2125.925
US Class I total length density = 5155468

County activity level / national activity level
2125.925 length-density / 5155468 Class I length-density = 0.000412

These county ratios were applied to the national locomotive estimates to apportion the emissions to the county level as noted in the equation below.

*County pollutant emission by SCC = National - CA pollutant emission * SCC ratio * county ratio by SCC*

Example: State 01 County 001 Acrolein Class I line-haul emissions

Acrolein estimates for class I rail in county 01-001 = (113.799 ton/yr - 11.625 ton/yr) *0.8455 * 0.000412 = 0.0356 ton/year

Total chromium emissions were speciated into trivalent and hexavalent chromium based on the assumption that 66% of the total chromium was trivalent chromium and 34% of the total chromium was hexavalent chromium.

The national level emissions were then allocated to the county-level based on GIS rail activity data provided by the U.S. Department of Transportation (Bureau of Transportation). It is recognized that there are some inconsistencies with the BTS GIS data for other inventory years, therefore, the 1999 weight factors were used for all inventory years until BTS had revised their GIS data files.

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Appendix D

Other Nonroad Mobile Sources Emission Estimating Methods and Data

Other Nonroad Mobile Source Emission Estimates Methods

In this inventory effort, VOC and PM emission estimates obtain from the NONROAD ("Lockdown (May 2002)" version) model run, were speciated into the HAP components. In speciating the NONROAD output it is necessary to take into consideration the fact that counties use different fuels which have different HAP speciation profiles for each of the different nonroad equipment.

In order to develop the most accurate other nonroad emission estimates, it was critical to create an appropriate set of speciation profiles for each county that reflects the different fuels used. The use of different gasoline fuels mostly effects organic HAP emission estimates. This appendix documents how the organic HAP speciation profiles were developed and applied to individual equipment types for each gasoline fuel.

The approach used to developed organic HAP speciation profiles for diesel powered nonroad equipment is similar to the approach used to develop speciation profiles for gasoline powered nonroad equipment, except for aldehydes and PAHs. Data for PAHs were provided to account for use of onroad fuels in nonroad applications. This information was used to weight the nonroad speciation profiles to include onroad diesel. This appendix documents how these gasoline and diesel speciation profiles were developed.

Once the organic HAP speciation profiles were developed and assigned to appropriate other nonroad equipment, these profiles are applied to the county level VOC and PM estimates, taking into account the different fuels used in each county. This apprendices documents how this was accomplished. Because the NONROAD model provides county level VOC and PM estimates, spatial allocation of organic HAPs was not required.

Estimating emissions of metal HAPs and dioxin/furan cogeners is somewhat different as these pollutants are less effected by use of different reformulated and oxygenated fuels. For the most part, metal nonroad HAP emissions are derived by applying emission factors to activity or fuel usage data. Lead estimates were derived by applying the lead concentration of fuels to the total nonroad fuel usage. Metal HAP emissions were spatially allocated to the county-level based on ratio of county PM_{10} emissions to the national PM_{10} emissions.

Because of the size of some of the other nonroad tables, they are included at the end of the text section of this appendix.

Organic HAPs

Development of speciation profiles for gasoline powered equipment

To estimate organic HAP emissions for other nonroad sources, fuel usage data were considered in assigning appropriate speciation profiles to each county. Volume 2 contains lists for each year of the types of fuels used and the percentage of the year that these fuels were in use for each county.

HAP/VOC speciation profiles for each nonroad engine type were matched to individual counties based on the fuels used in the county. In some cases it was possible to obtain engine-specific speciation profiles for individual HAPs and specific fuels. These speciation profiles can be found in Table D-1 for organic HAPs excluding PAH's (Scarbro, 2001 and 2002; Hare and Carroll 1993; Carroll, 1991; Censullo 1991; Hare and White 1991) and Table D-2 for PAHs (Cook and Somers, 2001; Scarboro, 2002).

When specific speciation profiles could not be obtained, average emission factors were developed and used for the three engine types (i.e, 2-stroke, 4-stroke, and diesel). These average speciation profiles were derived by weighting the number of tests associated with each profile as noted in the following equation:

Average HAP Speciation Profile = ∑ speciation profile number of test/ total number of tests*

Example: Average Acrolein Speciation Profile

Acrolein Speciation Profile = (0.00158 mg Acrolein / mg VOC * 6/7) + (0.01173 mg Acrolein/mg VOC * 1/7) = 0.00303 mgAcrolein / mg VOC

All profiles used in this inventory are based on recent test studies published in peer-reviewed journals, as well as profiles compiled in the EPA's SPECIATE database (EPA, 1995).

Development of speciation profiles for diesel powered equipment

For diesel powered other nonroad equipment, speciation profiles were developed in the same fashion as the gasoline powered equipment, except for aetaldehyde, acrolein, formaldehyde, propionaldehyde and PAHs. The approaches used to develop speciation profiles for these pollutants are discussed in this section.

Diesel speciation profiles for acetaldehyde, acrolein, formaldehyde, and propionaldehyde were developed from HAP and total hydrocarbon (THC) emission factors, as noted in the equations below.

*HAP Speciation Profile = HAP Emission Factor / THC Emission Factor * THC/VOC conversion factor*

Example: Acrolein Speciation Profile derived from emission factors

Acrolein Speciation Profile = 0.4 mg Acrolein/hp-hrc / 260 mg THC/ hp-hr * 1.0197 THC/VOC = 0.00158 mg Acrolein/mgVOC

PAH speciation profiles for other nonroad diesel equipment were developed taking into consideration highway fuel used in nonroad diesel applications. In this inventory onroad and nonroad speciation profiles were developed based on PAH and PM_{10} emission factors as noted in the equations below.

Onroad PAH Speciation Profile = Onroad Diesel PAH emission factor/Onroad Diesel PM_{10} emission factor

Example: Onroad Diesel Anthracene Speciation Profile

Onroad Anthracene Profile= 3.0 E-7 g/hp-hr / 0.473 g PM/ hp-hr = 6.4 E-7 g/ g PM_{10}

Nonroad PAH Speciation Profile = Nonroad Diesel PAH emission factor / Nonroad PM_{10} emission factor

Example: Nonroad Diesel Anthracene Speciation Profile

Nonroad Anthracene Profile = 1.9 E-7 g/hp-hr / 0.555 g PM/ hp-hr = 3.4 E-7 g/ g PM_{10}

These PAH speciation profiles were weighted based on the percentage of fuel used nationally in onroad and nonroad diesel applications as noted in the following equation.

*Weighted Diesel PAH Speciation Profile = (% highway usage * onroad profile) + ((1- % highway usage) * nonroad profile)*

Example: Weighted PAH Diesel Speciation Profile

Anthracene Speciation Profile = (0.29855* 6.4 E-7 g/ g PM_{10}) + ((1- 0.29855) * 3.4E-7 g/g PM_{10})
= 4.3 E-7 g/ g PM_{10}

It should also be noted that the assumption was made that diesel fuels have negligible evaporative emissions, therefore diesel evaporative speciation profiles were not developed for this inventory.

Calculation of county-level organic HAP emissions

To calculate county-specific HAP emissions, these matched HAP/VOC profiles were applied to county nonroad VOC estimates derived from the NONROAD model run for each county using the following equation.

HAP Emissions (ton/yr) = $\sum$ *(fuel percent by type * speciation profile for fuel (ton HAP/tonVOC) * VOC estimate (ton/yr))*

Note: It is necessary to sum up all six types of fuel and all engine types for total emissions for each pollutant and county. Also fuel percents for each county must add up to 100%.

Example: Ethylbenzene from baseline fuel for a specific county

Ethylbenzene = (54.167% baseline fuel) * (0.0077 ton ethylbenzene/ton evaporative VOC) * (0.011872369 evaporative VOC)
= 4.95 E-5 tons ethylbenzene

As organic HAP emission estimates were calculated at the county-level, there was no need to spatially allocate these emission estimates further.

Metal and Dioxin/Furan HAPs

Emission estimates for metal and dioxin/furan HAPs is less complicated than for organic HAPs as emissions are not as dependent upon fuels. Most metal and dioxin/furan HAPs emissions were estimated by using national activity data where available or fuel usage. Metal emission factors are listed in Table D-3 and dioxin emission factors are listed in Table D-2. These national emission estimates were developed by using the following equation.

*National Metal HAP Emissions = Activity or fuel usage * Emission factor*

Example: National 2-stroke nonroad nickel emission estimate

Nickel estimate = 2,22935,221 gallons* 0.000077486 g of nickel/gal* 0.002205 lbs/g * 0.0005 tons/lb = 0.0190 tons nickel

It should be noted that a national lead estimate was obtained by multiplying the average lead content of mobile fuel with the amount of fuel used nationally and the percentage of fuel used by other nonroad sources. The percentage of fuel used by other nonroad sources was obtained by dividing the difference of the non-highway fuel used and aviation fuel used by the total motor fuel used (OHPI, 2001).

*Nonroad percent = (non-highway - aviation) / (highway + non-highway - aviation) * 100%*

Where:

Nonroad percent = Percent of total motor fuel use attributed to nonroad sources
Non-highway = Fuel used by non-highway vehicles including aviation (gallons/yr)
Aviation = Gasoline fuel used by piston engine aircraft (gallons/yr)
Highway = Fuel used by highway vehicles (gallons/yr)

Example: Percentage of national mobile fuel usage which is used in nonroad applications

$$\text{Nonroad percent} = \frac{(2{,}942{,}419{,}000\ \text{gallon/yr} - 322{,}285{,}000\ \text{gallon/yr})*100\%}{(128{,}743{,}412{,}000\ \text{gallon/yr} + 2{,}942{,}419{,}000\ \text{gallon/yr} - 322{,}285{,}000\ \text{gallon/yr})}$$

= 1.9946 % of mobile fuel is used in nonroad applications

To calculate the national lead emissions, the total mobile fuel usage was applied to the lead concentration found in mobile fuels. This national mobile lead value was adjusted to estimate other nonroad usage by using the nonroad fuel usage percentage developed noted above.

*Nonroad lead estimate = National mobile fuel usage (weight) *% nonroad * fuel lead concentration*

Example: National nonroad lead emission estimate

Lead estimate= 397,660,476 tons of fuel * 1.9946% * 0.0003 lbs lead/ton of fuel * 0.0005 tons/lb = 59.65 tons of lead

Total chromium emissions were speciated into trivalent and hexavalent chromium based on the assumption that 66% of the total chromium was trivalent chromium and 34% of the total chromium was hexavalent chromium.

National metal HAP and dioxin and furan emissions were spatially allocated to counties relative to the county proportion PM_{10} emissions compared to the national PM_{10} emissions as noted in the following equation. The county and national level PM emission estimates were obtained from the NONROAD model run.

*County-level metal HAP emissions = National metal HAP emission * county PM_{10}/ national PM_{10}*

Table D-1. Speciation Profile for Specific Engines

HAP	1,3-Butadiene	Reference
Moped		
2-stroke Exhaust HAP/VOC Fraction	0.001	Hare and White (1991)
Snowmobile		
2-stroke Exhaust Baseline HAP/VOC Fraction	0.0012	White and Carrol (1998)
2-stroke Exhaust RFG-Ethanol HAP/VOC Fraction	0.00732	White and Carrol (1998)
Lawnmower		
2-stroke Exhaust HAP/VOC Fraction	0.002	Carroll (1991)
Chainsaw		
2-stroke Exhaust HAP/VOC Fraction	0.002	Hare and Carroll (1993)
Trimmer		
2-stroke Exhaust HAP/VOC Fraction	0.001	Carroll (1991)
Outboard/Pleasure Craft		
2-stroke Exhaust RFG HAP/VOC Fraction	0.0014	Gabele and Pyle
4-stroke Exhaust RFG HAP/VOC Fraction	0.00875	Gabele and Pyle
Default		
2-stroke Exhaust Baseline HAP/VOC Fraction	0.0021456	ERG (1999)
4-stroke Exhaust Baseline HAP/VOC Fraction	0.0095212	ERG (1999)
Diesel Exhaust HAP/VOC Fraction	0.0018616	ERG (1999)

HAP	Formaldehyde	Reference
Moped		
2-stroke Exhaust HAP/VOC Fraction	0.002	Hare and White (1991)
Snowmobile		
2-stroke Exhaust Baseline HAP/VOC Fraction	0.00527	White and Carrol (1998)
2-stroke Exhaust RFG-Ethanol HAP/VOC Fraction	0.00859	White and Carrol (1998)
Lawnmower		
2-stroke Exhaust HAP/VOC Fraction	0.002	Carroll (1991)
Chainsaw		
2-stroke Exhaust HAP/VOC Fraction	0.007	Hare and Carroll (1993)
Trimmer		
2-stroke Exhaust HAP/VOC Fraction	0.003	Carroll (1991)
Outboard/Pleasure Craft		
2-stroke Exhaust RFG HAP/VOC Fraction	0.00087	Gabele and Pyle
4-stroke Exhaust RFG HAP/VOC Fraction	0.00375	Gabele and Pyle
Default		

Table D-1. Speciation Profile for Specific Engines (Continued)

HAP	Formaldehyde	Reference
2-stroke Exhaust Baseline HAP/VOC Fraction	0.0025380	ERG (1999)
2-stroke Exhaust RFG MTBE HAP/VOC Fraction	0.0034009	ERG (1999)
2-stroke Exhaust WO MTBE HAP/VOC Fraction	0.0036801	ERG (1999)
2-stroke Exhaust RFG/WO Ethanol HAP/VOC Fraction	0.0034517	ERG (1999)
4-stroke Exhaust Baseline HAP/VOC Fraction	0.01715	ERG (1999)
4-stroke Exhaust RFG MTBE HAP/VOC Fraction	0.015698	ERG (1999)
4-stroke Exhaust WO MTBE HAP/VOC Fraction	0.016987	ERG (1999)
4-stroke Exhaust RFG/WO Ethanol HAP/VOC Fraction	0.015933	ERG (1999)
Diesel HAP/VOC Fraction	0.11815	Scrabro (2002a,b)
CA Diesel HAP/VOC Fraction	0.12667	Scrabro (2002a,b)

HAP	Benzene	Reference
Moped		
2-stroke Exhaust HAP/VOC Fraction	0.015	Hare and White (1991)
Snowmobile		
2-stroke Exhaust Baseline HAP/VOC Fraction	0.00714	White and Carrol (1998)
2-stroke Exhaust RFG-Ethanol HAP/VOC Fraction	0.00732	White and Carrol (1998)
Lawnmower		
2-stroke Exhaust HAP/VOC Fraction	0.0014	Carroll (1991)
Chainsaw		
2-stroke Exhaust HAP/VOC Fraction	0.008	Hare and Carroll (1993)
Trimmer		
2-stroke Exhaust HAP/VOC Fraction	0.011	Carroll (1991)
Outboard/Pleasure Craft		
2-stroke Exhaust RFG HAP/VOC Fraction	0.01239	Gabele and Pyle
4-stroke Exhaust RFG HAP/VOC Fraction	0.03313	Gabele and Pyle
Default		
2-stroke Exhaust Baseline HAP/VOC Fraction	0.025158	ERG (1999)
2-stroke Exhaust RFG MTBE HAP/VOC Fraction	0.020126	ERG (1999)
2-stroke Exhaust WO MTBE HAP/VOC Fraction	0.017862	ERG (1999)
2-stroke Exhaust RFG/WO Ethanol HAP/VOC Fraction	0.022642	ERG (1999)
2-stroke Evaporative Baseline HAP/VOC Fraction	0.022	ERG (1999)
2-stroke Evaporative RFG/WO MTBE HAP/VOC Fraction	0.015840	ERG (1999)
2-stroke Evaporative RFG/WO Ethanol HAP/VOC Fraction	0.012540	ERG (1999)
4-stroke Exhaust Baseline HAP/VOC Fraction	0.052466	ERG (1999)
4-stroke Exhaust RFG MTBE HAP/VOC Fraction	0.041972	ERG (1999)
4-stroke Exhaust WO MTBE HAP/VOC Fraction	0.037251	ERG (1999)
4-stroke Exhaust RFG/WO Ethanol HAP/VOC Fraction	0.047219	ERG (1999)
4-stroke Evaporative Baseline HAP/VOC Fraction	0.022	ERG (1999)

Table D-1. Speciation Profile for Specific Engines (Continued)

HAP	Benzene	Reference
4-stroke Evaporative RFG/WO MTBE HAP/VOC Fraction	0.015840	ERG (1999)
4-stroke Evaporative RFG/WO Ethanol HAP/VOC Fraction	0.012540	ERG (1999)
Diesel HAP/VOC Fraction	0.020344	ERG (1999)

HAP	Acetaldehyde	Reference
Moped		
2-stroke Exhaust HAP/VOC Fraction	0.0006	Hare and White (1991)
Snowmobile		
2-stroke Exhaust Baseline HAP/VOC Fraction	0.00074	White and Carrol (1998)
2-stroke Exhaust RFG-Ethanol HAP/VOC Fraction	0.00469	White and Carrol (1998)
Lawnmower		
2-stroke Exhaust HAP/VOC Fraction	0.004	Carroll (1991)
Chainsaw		
2-stroke Exhaust HAP/VOC Fraction	0.0013	Hare and Carroll (1993)
Trimmer		
2-stroke Exhaust HAP/VOC Fraction	0.0006	Carroll (1991)
Outboard/Pleasure Craft		
2-stroke Exhaust RFG HAP/VOC Fraction	0.00022	Gabele and Pyle
4-stroke Exhaust RFG HAP/VOC Fraction	0.00063	Gabele and Pyle
Default		
2-stroke Exhaust Baseline HAP/VOC Fraction	0.0016641	ERG (1999)
2-stroke Exhaust RFG MTBE HAP/VOC Fraction	0.0015809	ERG (1999)
2-stroke Exhaust WO MTBE HAP/VOC Fraction	0.0016641	ERG (1999)
2-stroke Exhaust RFG/WO Ethanol HAP/VOC Fraction	0.0033282	ERG (1999)
4-stroke Exhaust Baseline HAP/VOC Fraction	0.0041006	ERG (1999)
4-stroke Exhaust RFG MTBE HAP/VOC Fraction	0.0038956	ERG (1999)
4-stroke Exhaust WO MTBE HAP/VOC Fraction	0.0041006	ERG (1999)
4-stroke Exhaust RFG/WO Ethanol HAP/VOC Fraction	0.0082012	ERG (1999)
Diesel HAP/VOC Fraction	0.05308	Scrabro (2002a,b)
CA Diesel HAP/VOC Fraction	0.07461	Scrabro (2002a,b)

Table D-1. Speciation Profile for Specific Engines (Continued)

HAP	Ethylbenzene	Reference
Snowmobile		
2-stroke Exhaust Baseline HAP/VOC Fraction	0.00403	White and Carrol (1998)
2-stroke Exhaust RFG-Ethanol HAP/VOC Fraction	0.00403	White and Carrol (1998)
Outboard/Pleasure Craft		
2-stroke Exhaust RFG HAP/VOC Fraction	0.0009	Gabele and Pyle
4-stroke Exhaust RFG HAP/VOC Fraction	0.03017	Gabele and Pyle
Default		
2-stroke Exhaust Baseline HAP/VOC Fraction	0.023958	ERG (1999)
2-stroke Exhaust RFG MTBE HAP/VOC Fraction	0.019885	ERG (1999)
2-stroke Exhaust WO MTBE HAP/VOC Fraction	0.018687	ERG (1999)
2-stroke Exhaust RFG/WO Ethanol HAP/VOC Fraction	0.021802	ERG (1999)
2-stroke Evaporative Baseline HAP/VOC Fraction	0.0077000	ERG (1999)
2-stroke Evaporative RFG/WO MTBE HAP/VOC Fraction	0.0063140	ERG (1999)
2-stroke Evaporative RFG/WO Ethanol HAP/VOC Fraction	0.0044660	ERG (1999)
4-stroke Exhaust Baseline HAP/VOC Fraction	0.019824	ERG (1999)
4-stroke Exhaust RFG MTBE HAP/VOC Fraction	0.016454	ERG (1999)
4-stroke Exhaust WO MTBE HAP/VOC Fraction	0.015463	ERG (1999)
4-stroke Exhaust RFG/WO Ethanol HAP/VOC Fraction	0.018040	ERG (1999)
4-stroke Evaporative Baseline HAP/VOC Fraction	0.0084022	ERG (1999)
4-stroke Evaporative RFG/WO MTBE HAP/VOC Fraction	0.0068898	ERG (1999)
4-stroke Evaporative RFG/WO Ethanol HAP/VOC Fraction	0.0048733	ERG (1999)
Diesel Exhaust HAP/VOC Fraction	0.0031001	ERG (1999)

HAP	Styrene	Reference
Outboard/Pleasure Craft		
2-stroke Exhaust RFG HAP/VOC Fraction	0.00115	Gabele and Pyle
4-stroke Exhaust RFG HAP/VOC Fraction	0.00408	Gabele and Pyle
Default		
2-stroke Exhaust Baseline HAP/VOC Fraction	0.0012952	ERG (1999)
2-stroke Exhaust RFG MTBE HAP/VOC Fraction	0.0010750	ERG (1999)
2-stroke Exhaust WO MTBE HAP/VOC Fraction	0.0010103	ERG (1999)
2-stroke Exhaust RFG/WO Ethanol HAP/VOC Fraction	0.0011787	ERG (1999)
4-stroke Exhaust Baseline HAP/VOC Fraction	0.00075849	ERG (1999)
4-stroke Exhaust RFG MTBE HAP/VOC Fraction	0.00062955	ERG (1999)
4-stroke Exhaust WO MTBE HAP/VOC Fraction	0.00059162	ERG (1999)
4-stroke Exhaust RFG/WO Ethanol HAP/VOC Fraction	0.00069023	ERG (1999)
Diesel Exhaust HAP/VOC Fraction	0.00059448	ERG (1999)

Table D-1. Speciation Profile for Specific Engines (Continued)

HAP	Acrolein	Reference
Snowmobile		
2-stroke Exhaust Baseline HAP/VOC Fraction	0.00037	White and Carrol (1998)
2-stroke Exhaust RFG-Ethanol HAP/VOC Fraction	0.00056	White and Carrol (1998)
Lawnmower		
2-stroke Exhaust HAP/VOC Fraction	0.0003	Carroll (1991)
Chainsaw		
2-stroke Exhaust HAP/VOC Fraction	0.0004	Hare and Carroll (1993)
Trimmer		
2-stroke Exhaust HAP/VOC Fraction	0.0003	Carroll (1991)
Outboard/Pleasure Craft		
2-stroke Exhaust RFG HAP/VOC Fraction	0.00002	Gabele and Pyle
4-stroke Exhaust RFG HAP/VOC Fraction	0.00006	Gabele and Pyle
Default		
2-stroke Exhaust Baseline HAP/VOC Fraction	0.0003	ERG (1999)
2-stroke Exhaust RFG MTBE HAP/VOC Fraction	0.00030900	ERG (1999)
2-stroke Exhaust WO MTBE HAP/VOC Fraction	0.00031500	ERG (1999)
2-stroke Exhaust RFG/WO Ethanol HAP/VOC Fraction	0.00029700	ERG (1999)
4-stroke Exhaust Baseline HAP/VOC Fraction	0.0007	ERG (1999)
4-stroke Exhaust RFG MTBE HAP/VOC Fraction	0.00072100	ERG (1999)
4-stroke Exhaust WO MTBE HAP/VOC Fraction	0.00073500	ERG (1999)
4-stroke Exhaust RFG/WO Ethanol HAP/VOC Fraction	0.00069300	ERG (1999)
Diesel HAP/VOC Fraction	0.00303	Scrabro (2002a,b)
CA Diesel HAP/VOC Fraction	0.00710	Scrabro (2002a,b)

HAP	Toluene	Reference
Snowmobile		
2-stroke Exhaust Baseline HAP/VOC Fraction	0.21244	White and Carrol (1998)
2-stroke Exhaust RFG-Ethanol HAP/VOC Fraction	0.19281	White and Carrol (1998)
Chainsaw		
2-stroke Exhaust HAP/VOC Fraction	0.0598	Hare and Carroll (1993)
Outboard/Pleasure Craft		
2-stroke Exhaust RFG HAP/VOC Fraction	0.06322	Gabele and Pyle
4-stroke Exhaust RFG HAP/VOC Fraction	0.10672	Gabele and Pyle
Default		
2-stroke Exhaust Baseline HAP/VOC Fraction	0.097797	ERG (1999)
2-stroke Exhaust RFG MTBE HAP/VOC Fraction	0.081171	ERG (1999)
2-stroke Exhaust WO MTBE HAP/VOC Fraction	0.076282	ERG (1999)
2-stroke Exhaust RFG/WO Ethanol HAP/VOC Fraction	0.088995	ERG (1999)
2-stroke Evaporative Baseline HAP/VOC Fraction	0.041300	ERG (1999)

Table D-1. Speciation Profile for Specific Engines (Continued)

HAP	Toluene	Reference
2-stroke Evaporative RFG/WO MTBE HAP/VOC Fraction	0.027671	ERG (1999)
2-stroke Evaporative RFG/WO Ethanol HAP/VOC Fraction	0.019411	ERG (1999)
4-stroke Exhaust Baseline HAP/VOC Fraction	0.071842	ERG (1999)
4-stroke Exhaust RFG MTBE HAP/VOC Fraction	0.059629	ERG (1999)
4-stroke Exhaust WO MTBE HAP/VOC Fraction	0.056037	ERG (1999)
4-stroke Exhaust RFG/WO Ethanol HAP/VOC Fraction	0.065376	ERG (1999)
4-stroke Evaporative Baseline HAP/VOC Fraction	0.045067	ERG (1999)
4-stroke Evaporative RFG/WO MTBE HAP/VOC Fraction	0.030195	ERG (1999)
4-stroke Evaporative RFG/WO Ethanol HAP/VOC Fraction	0.021181	ERG (1999)
Diesel HAP/VOC Fraction	0.014967	ERG (1999)

HAP	Hexane	Reference
Snowmobile		
2-stroke Exhaust Baseline HAP/VOC Fraction	0.00468	White and Carrol (1998)
2-stroke Exhaust RFG-Ethanol HAP/VOC Fraction	0.00468	White and Carrol (1998)
Outboard/Pleasure Craft		
2-stroke Exhaust RFG HAP/VOC Fraction	0.00952	Gabele and Pyle
4-stroke Exhaust RFG HAP/VOC Fraction	0.00946	Gabele and Pyle
Default		
2-stroke Exhaust Baseline HAP/VOC Fraction	0.014152	ERG (1999)
2-stroke Exhaust RFG MTBE HAP/VOC Fraction	0.014576	ERG (1999)
2-stroke Exhaust WO MTBE HAP/VOC Fraction	0.014859	ERG (1999)
2-stroke Exhaust RFG/WO Ethanol HAP/VOC Fraction	0.014010	ERG (1999)
2-stroke Evaporative Baseline HAP/VOC Fraction	0.023400	ERG (1999)
2-stroke Evaporative RFG/WO MTBE HAP/VOC Fraction	0.0086580	ERG (1999)
2-stroke Evaporative RFG/WO Ethanol HAP/VOC Fraction	0.0095940	ERG (1999)
4-stroke Exhaust Baseline HAP/VOC Fraction	0.0099219	ERG (1999)
4-stroke Exhaust RFG MTBE HAP/VOC Fraction	0.010220	ERG (1999)
4-stroke Exhaust WO MTBE HAP/VOC Fraction	0.010418	ERG (1999)
4-stroke Exhaust RFG/WO Ethanol HAP/VOC Fraction	0.0098227	ERG (1999)
4-stroke Evaporative Baseline HAP/VOC Fraction	0.025534	ERG (1999)
4-stroke Evaporative RFG/WO MTBE HAP/VOC Fraction	0.0094476	ERG (1999)
4-stroke Evaporative RFG/WO Ethanol HAP/VOC Fraction	0.010469	ERG (1999)
Diesel HAP/VOC Fraction	0.0015913	ERG (1999)

Table D-1. Speciation Profile for Specific Engines (Continued)

HAP	Propionaldehyde	Reference
Snowmobile		
2-stroke Exhaust Baseline HAP/VOC Fraction	0.00046	White and Carrol (1998)
2-stroke Exhaust RFG-Ethanol HAP/VOC Fraction	0.00069	White and Carrol (1998)
Outboard/Pleasure Craft		
2-stroke Exhaust RFG HAP/VOC Fraction	0.00007	Gabele and Pyle
4-stroke Exhaust RFG HAP/VOC Fraction	0.00018	Gabele and Pyle
Default		
2-stroke Exhaust Baseline HAP/VOC Fraction	0.00024680	ERG (1999)
2-stroke Exhaust RFG MTBE HAP/VOC Fraction	0.00025420	ERG (1999)
2-stroke Exhaust WO MTBE HAP/VOC Fraction	0.00025914	ERG (1999)
2-stroke Exhaust RFG/WO Ethanol HAP/VOC Fraction	0.00024433	ERG (1999)
4-stroke Exhaust Baseline HAP/VOC Fraction	0.0018808	ERG (1999)
4-stroke Exhaust RFG MTBE HAP/VOC Fraction	0.0019372	ERG (1999)
4-stroke Exhaust WO MTBE HAP/VOC Fraction	0.0019749	ERG (1999)
4-stroke Exhaust RFG/WO Ethanol HAP/VOC Fraction	0.0018620	ERG (1999)
Diesel HAP/VOC Fraction	0.011815	Scrabro (2002a,b)
CA Diesel HAP/VOC Fraction	0.01120	Scrabro (2002a,b)

HAP	2,2,4-Trimethylpentane	Reference
Snowmobile		
2-stroke Exhaust HAP/VOC Fraction	0.068516283	Gabele & Pyle
Inboard		
4-stroke Exhaust HAP/VOC Fraction	0.064410866	Gabele & Pyle
Outboard		
2-stroke Exhaust HAP/VOC Fraction	0.068516283	Gabele & Pyle
Lawn and Garden		
2-stroke Exhaust HAP/VOC Fraction	0.037227275	Hare et. al. 1993
4-stroke Exhaust HAP/VOC Fraction	0.014722579	Hare et. al. 1993
Construction and Agriculture		
4-stroke Exhaust HAP/VOC Fraction	0.019253927	Newkirk & Bass 1995
Default		
2-stroke Exhaust HAP/VOC Fraction	0.037227275	Hare et. al. 1993
2-stroke Evaporative HAP/VOC Fraction	0.014115385	Speciate 3.1 July 2000
Small 4-stroke Exhaust HAP/VOC Fraction	0.014722579	Hare et. al. 1993
Large 4-stroke Exhaust HAP/VOC Fraction	0.019253927	Newkirk & Bass 1995
4-stroke Evaporative HAP/VOC Fraction	0.014115385	Speciate 3.1 July 2000

Table D-1. Speciation Profile for Specific Engines (Continued)

HAP	2,2,4-Trimethylpentane	Reference
Diesel HAP/VOC Fraction	0.000719235	Newkirk & Bass 1995 and Truex et. al. 1998
CA Diesel HAP/VOC Fraction	0.00059392	Truex et. al. 1998

HAP	2,3,7,8-TCDD TEQ	Reference
Default		
2-Stroke Dioxin/Furan/Fuel Fraction	1.37385E-17 tons TEQ/gal	ERG (1999)
4-Stroke Dioxin/Furan/Fuel Fraction	1.37385E-17 tons TEQ/gal	ERG (1999)
Diesel Dioxin/Furan/Fuel Fraction	1.90705E-14 tons TEQ/gal	ERG (1999)

HAP	Xylenes	Reference
Snowmobile		
2-stroke Exhaust Baseline HAP/VOC Fraction	0.01485	White and Carrol (1998)
2-stroke Exhaust RFG-Ethanol HAP/VOC Fraction	0.01776	White and Carrol (1998)
Chainsaw		
2-stroke Exhaust HAP/VOC Fraction	0.0931	Hare and Carroll (1993)
Outboard/Pleasure Craft		
2-stroke Exhaust RFG HAP/VOC Fraction	0.08069	Gabele and Pyle
4-stroke Exhaust RFG HAP/VOC Fraction	0.09417	Gabele and Pyle
Default		
2-stroke Exhaust Baseline HAP/VOC Fraction	0.10749	ERG (1999)
2-stroke Exhaust RFG MTBE HAP/VOC Fraction	0.089214	ERG (1999)
2-stroke Exhaust WO MTBE HAP/VOC Fraction	0.083840	ERG (1999)
2-stroke Exhaust RFG/WO Ethanol HAP/VOC Fraction	0.097813	ERG (1999)
2-stroke Evaporative Baseline HAP/VOC Fraction	0.022300	ERG (1999)
2-stroke Evaporative RFG/WO MTBE HAP/VOC Fraction	0.018732	ERG (1999)
2-stroke Evaporative RFG/WO Ethanol HAP/VOC Fraction	0.01819	ERG (1999)
4-stroke Exhaust Baseline HAP/VOC Fraction	0.067799	ERG (1999)
4-stroke Exhaust RFG MTBE HAP/VOC Fraction	0.056273	ERG (1999)
4-stroke Exhaust WO MTBE HAP/VOC Fraction	0.052883	ERG (1999)
4-stroke Exhaust RFG/WO Ethanol HAP/VOC Fraction	0.061697	ERG (1999)
4-stroke Evaporative Baseline HAP/VOC Fraction	0.024334	ERG (1999)
4-stroke Evaporative RFG/WO MTBE HAP/VOC Fraction	0.020440	ERG (1999)
4-stroke Evaporative RFG/WO Ethanol HAP/VOC Fraction	0.012897	ERG (1999)
Diesel HAP/VOC Fraction	0.010582	ERG (1999)

Table D-1. Speciation Profile for Specific Engines (Continued)

HAP	Methyl tert-butyl ether	Reference
Outboard/Pleasure Craft		
2-stroke Exhaust RFG-MTBE HAP/VOC Fraction	0.08157	Gabele and Pyle
Default		
2-stroke Exhaust RFG MTBE HAP/VOC Fraction	0.1241	ERG (1999)
2-stroke Exhaust WO MTBE HAP/VOC Fraction	0.1693	ERG (1999)
2-stroke Evaporative RFG MTBE HAP/VOC Fraction	0.1397	ERG (1999)
2-stroke Evaporative WO MTBE HAP/VOC Fraction	0.1397	ERG (1999)
4-stroke Exhaust RFG MTBE HAP/VOC Fraction	0.1354	ERG (1999)
4-stroke Exhaust WO MTBE HAP/VOC Fraction	0.1847	ERG (1999)
4-stroke Evaporative RFG MTBE HAP/VOC Fraction	0.1524	ERG (1999)
4-stroke Evaporative WO MTBE HAP/VOC Fraction	0.1524	ERG (1999)

Table D-2. PAH Speciation Profile for Other nonroad Equipment

PAH	2-stroke	4-stroke	Diesel*
	Fraction of PM10	Fraction of PM10	Fraction of PM10
Benz[a]Anthracene	0.000034	0.00010	0.0000071
Benzo[a]Pyrene	0.000029	0.00010	0.00000035
Benzo[b]Fluoranthene	0.000016	0.00012	0.00000049
Benzo[k]Fluoranthene	0.000014	0.00012	0.00000035
Chrysene	0.000021	0.00010	0.0000019
Dibenzo[a,h]Anthracene	0.000001	0.00000	0.0000000029
Indeno[1,2,3-c,d]Pyrene	0.000035	0.00008	0.000000079
Acenaphthene	0.000002	0.00073	0.0001
Acenaphthylene	0.000075	0.00412	0.000084
Anthracene	0.000067	0.00085	0.00000043
Benzo[g,h,i,]Perylene	0.000116	0.00026	0.00000019
Fluoranthene	0.000267	0.00091	0.000017
Fluorene	0.000239	0.00151	0.0001
Naphthalene	0.000004	0.09073	0.00046
Phenanthrene	0.000208	0.00254	0.00026
Pyrene	0.000318	0.00124	0.0000029

* Takes into consideration spill over effect.

Table D-3. Specific Metal Speciation Profile for Other Nonroad Equipment

Metal	Chromium	Reference
Default		
2-Stroke Metal/Fuel Fraction*	0.00010638 g/gal	Ball (1997)
4-Stroke Metal/Fuel Fraction*	0.00010638 g/gal	Ball (1997)
Diesel Metal/Activity Fraction**	0.03 ug/Bhp-hr	Truex (1998)

Note: Chromium was later speciated into Chromium III and Chromium VI using the ratios, 0.66 and 0.34 respectively.

Metal	Manganese	Reference
Default		
2-Stroke Metal/Fuel Fraction[a]	0.000035604 g/gal	Ball (1997)
4-Stroke Metal/Fuel Fraction[a]	0.000035604 g/gal	Ball (1997)
Diesel Metal/Activity Fraction[b]	1.37 ug/Bhp-hr	Truex (1998)

Metal	Nickel	Reference
Default		
2-Stroke Metal/Fuel Fraction[a]	0.000077486 g/gal	Ball (1997)
4-Stroke Metal/Fuel Fraction[a]	0.000077486 g/gal	Ball (1997)
Diesel Metal/Activity Fraction[b]	2.035 ug/Bhp-hr	Truex (1998)

[a] Combined average represents a weighted average of the USO6 and UDDS emission factors for each vehicle (the weighting being 28% for the USO6 factor, and 72% for the UDDS factor) and a subsequent straight average between the two weighted averages for each.

*Conversion factor of 21.5 miles/gal used (E-mail from Rich Cook "Metal Emission and PAH -reply" 3/7/02)

*Sample Calculation:

EF by fuel = Average of ((USO6 EF * 0.28)+ (UDDS EF * 0.72)) *conversion factor

Chromium EF by fuel = (((0.9 ug/mile * 0.28)+(8.5 ug/mile * 0.72))+((4.1 ug/mile * 0.28)+(3.3 ug/mile * 0.72)))
/ 2 * (21.5 miles/gal / 1000000 ug/g)
= 0.000106382 g/gal

[b] Emission Factor is the average of cold start and hot start emission factors

[c] Emission Factors based on detection limits and conversion factor of 21.5 miles/gal (E-mail from Rich Cook "Metal Emission and PAH -reply" 3/7/02)

References:

Carroll, J.N. Emission Tests of In-use Small Utility Engines: Task III Report, Non-road Source Emission Factors Improvement. Prepared for U.S. EPA by Southwest Research Institute. Report SwRI 3426-0006, 1991.

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White, Jeff J. and James N. Carroll. *Emissions from Snowmobile Engines Using Bio-based Fuels and Lubricants.* State of Montana Department of Environmental Quality, Helena, MO. October 1998.

Appendix E

State Database Summary Sheets for Draft NEI

Aircraft

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Alabama

State/Local Agency Name: Alabama Department of Environmental Management

Contact Name, Address, Phone Number, Email:

Lisa B. Cole
lbcolea@adem.state.al.us
(334) 270-5615

Counties Included/Number in State: 66 out of 67

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Arizona, Maricopa County

State/Local Agency Name: MARICOPA

Contact Name, Address, Phone Number, Email:

Bob Downing
bdowning@mail.maricopa.gov
(602) 506-6790

Counties Included/Number in State: 1 out of 15

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Arkansas

State/Local Agency Name: Arkansas Department of Environmental Quality

Contact Name, Address, Phone Number, Email:

Ron Hoofman
hoofman@adeq.state.ar.us
(501) 682-0537

Counties Included/Number in State: 74 out of 75

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Both

CO, NH_3, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC, and Lead

# of HAPs in File: 1

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: California

State/Local Agency Name: California Air Resources Board

Contact Name, Address, Phone Number, Email:

Andy Alexis
aalexis@arb.ca.gov
(916) 323-1085

Counties Included/Number in State:55 (Criteria) and 53 (HAPS) out of 58

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Both

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

1,3-Butadiene, 2,2,4-Trimethylpentane, Acetaldehyde, Acrolein, Arsenic, Benzene, Cadmium, Chlorine, Chromium, Cobalt, Cumene, Ethyl Benzene, Formaldehyde, Hexane, Lead, Manganese, Methyl Ethyl Ketone, Methyl Tert-Butyl Ether, Naphthalene, Nickel, o-Xylene, Phenol, Propionaldehyde, Selenium, Styrene, Toluene

# of HAPs in File: 26 HAPs

General Comments on File, if any:

SCC's were updated to reflect current SCC's using EPA crosswalk table.

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: California

State/Local Agency Name: California Air Resources Board

Contact Name, Address, Phone Number, Email:

Andy Alexis
aalexis@arb.ca.gov
(916) 323-1085

Counties Included/Number in State: 55 out of 58

Inventory Year: 1999

Inventory Type-Criteria, Toxics: Both

# of HAPs in file: 40 HAPs

Resolution:

- Replaced estimates with state submitted data for HAP and criteria emissions.
- Did not use state submitted estimates for HAPs that are not on the list of 188.

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Colorado

State/Local Agency Name: Colorado APCD

Contact Name, Address, Phone Number, Email:

Dale M. Wells
dale.wells@state.co.us
(303) 692-3237

Counties Included/Number in State: 45 out of 64

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Connecticut

State/Local Agency Name: CT DEP

Contact Name, Address, Phone Number, Email:

Steven Potter
steven.potter@po.state.ct.us
(860) 424-3384

Counties Included/Number in State: 8 out of 8

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Delaware

State/Local Agency Name: Delaware Air Quality Management, DNREC

Contact Name, Address, Phone Number, Email:

David Fees
david.fees@state.de.us
(302) 739-4791

Counties Included/Number in State: 3 out of 3

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Both

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

1,3-Butadiene, Acenaphthene, Acenaphthylene, Acetaldehyde, Acrolein, Anthracene, Benz[a]Anthracene, Benzene, Benzo[a]Pyrene, Benzo[b]Fluoranthene, Benzo[g,h,i,]Perylene, Benzo[k]Fluoranthene, Chrysene, Ethyl Benzene, Fluoranthene, Fluorene, Formaldehyde, Indeno[1,2,3-c,d]Pyrene, Naphthalene, Phenanthrene, Pyrene, Styrene, Toluene, Xylenes (Mixture of o, m, and p Isomers)

# of HAPs in File: 24 HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Florida (Pinellas County)

State/Local Agency Name: Pinellas County Department of Environmental Management

Contact Name, Address, Phone Number, Email:

Bob Soptei
bsoptei@co.pinellas.fl.us
(727) 464-4422

Counties Included/Number in State: 1 out of 68

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Both

CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, PM-PRI, SO_2, and VOC

1,3-Butadiene, 2,2,4-Trimethylpentane, Acenaphthene, Acenaphthylene, Acetaldehyde, Acrolein, Anthracene, Benz[a]Anthracene, Benzene, Benzo[a]Pyrene, Benzo[b]Fluoranthene, Benzo[g,h,i,]Perylene, Benzo[k]Fluoranthene, Chrysene, Dibenzo[a,h]Anthracene, Ethyl Benzene, Fluoranthene, Fluorene, Formaldehyde, Hexane, Indeno[1,2,3-c,d]Pyrene, Lead & Compounds, Naphthalene, Phenanthrene, Phenol, Propionaldehyde, Pyrene, Styrene, Toluene, Xylenes

# of HAPs in File: 30 HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Georgia

State/Local Agency Name: Georgia Environmental Protection Division

Contact Name, Address, Phone Number, Email:

Scott Southwick
scott_southwick@dnr.state.ga.us
(404) 362-4569

Counties Included/Number in State: 131 out of 159

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Idaho

State/Local Agency Name: DEQ

Contact Name, Address, Phone Number, Email:

Gary Reinbold
greinbol@deq.state.id.us
(208) 373-0253

Counties Included/Number in State: 41 out of 44

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Kentucky (Jefferson County)

State/Local Agency Name: Louisville Metro APCD

Contact Name, Address, Phone Number, Email:

Gary Flispart
Gary.Flispart@loukymetro.org
(502) 574-6000

Counties Included/Number in State: 1 out of 120

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Louisiana

State/Local Agency Name: Department of Environmental Quality

Contact Name, Address, Phone Number, Email:

Elizabeth McDearman
elizabethm@deq.state.la.us
(225) 765-0303
(225) 765-0617 (fax)

Counties Included/Number in State: 1 out of 64

Inventory Year: 1999

Inventory Type-Criteria, Toxics: Criteria

# of HAPs in file: None

General Comments on File, if Any: Only submitted data for one county in state for aircraft.

Resolution:

- Replaced estimates with state submitted data for VOC and NO_x emissions.
- Did not append zero emission records into file.

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Maryland

State/Local Agency Name: Maryland Department of Environment

Contact Name, Address, Phone Number, Email:

Roger Thunell
rthunell@mde.state.md.us
(410) 537-3273

Counties Included/Number in State: 24 out of 24

Inventory Year: 2002

Inventory Type-Criteria, Toxics, both: Criteria

# of HAPs in file: No HAPs

Comments:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Maryland

State/Local Agency Name: Maryland Department of Environment

Contact Name, Address, Phone Number, Email:

Leif Hockstad
lhockstad@mde.state.md.us
(410) 631-3277
(410) 631-3202 (fax)

Counties Included/Number in State: 24 out of 24

Inventory Year: 1999

Inventory Type-Criteria, Toxics, both: Criteria

# of HAPs in file: No HAPs

Comments:

- Replaced estimates with state submitted data for HAP emissions.

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Massachusetts

State/Local Agency Name: Massachusetts DEP

Contact Name, Address, Phone Number, Email:

Kenneth Santlal
kenneth.santlal@state.ma.us
(617) 292-5776

Counties Included/Number in State: 14 out of 14

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Michigan

State/Local Agency Name: Michigan Dept of Environmental Quality

Contact Name, Address, Phone Number, Email:

Allan Ostrander
ostranda@state.mi.us
(517) 335-2717

Counties Included/Number in State: 83 out of 83

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Minnesota

State/Local Agency Name: Minnesota Air Pollution Control Agency

Contact Name, Address, Phone Number, Email:

Chun Yi Wu
Minnesota Air Pollution Control Agency
chun.yi.wu@pca.state.mn.us
(651) 282-5855

Counties Included/Number in State: 65 out of 87

Inventory Year: 1999

Inventory Type - Criteria, toxics, both: Toxics

1,3-Butadiene, 2,2,4-Trimethylpentane, Acenaphthene, Acenaphthylene, Acetaldehyde, Acrolein, Anthracene, Benz[a]Anthracene, Benzene, Benzo[a]Pyrene, Benzo[b]Fluoranthene, Benzo[g,h,i,]Perylene, Benzo[k]Fluoranthene, Chrysene, Ethyl Benzene, Fluoranthene, Fluorene, Formaldehyde, Hexane, Indeno[1,2,3-c,d]Pyrene, Lead, Naphthalene, Phenanthrene, Propionaldehyde, Pyrene, Styrene, Toluene, Xylenes (Mixture of o, m, and p Isomers)

# of HAPs in File: 28

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Mississippi

State/Local Agency Name: Mississippi DEQ

Contact Name, Address, Phone Number, Email:

Keith Head
keith_head@deq.state.ms.us
(601) 961-5577

Counties Included/Number in State: 36 out of 82

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Nebraska

State/Local Agency Name: Lincoln-Lancaster County Health Dept.

Contact Name, Address, Phone Number, Email:

Charles Riley
criley@ci.lincoln.ne.us
(402) 441-6202
(402) 441-8323 (fax)

Counties Included/Number in State: 1 out of 93

Inventory Year: 1999

Inventory Type-Criteria, Toxics, both: Criteria

# of HAPs in file: None

General Comments on File, if Any: Only submitted data for one county in state for aircraft.

Resolution:

- Replaced estimates with state submitted data for VOC, NO_x, CO, SO_x, PM_{10}-PRI emissions.
- Did not append zero emission records into file.

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: New Hampshire

State/Local Agency Name: New Hampshire Dept. of Environmental Services Air Resources Division

Contact Name, Address, Phone Number, Email:

David Healy
dhealy@des.state.nh.us
(603) 271-0871

Counties Included/Number in State: 10 out of 10

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Both

CO, NO_x, SO_2, VOC

1,3-Butadiene, Acetaldehyde, Acrolein, Benzene, Ethyl Benzene, Formaldehyde, Hexane, Naphthalene, Polycyclic Organic Matter, Propionaldehyde, Styrene, Toluene, and Xylenes (Mixture of o, m, and p Isomers)

# of HAPs in File: 13 HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: New Jersey

State/Local Agency Name: NJ Department of Environmental Protection

Contact Name, Address, Phone Number, Email:

John Gorgol
john.gorgol@dep.state.nj.us
(609) 292-1413

Counties Included/Number in State: 21 out of 21

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Nevada (Clark County)

State/Local Agency Name: DAQM

Contact Name, Address, Phone Number, Email:

Ebrahim Juma
juma@co.clark.nv.us
(702) 455-1621

Counties Included/Number in State: 1 out of 17

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: North Carolina

State/Local Agency Name:

Contact Name, Address, Phone Number, Email:

Counties Included/Number in State: 48 out of 100

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Oregon

State/Local Agency Name: ODEQ

Contact Name, Address, Phone Number, Email:

Jeffrey Stocum
stocum.jeffrey@deq.state.or.us
(503) 229-5506

Counties Included/Number in State: 35 out of 36

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Both

NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, and VOC

1,3-Butadiene, Acenaphthene, Acenaphthylene, Acetaldehyde, Acrolein, Anthracene, Benz[a]Anthracene, Benzene, Benzo[a]Pyrene, Benzo[b]Fluoranthene, Benzo[g,h,i,]Perylene, Benzo[k]Fluoranthene, Chrysene, Ethyl Benzene, Fluoranthene, Fluorene, Formaldehyde, Hexane, Indeno[1,2,3-c,d]Pyrene, Naphthalene, Phenanthrene, Phenol, Propionaldehyde, Pyrene, Styrene, Toluene, Xylenes (Mixture of o, m, and p Isomers)

# of HAPs in File: 27 HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Pennsylvania

State/Local Agency Name: PA DEP BAQ

Contact Name, Address, Phone Number, Email:

Robert Altenburg
raltenburg@state.pa.us
(717) 787-9495

Counties Included/Number in State: 8 out of 67

Inventory Year: 1999

Inventory Type-Criteria, Toxics, both: Criteria

# of HAPs in file: None

General Comments on File, if Any: State submitted only OSD estimates

Resolution:

Replaced EPA based OSD emission estimates with State submitted emission estimates

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Puerto Rico and the Virgin Islands

State/Local Agency Name: Region II

Contact Name, Address, Phone Number, Email:

Raymond Forde
EPA Region II
NY, NY
Forde.raymond@epamail.epa.gov

Counties Included/Number in State:

Inventory Year: 1996

Inventory Type - Criteria, toxics, both: HAPs

# of HAPs in File: 13

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Rhode Island

State/Local Agency Name: RIDEM

Contact Name, Address, Phone Number, Email:

Karen Slattery
karen.slattery@dem.ri.gov
(401) 222-2808

Counties Included/Number in State: 5 out of 5

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: South Carolina

State/Local Agency Name: South Carolina DHEC

Contact Name, Address, Phone Number, Email:

Bob Betterton
SC DHEC
Columbia, SC
betterrj@columb31.dhec.state.sc.us

Counties Included/Number in State:

Inventory Year: 1996

Inventory Type - Criteria, toxics, both: HAPs

# of HAPs in File:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: South Carolina

State/Local Agency Name: South Carolina DHEC

Contact Name, Address, Phone Number, Email:

Lynn Allen
(803) 898-4069
(803) 898-4117 (fax)

Counties Included/Number in State: 43 out of 46

Inventory Year: 1999

Inventory Type - Criteria, toxics, both: Criteria

# of HAPs in File: None

General Comments on File, if any:

- Replaced estimates with state submitted data for HC, NO_x, CO, SO_x emissions. Converted HC emissions to VOC emissions.
- Did not append zero emission records into file.

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Tennessee

State/Local Agency Name: TDEC APC

Contact Name, Address, Phone Number, Email:

James R. Redus
Ron.Redus@state.tn.us
(615) 532-0577

Counties Included/Number in State: 49 out of 95

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Tennessee (Nashville/Davidson County)

State/Local Agency Name: Metro Public Health Department Nashville/Davidson Cty

Contact Name, Address, Phone Number, Email:

Laura Artates
laura.artates@nashville.gov
(615) 340-5653

Counties Included/Number in State: 1 out of 95

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Tennessee

State/Local Agency Name: CHCAPCB

Contact Name, Address, Phone Number, Email:

Heather Sandner
sandner_h@mail.chattanooga.gov
(423) 867-4321
(423) 867-4348 (fax)

Counties Included/Number in State: 1 out of 95

Inventory Year: 1999

Inventory Type-Criteria, Toxics, both: Criteria

# of HAPs in file: None

General Comments on File, if Any: Only submitted data for one county in state for aircraft.

- Replaced estimates with state submitted data for HC, NO_x, CO, SO_x emissions. Converted HC emissions to VOC emissions.
- Did not append zero emission records into file.

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Texas

State/Local Agency Name: TCEQ

Contact Name, Address, Phone Number, Email:

Melinda Torres
Metorres@tceq.state.tx.us
(512) 239-0058

Counties Included/Number in State: 167 out of 254

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-FIL, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Texas

State/Local Agency Name: Texas Natural Resource Conservation Committee

Contact Name, Address, Phone Number, Email:

Charlie Rubrick
crubick@tnrcc.state.tx.us
512-239-1478

Counties Included/Number in State: 15 out of 254

Inventory Year: 1999

Inventory Type-Criteria, Toxics, both: Criteria

# of HAPs in file: None

General Comments on File, if Any:

Resolution:

- Replaced EPA based emission estimates with State submitted emission estimates

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Utah

State/Local Agency Name: Utah Division of Air Quality

Contact Name, Address, Phone Number, Email:

Carol A. Nielsen
canielsen@utah.gov
(801) 536-4073
(801) 536-0085 (fax)

Counties Included/Number in State: 29 out of 29

Inventory Year: 2002

Inventory Type-Criteria, Toxics, both: Criteria

# of HAPs in file: None

General Comments on File, if Any:

- Corrected invalid pollutant codes

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Utah

State/Local Agency Name: Utah Division of Air Quality

Contact Name, Address, Phone Number, Email:

Carol A. Nielsen
canielsen@utah.gov
(801) 536-4073
(801) 536-0085 (fax)

Counties Included/Number in State: 29 out of 29

Inventory Year: 1999

Inventory Type-Criteria, Toxics, both: Criteria

# of HAPs in file: None

General Comments on File, if Any:

- Utah incorrectly coded emissions as daily instead of annual. Corrected file to reflect correct annual emissions.

Resolution:

- Corrected emission type code.
- Replaced estimates with state submitted data for VOC, NO_x, CO, SO_x, PM_{10}-PRI, and NH_3 emissions.
- Did not append zero emission records into file.

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Virginia

State/Local Agency Name: Virginia Department of Environmental Quality

Contact Name, Address, Phone Number, Email:

Thomas C. Foster
tcfoster@deq.state.va.us
(804) 698-4411

Counties Included/Number in State: 136 out of 136

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Wisconsin

State/Local Agency Name: Wisconsin Department of Natural Resources

Contact Name, Address, Phone Number, Email:

Grant Hetherington
ww.dnr.state.wi.us
(608) 267-7539

Counties Included/Number in State: 72 out of 72

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Both

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

1,3-Butadiene, 2,2,4-Trimethylpentane, Acenaphthene, Acetaldehyde, Acrolein, Anthracene, Benz[a]Anthracene, Benzene, Benzo[a]Pyrene, Benzo[b]Fluoranthene, Benzo[g,h,i,]Perylene, Benzo[k]Fluoranthene, Chrysene, Dibenzo[a,h]Anthracene, Ethyl Benzene, Formaldehyde, Indeno[1,2,3-c,d]Pyrene, Naphthalene, Phenol, Propionaldehyde, Pyrene, Styrene, Toluene, Xylenes (Mixture of o, m, and p Isomers), and o-Xylene.

# of HAPs in File: 24 HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: West Virginia

State/Local Agency Name: WVDEP Division of Air Quality

Contact Name, Address, Phone Number, Email:

David Porter
dporter@wvdep.org
(304) 926-3647

Counties Included/Number in State: 17 out of 55

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Aircraft

State: Wisconsin

State/Local Agency Name: Wisconsin Department of Natural Resources

Contact Name, Address, Phone Number, Email:

Grant D. Hetherington
hetheg@dnr.state.wi.us
(608) 267-7539
(608) 267-0560

Counties Included/Number in State: 13 out of 72

Inventory Year: 1999

Inventory Type-Criteria, Toxics, both: Criteria

# of HAPs in file: None

General Comments on File, if Any:

- State submitted both annual and daily emission estimates.

Resolution:

- Replaced estimates with state submitted data for VOC, NO_x, CO emissions.

Commercial Marine Vessels

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Alabama

State/Local Agency Name: Alabama Department of Environmental Management

Contact Name, Address, Phone Number, Email:

Lisa B. Cole
lbcolea@adem.state.al.us
(334) 270-5615

Counties Included/Number in State: 32 out of 67

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Alabama

State/Local Agency Name: Emission Factor Inventory Group

Contact Name, Address, Phone Number, Email:

Doug Solomon, US EPA
solomon.douglas@epa.gov
(919) 541-4132

Counties Included/Number in State: 45 out of 67

Inventory Year: 1999

Inventory Type-Criteria, Toxics, both: Criteria

# of HAPs in file: None

General Comments on File, if Any:

- State submitted emission estimates for commercial marine vessels

Resolution:

- Replaced EPA emission estimates with State submitted emission estimates

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Alaska

State/Local Agency Name: Alaska Department of Environmental Conservation

Contact Name, Address, Phone Number, Email:

Alice Edwards /Joan Kassel
Alaska Department of Environmental Conservation
410 Willoughby Ave. Suite 105
Juneau,. AK 99801
aedwards@envircon.state.ak.us
jkassel@envircon.state.ak.us
Alice (907) 465-5109
Joan (907) 465-5129

Counties Included/Number in State: added 23 port

Inventory Year: 1996

Inventory Type - Criteria, toxics, both: HAPs

# of HAPs in File:

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Arkansas

State/Local Agency Name: Arkansas Department of Environmental Quality

Contact Name, Address, Phone Number, Email:

Ron Hoofman
hoofman@adeq.state.ar.us
(501) 682-0537

Counties Included/Number in State: 27 out of 75

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NH_3, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: California

State/Local Agency Name: California Air Resources Board

Contact Name, Address, Phone Number, Email:

Andy Alexis
aalexis@arb.ca.gov
(916) 323-1085

Counties Included/Number in State: 21 out of 58

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Both

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

1,3-Butadiene, 2,2,4-Trimethylpentane, Acetaldehyde, Acrolein, Antimony, Arsenic, Benzene, Cadmium, Chlorine, Chlorobenzene, Chromium, Cobalt, Cumene, Ethyl Benzene, Formaldehyde, Hexane, Lead, Manganese, Mercury, Methanol, Methyl Ethyl Ketone, Methyl Tert-Butyl Ether, m-Xylene, Naphthalene, Nickel, o-Xylene, Phosphorus, Propionaldehyde, p-Xylene, Selenium, Styrene, Toluene

# of HAPs in File: 32 HAPs

General Comments on File, if any:

Submitted pollutant code 1151. Not on EPA list of pollutants for HAPs.

SCC's were updated to reflect current SCC's using EPA crosswalk table.

Pollutant codes were updated to reflect current pollutant code.

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: California

State/Local Agency Name: California Air Resources Board

Contact Name, Address, Phone Number, Email:

Andy Alexis
aalexis@arb.ca.gov
(916) 323-1085

Counties Included/Number in State: 21 out of 58

Inventory Year: 1999

Inventory Type-Criteria, Toxics, both: Both

# of HAPs in file: 50 HAPs

General Comments on File, if Any:

- Replaced estimates with state submitted data for HAP and criteria emissions.
- Did not use state submitted estimates for HAPs that were not on the list of 188.

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Connecticut

State/Local Agency Name: CT DEP

Contact Name, Address, Phone Number, Email:

Steven Potter
steven.potter@po.state.ct.us
(860) 424-3384

Counties Included/Number in State: 8 out of 8

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

SCCs were updated to reflect current EPA SCCs.

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Delaware

State/Local Agency Name: Delaware Air Quality Management, DNREC

Contact Name, Address, Phone Number, Email:

David Fees
david.fees@state.de.us
(302) 739-4791

Counties Included/Number in State: 3 out of 3

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Both

CO, NH_3, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

1,2,3,4,6,7,8-Heptachlorodibenzofuran, 1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin, 1,2,3,4,7,8,9-Heptachlorodibenzofuran, 1,2,3,4,7,8-Hexachlorodibenzofuran, 1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin, 1,2,3,6,7,8-Hexachlorodibenzofuran, 1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin, 1,2,3,7,8,9-Hexachlorodibenzofuran, 1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin, 1,2,3,7,8-Pentachlorodibenzofuran, 1,2,3,7,8-Pentachlorodibenzo-p-Dioxin, 1,3-Butadiene, 2,3,4,6,7,8-Hexachlorodibenzofuran, 2,3,4,7,8-Pentachlorodibenzofuran, 2,3,7,8-Tetrachlorodibenzofuran, 2,3,7,8-Tetrachlorodibenzo-p-Dioxin, Acenaphthene, Acenaphthylene, Acetaldehyde, Acrolein, Anthracene, Benz[a]Anthracene, Benzene, Benzo[a]Pyrene, Benzo[b]Fluoranthene, Benzo[g,h,i,]Perylene, Benzo[k]Fluoranthene, Beryllium, Cadmium, Chromium IV, Chrysene, Dibenzo[a,h]Anthracene, Ethyl Benzene, Fluoranthene, Fluorene, Formaldehyde, Indeno[1,2,3-c,d]Pyrene, Lead, Manganese, Naphthalene, Nickel, Octachlorodibenzofuran, Octachlorodibenzo-p-Dioxin, Phenanthrene, Pyrene, Styrene, Toluene, Xylenes (Mixture of o, m, and p Isomers)

# of HAPs in File: 48 HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Georgia

State/Local Agency Name: Georgia Environmental Protection Division

Contact Name, Address, Phone Number, Email:

Scott Southwick
scott_southwick@dnr.state.ga.us
(404) 362-4569

Counties Included/Number in State: 22 out of 159

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Indiana

State/Local Agency Name:

Contact Name, Address, Phone Number, Email:

Counties Included/Number in State: 3 out of 92

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NH_3, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, PM-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

SCC's were updated to reflect current SCC's using EPA crosswalk table.

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Kentucky

State/Local Agency Name: Louisville Metro APCD

Contact Name, Address, Phone Number, Email:

Gary Flispart
Gary.Flispart@loukymetro.org
(502) 574-6000

Counties Included/Number in State: 1 out of 120

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Maine

State/Local Agency Name:

Contact Name, Address, Phone Number, Email:

Counties Included/Number in State: 7 out of 16

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Both

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, and VOC

16-PAH, 2,2,4-Trimethylpentane, 7-PAH, Acenaphthene, Acenaphthylene, Acetaldehyde, Acrolein, Anthracene, Benz[a]Anthracene, Benzene, Benzo[a]Pyrene, Benzo[b]Fluoranthene, Benzo[g,h,i,]Perylene, Benzo[k]Fluoranthene, Beryllium, Cadmium, Chromium (VI), Chromium III, Chrysene, Ethyl Benzene, Fluoranthene, Fluorene, Formaldehyde, Hexane, Lead, Manganese, Naphthalene, Nickel, Phenanthrene, Propionaldehyde, Pyrene, Selenium, Styrene, Toluene, Xylenes (Mixture of o, m, and p Isomers)

# of HAPs in File: 35 HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Maryland

State/Local Agency Name: Maryland Department of the Environment

Contact Name, Address, Phone Number, Email:

Roger Thunell
rthunell@mde.state.md.us
(410) 537-3273

Counties Included/Number in State: 1 out of 24

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

SCCs were updated to reflect current EPA SCCs.

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Maryland

State/Local Agency Name: Maryland Department of Environment

Contact Name, Address, Phone Number, Email:

Leif Hockstad
lhockstad@mde.state.md.us
(410) 631-3277
(410) 631-3202 (fax)

Counties Included/Number in State: 24 out of 24

Inventory Year: 1999

Inventory Type-Criteria, Toxics, both: Toxics

# of HAPs in file: 17 HAPs

General Comments on File, if Any:

- Replaced estimates with state submitted data for HAP emissions.

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Massachusetts

State/Local Agency Name: Massachusetts DEP

Contact Name, Address, Phone Number, Email:

Kenneth Santlal
kenneth.santlal@state.ma.us
(617) 292-5776

Counties Included/Number in State: 14 out of 14

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

SCCs were updated to reflect current EPA SCCs.

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Michigan

State/Local Agency Name: Michigan DEQ Air Quality

Contact Name, Address, Phone Number, Email:

Allan Ostrander
ostranda@michigan.gov
(517) 335-2717

Counties Included/Number in State: 83 out of 83

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NH_3, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, PM-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

SCCs were updated to reflect current EPA SCCs.

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Minnesota

State/Local Agency Name: Minnesota Air Pollution Control Agency

Contact Name, Address, Phone Number, Email:

Chun Yi Wu
Minnesota Air Pollution Control Agency
chun.yi.wu@pca.state.mn.us
(651) 282-5855

Counties Included/Number in State: 3 out of 87

Inventory Year: 1999

Inventory Type - Criteria, toxics, both: Toxics

16-PAH, 2,2,4-Trimethylpentane, 7-PAH, Acenaphthene, Acenaphthylene, Acetaldehyde, Acrolein, Anthracene, Arsenic, Benz[a]Anthracene, Benzene, Benzo[a]Pyrene, Benzo[b]Fluoranthene, Benzo[g,h,i,]Perylene, Benzo[k]Fluoranthene, Beryllium, Cadmium, Chromium (VI), Chromium III, Chrysene, Ethyl Benzene, Fluoranthene, Fluorene, Formaldehyde, Hexane, Indeno[1,2,3-c,d]Pyrene, Lead, Manganese, Mercury, Naphthalene, Nickel, Phenanthrene, Propionaldehyde, Pyrene, Selenium, Styrene, Toluene, Xylenes (Mixture of o, m, and p Isomers)

# of HAPs in File: 38

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Mississippi

State/Local Agency Name: Template

Contact Name, Address, Phone Number, Email:

Keith Head
keith_head@deq.state.ms.us
(601) 961-5577

Counties Included/Number in State: 27 out of 82

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: New Jersey

State/Local Agency Name: NJ Department of Environmental Protection

Contact Name, Address, Phone Number, Email:

John Gorgol
john.gorgol@dep.state.nj.us
(609) 292-1413

Counties Included/Number in State: 21 out of 21

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

SCCs were updated to reflect current EPA SCCs.

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: New York

State/Local Agency Name: NYSDEC DIVISION OF AIR RESOURCES BAQP/MSS

Contact Name, Address, Phone Number, Email:

Kevin P. Mcgarry
kpmcgarr@gw.dec.state.ny.us
(518) 402-8396

Counties Included/Number in State: 30 out of 62

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

Pollutant codes were updated to reflect current EPA pollutant codes.

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: North Carolina

State/Local Agency Name:

Contact Name, Address, Phone Number, Email:

Counties Included/Number in State: 30 out of 100

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Ohio

State/Local Agency Name:

Contact Name, Address, Phone Number, Email:

Counties Included/Number in State: 8 out of 88

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NH_3, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, PM-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

SCC's were updated to reflect current SCC's using EPA crosswalk table.

Pollutant codes were updated to reflect current EPA pollutant codes.

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Oregon

State/Local Agency Name: ODEQ

Contact Name, Address, Phone Number, Email:

Jeffrey Stocum
stocum.jeffrey@deq.state.or.us
(503) 229-5506

Counties Included/Number in State: 10 out of 36

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, and VOC

Acrolein, Arsenic, Chromium, Ethyl Benzene, Hexane, Manganese, Nickel, Propionaldehyde, Styrene, Toluene, Xylenes (Mixture of o, m, and p Isomers)

# of HAPs in File: 11 HAPs

General Comments on File, if any:

SCCs were updated to reflect current EPA SCCs.

Pollutant codes were updated to reflect current EPA pollutant codes.

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Pennsylvania

State/Local Agency Name: PA DEP BAQ

Contact Name, Address, Phone Number, Email:

Robert Altenburg
raltenburg@state.pa.us
717-787-9495

Counties Included/Number in State: 11 out of 67

Inventory Year: 1999

Inventory Type-Criteria, Toxics, both: Criteria

# of HAPs in file: None

General Comments on File, if Any: State submitted only OSD estimates

Resolution:

- Replaced EPA based OSD emission estimates with State submitted emission estimates

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Puerto Rico and the Virgin Islands

State/Local Agency Name: Region II

Contact Name, Address, Phone Number, Email:

Raymond Forde
EPA Region II
NY, NY
Forde.raymond@epamail.epa.gov

Counties Included/Number in State:

Inventory Year: 1996

Inventory Type - Criteria, toxics, both: HAPs

# of HAPs in File: 20

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Rhode Island

State/Local Agency Name: RIDEM

Contact Name, Address, Phone Number, Email:

Karen Slattery
karen.slattery@dem.ri.gov
(401) 222-2808

Counties Included/Number in State: 5 out of 5

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Tennessee

State/Local Agency Name: TDEC APC

Contact Name, Address, Phone Number, Email:

James R. Redus
ron.redus@state.tn.us
(615) 532-0577

Counties Included/Number in State: 31 out of 95

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Tennessee (Nashville/Davidson County)

State/Local Agency Name: Metro Public Health Department Nashville/Davidson Cty

Contact Name, Address, Phone Number, Email:

Laura Artates
laura.artates@nashville.gov
(615) 340-5653

Counties Included/Number in State: 1 out of 95

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Texas

State/Local Agency Name: TCEQ

Contact Name, Address, Phone Number, Email:

Melinda Torres
Metorres@tceq.state.tx.us
(512) 239-0058

Counties Included/Number in State: 19 out of 254

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Both

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

16-PAH, 7-PAH, Acetaldehyde, Acrolein, Arsenic & compounds, Benzene, Beryllium, Cadmium, Chromium, Chromium & Compounds, Ethyl Benzene, Formaldehyde, Hexane, Lead, Manganese & Compounds, Nickel, Nickel& Compounds, Propionaldehyde, Selenium, Styrene, Toluene, Xylenes (Mixture of o, m, and p Isomers)

# of HAPs in File: 22 HAPs

General Comments on File, if any:

SCCs were updated to reflect current EPA SCCs.

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Texas

State/Local Agency Name: Texas Natural Resource Conservation Committee

Contact Name, Address, Phone Number, Email:

Charlie Rubrick
crubick@tnrcc.state.tx.us
(512) 239-1478

Counties Included/Number in State: 6 out of 254

Inventory Year: 1999

Inventory Type-Criteria, Toxics, both: Criteria

# of HAPs in file: None

General Comments on File, if Any:

Resolution:

- Replaced EPA based emission estimates with State submitted emission estimates

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Virginia

State/Local Agency Name: Virginia Department of Environmental Quality

Contact Name, Address, Phone Number, Email:

Thomas C. Foster
tcfoster@deq.state.va.us
(804) 698-4411

Counties Included/Number in State: 136 out of 136

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

SCCs were updated to reflect current EPA SCCs.

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Washington

State/Local Agency Name: WA Department of Ecology

Contact Name, Address, Phone Number, Email:

Sally Otterson
sott461@ecy.wa.gov
(360) 407-6806

Counties Included/Number in State: 30 out of 39

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NH_3, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: West Virginia

State/Local Agency Name: WVDEP Division of Air Quality

Contact Name, Address, Phone Number, Email:

David Porter
dporter@wvdep.org
(304) 926-3647

Counties Included/Number in State: 20 out of 55

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Wisconsin

State/Local Agency Name: Wisconsin Department of Natural Resources

Contact Name, Address, Phone Number, Email:

Grant Hetherington
hetheg@dnr.state.wi.us
(608) 267-7539

Counties Included/Number in State: 20 out of 72

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Both

CO, NH_3, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, PM-PRI, SO_2, VOC

# of HAPs in File: 14 HAPs

General Comments on File, if any:

2,2,4-Trimethylpentane, Acetaldehyde, Acrolein, Benzene, Chromium, Ethyl Benzene, Formaldehyde, Hexane, Manganese, Nickel, Propionaldehyde, Styrene, Toluene, Xylenes (Mixture of o, m, and p Isomers)

STATE DATABASE SUMMARY REPORT

Source Category: Commercial Marine Vessels

State: Wisconsin

State/Local Agency Name: Wisconsin Department of Natural Resources

Contact Name, Address, Phone Number, Email:

Grant D. Hetherington
hetheg@dnr.state.wi.us
(608) 267-7539
(608) 267-0560

Counties Included/Number in State: 3 out of 72

Inventory Year: 1999

Inventory Type-Criteria, Toxics, both: Criteria

# of HAPs in file: None

General Comments on File, if Any:

- State submitted both annual and daily emission estimates.

Resolution:

- Replaced estimates with state submitted data for VOC, NO_x, CO emissions.

Locomotives

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Alabama

State/Local Agency Name: Alabama Department of Environmental Management

Contact Name, Address, Phone Number, Email:

Lisa B. Cole
lbcolea@adem.state.al.us
(334) 270-5615

Counties Included/Number in State: 32 out of 67

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

SCCs were updated to reflect current EPA SCCs.

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Alabama

State/Local Agency Name: Alabama Department of Environmental Management

Contact Name, Address, Phone Number, Email:

Ken Barrett
Alabama Department of Environmental Management
Air Division
P.O. Box 301463
Montgomery, Alabama 36130-1463
kab@adem.state.al.us
(334) 271-7861

Counties Included/Number in State: noted counties with out railroads

Inventory Year: 1996

Inventory Type - Criteria, toxics, both:

# of HAPs in File:

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Alabama

State/Local Agency Name: Alabama Department of Environmental Management

Contact Name, Address, Phone Number, Email:

Cala Obenauf
cjo@adem.state.al.us
(334) 270-5683

Counties Included/Number in State: 67 out of 67

Inventory Year: 1999

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, VOC

# of HAPs in File: 0 HAPs

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Alaska

State/Local Agency Name: Alaska Department of Environmental Conservation

Contact Name, Address, Phone Number, Email:

Melanie Lambardo
melanie_lambardo@dec.state.ak.us
(907) 465-5116

Counties Included/Number in State: 6 out of 27

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, HC, NO_x, PM_{10}

# of HAPs in File: No HAPs

General Comments on File, if any:

HC emissions not used-incorrect format submitted

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Alaska

State/Local Agency Name: Alaska Department of Environmental Conservation

Contact Name, Address, Phone Number, Email:

Alice Edwards /Joan Kassel
Alaska Department of Environmental Conservation
410 Willoughby Ave. Suite 105
Juneau,. AK 99801
aedwards@envircon.state.ak.us
jkassel@envircon.state.ak.us
Alice (907) 465-5109
Joan (907) 465-5129

Counties Included/Number in State: deleted 19 counties that do not have railroads

Inventory Year: 1996

Inventory Type - Criteria, toxics, both: HAPs

# of HAPs in File:

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Arizona, Maricopa County

State/Local Agency Name: MARICOPA

Contact Name, Address, Phone Number, Email:

Bob Downing
bdowning@mail.maricopa.gov
(602) 506-6790

Counties Included/Number in State: 1 out of 15

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NH_3, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

SCCs were updated to reflect current EPA SCCs.

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Arkansas

State/Local Agency Name: Arkansas Department of Environmental Quality

Contact Name, Address, Phone Number, Email:

Ron Hoofman
hoofman@adeq.state.ar.us
(501) 682-0537

Counties Included/Number in State: 66 out of 75

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NH_3, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: California

State/Local Agency Name: California Air Resources Board

Contact Name, Address, Phone Number, Email:

Andy Alexis
aalexis@arb.ca.gov
(916) 323-1085

Counties Included/Number in State: 44 out of 58

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Both

CO, NO_x, PM_{10}-FIL, $PM_{2.5}$-FIL, PM-FIL, SO_2, VOC

1,3-Butadiene, 2,2,4-Trimethylpentane, Acetaldehyde, Acrolein, Antimony, Arsenic, Benzene, Cadmium, Chlorine, Chromium, Cobalt, Cumene, Ethyl Benzene, Formaldehyde, Hexane, Lead, Manganese, Mercury, Methanol, Methyl Ethyl Ketone, m-Xylene, Naphthalene, Nickel, o-Xylene, Phosphorus, Propionaldehyde, p-Xylene, Selenium, Styrene, Toluene

# of HAPs in File: 30 HAPs

General Comments on File, if any:

SCCs were updated to reflect current EPA SCCs.

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: California - Lake County

State/Local Agency Name:

Contact Name, Address, Phone Number, Email:

Counties Included/Number in State: deleted rail emission as there are no railroads in this county

Inventory Year: 1996

Inventory Type - Criteria, toxics, both: HAPs

# of HAPs in File:

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: California

State/Local Agency Name: California Air Resources Board

Contact Name, Address, Phone Number, Email:

Andy Alexis
aalexis@arb.ca.gov
(916) 323-1085

Counties Included/Number in State: 44 out of 58

Inventory Year: 1999

Inventory Type - Criteria, toxics both: Both

CO, NO_X, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_X, VOC

1,3-Butadiene, 2,2,4-Trimethylpentane, Acetaldehyde, Antimony, Arsenic, Benzene, Cadmium, Chlorine, Chromium, Cobalt, Cumene, Ethyl Benzene, Formaldehyde, Hexane, Lead, m-Xylene, Manganese, Mercury, Methanol, Methyl Ethyl Ketone, Naphthalene, Nickel, o-Xylene, p-Xylene, Phosphorus, Propionaldehyde, Selenium, Styrene, Toluene

(Other pollutants not on the 188 HAP list were also included but not used)

# of HAPs in File: 47 HAPs

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Colorado

State/Local Agency Name: Colorado APCD

Contact Name, Address, Phone Number, Email:

Dale M. Wells
dale.wells@state.co.us
(303) 692-3237

Counties Included/Number in State: 5 out of 64

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Connecticut

State/Local Agency Name: CT DEP

Contact Name, Address, Phone Number, Email:

Steven Potter
steven.potter@po.state.ct.us
(860) 424-3384

Counties Included/Number in State: 8 out of 8

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

SCCs were updated to reflect current EPA SCCs.

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Delaware

State/Local Agency Name: Delaware Air Quality Management

Contact Name, Address, Phone Number, Email:

David Fees
david.fees@state.de.us
(302) 739-4791

Counties Included/Number in State: 3 out of 3

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Both

CO, NH_3, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

1,2,3,4,6,7,8-Heptachlorodibenzofuran, 1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin, 1,2,3,4,7,8,9-Heptachlorodibenzofuran, 1,2,3,4,7,8-Hexachlorodibenzofuran, 1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin, 1,2,3,6,7,8-Hexachlorodibenzofuran, 1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin, 1,2,3,7,8,9-Hexachlorodibenzofuran, 1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin, 1,2,3,7,8-Pentachlorodibenzofuran, 1,2,3,7,8-Pentachlorodibenzo-p-Dioxin, 1,3-Butadiene, 2,2,4-Trimethylpentane, 2,3,4,6,7,8-Hexachlorodibenzofuran, 2,3,4,7,8-Pentachlorodibenzofuran, 2,3,7,8-Tetrachlorodibenzofuran, 2,3,7,8-Tetrachlorodibenzo-p-Dioxin, Acenaphthene, Acenaphthylene, Acetaldehyde, Acrolein, Anthracene, Benz[a]Anthracene, Benzene, Benzo[a]Pyrene, Benzo[b]Fluoranthene, Benzo[g,h,i,]Perylene, Benzo[k]Fluoranthene, Beryllium, Beryllium & Compounds, Cadmium, Cadmium & Compounds, Chromium III, Chromium IV, Chrysene, Dibenzo[a,h]Anthracene, Ethyl Benzene, Fluoranthene, Fluorene, Formaldehyde, Indeno[1,2,3-c,d]Pyrene, Lead, Manganese, Manganese & Compounds, Naphthalene, Nickel, Nickel & Compounds, Octachlorodibenzofuran, Octachlorodibenzo-p-Dioxin, Phenanthrene, Pyrene, Styrene, Toluene, Xylenes (Mixture of o, m, and p Isomers)

# of HAPs in File: 57 HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: District of Columbia

State/Local Agency Name: DC Department of Health

Contact Name, Address, Phone Number, Email:

Deirdre Elvis
deirdre.elvis@dc.gov
(202) 535-2256

Counties Included/Number in State: 1 out of 1

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

Pollutant codes were updated to reflect current EPA pollutant codes.

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Florida (Pinellas county)

State/Local Agency Name: Pinellas County Department of Environmental Management

Contact Name, Address, Phone Number, Email:

Bob Soptei
bsoptei@co.pinellas.fl.us
(727) 464-4422

Counties Included/Number in State: 1 out of 67

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, PM-PRI, SO_2, and VOC

1,3-Butadiene, 2,2,4-Trimethylpentane, Acenaphthene, Acenaphthylene, Acetaldehyde, Acrolein, Anthracene, Benz[a]Anthracene, Benzene, Benzo[a]Pyrene, Benzo[b]Fluoranthene, Benzo[g,h,i,]Perylene, Beryllium & Compounds, Cadmium & Compounds, Chromium (VI), Chromium III, Chrysene, Ethyl Benzene, Fluoranthene, Fluorene, Formaldehyde, Hexane, Indeno[1,2,3-c,d]Pyrene, Lead & Compounds, Manganese & Compounds, Naphthalene, Nickel & Compounds, Phenanthrene, Propionaldehyde, Pyrene, Styrene, Toluene, and Xylenes (Mixture of o, m, and p Isomers)

# of HAPs in File: 34 HAPs

General Comments on File, if any:

SCCs were updated to reflect current EPA SCCs.

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Georgia

State/Local Agency Name: Georgia Environmental Protection Division

Contact Name, Address, Phone Number, Email:

Scott Southwick
scott_southwick@dnr.state.ga.us
(404) 362-4569

Counties Included/Number in State: 114 out of 159

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Idaho

State/Local Agency Name: DEQ

Contact Name, Address, Phone Number, Email:

Gary Reinbold
greinbol@deq.state.id.us
(208) 373-0253

Counties Included/Number in State: 39 out of 44

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

SCCs were updated to reflect current EPA SCCs.

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Illinois

State/Local Agency Name: Illinois EPA

Contact Name, Address, Phone Number, Email:

David 'Buzz' Asselmeier
buzz.asselmeier@epa.state.il.us
(217) 524-4343

Counties Included/Number in State: 102 out of 102

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NH_3, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Indiana

State/Local Agency Name:

Contact Name, Address, Phone Number, Email:

Counties Included/Number in State: 92 out of 92

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NH_3, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, PM-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Kentucky (Jefferson County)

State/Local Agency Name: Louisville Metro APCD

Contact Name, Address, Phone Number, Email:

Gary Flispart
Gary.Flispart@loukymetro.org
(502) 574-6000

Counties Included/Number in State: 1 out of 120

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Louisiana

State/Local Agency Name: Department of Environmental Quality

Contact Name, Address, Phone Number, Email:

Elizabeth McDearman
elizabethm@deq.state.la.us
(225) 765-0303

Counties Included/Number in State: 5 out of 64

Inventory Year: 1999

Inventory Type - Criteria, toxics, both: Criteria

NO_x, VOC

# of HAPs in File: 0 HAPs

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Maryland

State/Local Agency Name: Maryland Department of the Environment

Contact Name, Address, Phone Number, Email:

Roger Thunell
rthunell@mde.state.md.us
(410) 537-3273

Counties Included/Number in State: 24 out of 24

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, PM_{25}-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

SCCs were updated to reflect current EPA SCCs.

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Maryland

State/Local Agency Name: Maryland Department of Environment

Contact Name, Address, Phone Number, Email:

Leif Hockstad
lhockstad@mde.state.md.us
(410) 631-3277

Counties Included/Number in State: 24 out of 24

Inventory Year: 1999

Inventory Type - Criteria, toxic, both: Toxics

Acrolein, Ethylbenzene, Hexane, Propionaldehyde, Styrene, Toluene, Xylenes (Mixture of o, m, and p Isomers)

# of HAPs in File: 7 HAPs

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Massachusetts

State/Local Agency Name: Massachusetts DEP

Contact Name, Address, Phone Number, Email:

Kenneth Santlal
kenneth.santlal@state.ma.us
(617) 292-5776

Counties Included/Number in State: 14 out of 14

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Minnesota

State/Local Agency Name: Minnesota Pollution Control Agency

Contact Name, Address, Phone Number, Email:

Chun Yi Wu
chun.yi.wu@pca.state.mn.us
(651) 282-5855

Counties Included/Number in State: 69 (criteria) and 81 (HAP) out of 87

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Both

CO, NO_x, PM_{10}-PRI, SO_2, VOC

1,3-Butadiene, 2,2,4-Trimethylpentane, Acenaphthene, Acenaphthylene, Acetaldehyde, Acrolein, Anthracene, Benz[a]Anthracene, Benzene, Benzo[a]Pyrene, Benzo[b]Fluoranthene, Benzo[g,h,i,]Perylene, Benzo[k]Fluoranthene, Beryllium, Cadmium, Chromium (VI), Chromium III, Chrysene, Ethyl Benzene, Fluoranthene, Fluorene, Formaldehyde, Hexane, Indeno[1,2,3-c,d]Pyrene, Lead, Manganese, Naphthalene, Nickel, Phenanthrene, Propionaldehyde, Pyrene, Styrene, Toluene , Xylenes (Mixture of o, m, and p Isomers)

# of HAPs in File: 34 HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Locomotive

State: Minnesota

State/Local Agency Name: Minnesota Air Pollution Control Agency

Contact Name, Address, Phone Number, Email:

Chun Yi Wu
Minnesota Air Pollution Control Agency
chun.yi.wu@pca.state.mn.us
(651)282-5855

Counties Included/Number in State: 83 out of 87

Inventory Year: 1999

Inventory Type - Criteria, toxics, both: Toxics

1,3-Butadiene, 2,2,4-Trimethylpentane, Acenaphthene, Acenaphthylene, Acetaldehyde, Acrolein, Anthracene, Arsenic & Compounds (Inorganic Including Arsine), Benz[a]Anthracene, Benzene, Benzo[a]Pyrene, Benzo[b]Fluoranthene, Benzo[g,h,i,]Perylene, Benzo[k]Fluoranthene, Beryllium & Compounds, Cadmium & Compounds, Chromium (VI), Chromium III, Chrysene, Ethyl Benzene, Fluoranthene, Fluorene, Formaldehyde, Hexane, Indeno[1,2,3-c,d]Pyrene, Lead & Compounds, Manganese & Compounds, Mercury & Compounds, Naphthalene, Nickel & Compounds, Phenanthrene, Propionaldehyde, Pyrene, Styrene, Toluene, Xylenes (Mixture of o, m, and p Isomers)

# of HAPs in File: 36

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Mississippi

State/Local Agency Name: Mississippi DEQ

Contact Name, Address, Phone Number, Email:

Keith Head
keith_head@deq.state.ms.us
(601) 961-5577

Counties Included/Number in State: 63 out of 82

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Montana (Fort Peck)

State/Local Agency Name: ITEP

Contact Name, Address, Phone Number, Email:

Sarah Kelly
Sarah.Kelly@nau.edu
(928) 523-6377

Counties Included/Number in State: 1 out of 57

Inventory Year: 2000

Inventory Type - Criteria, toxics, both: Both

CO, NO_x, PM_{10}-PRI, PM-PRI, SO_2, VOC

Formaldehyde

# of HAPs in File: 1 HAP

General Comments on File, if any:

SCCs were updated to reflect current EPA SCCs.

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Nebraska

State/Local Agency Name: Lincoln-Lancaster County Health Department

Contact Name, Address, Phone Number, Email:

Charles Riley
No address given
criley@ci.lincoln.ne.us
(402) 441-6202

Counties Included/Number in State: 1

Inventory Year: 1999

Inventory Type - Criteria, toxics, both: Criteria

CO, CO_2, NO_X, PM_{10}-PRI, SO_X, VOC

# of HAPs in File: 0 HAPs

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: New Hampshire

State/Local Agency Name: New Hampshire Dept of Environmental Services Air Resources Division

Contact Name, Address, Phone Number, Email:

David Healy
dhealy@des.state.nh.us
(603) 271-0871

Counties Included/Number in State: 10 out of 10

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Both

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

1,3-Butadiene, Acetaldehyde, Acrolein, Benzene, Beryllium & Compounds, Cadmium & Compounds, Chromium & Compounds, Ethyl Benzene, Formaldehyde, Hexane, Lead & Compounds, Manganese & Compounds, Mercury & Compounds, Naphthalene, Nickel & Compounds, Polycyclic Organic Matter, Propionaldehyde, Styrene, Toluene, Xylenes (Mixture of o, m, and p Isomers)

# of HAPs in File: 20 HAPs

General Comments on File, if any:

SCCs were updated to reflect current EPA SCCs.

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: New Jersey

State/Local Agency Name: NJ Department of Environmental Protection

Contact Name, Address, Phone Number, Email:

John Gorgol
john.gorgol@dep.state.nj.us
(609) 292-1413

Counties Included/Number in State: 21 out of 21

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

SCCs were updated to reflect current EPA SCCs.

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Nevada (Clark County)

State/Local Agency Name: DAQM

Contact Name, Address, Phone Number, Email:

Ebrahim Juma
juma@co.clark.nv.us
(702) 455-1621

Counties Included/Number in State: 1 out of 17

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM-PRI, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

SCCs were updated to reflect current EPA SCCs.

Pollutant codes were updated to reflect current EPA pollutant codes.

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: North Carolina

State/Local Agency Name:

Contact Name, Address, Phone Number, Email:

Counties Included/Number in State: 72 out of 100

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Ohio

State/Local Agency Name:

Contact Name, Address, Phone Number, Email:

Counties Included/Number in State: 88 out of 88

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NH_3, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, PM-PRI,

# of HAPs in File: No HAPs

General Comments on File, if any:

Pollutant codes were updated to reflect current EPA pollutant codes.

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Oregon

State/Local Agency Name: ODEQ

Contact Name, Address, Phone Number, Email:

Jeffrey Stocum
stocum.jeffrey@deq.state.or.us
(503) 229-5506

Counties Included/Number in State: 32 out of 36

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Both

NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, and VOC

1,3-Butadiene, Acenaphthene, Acenaphthylene, Acetaldehyde, Acrolein, Anthracene, Arsenic Benz[a]Anthracene, Benzene, Benzo[a]Pyrene, Benzo[b]Fluoranthene, Benzo[g,h,i,]Perylene, Benzo[k]Fluoranthene, Beryllium, Cadium, Chromium, Chrysene, Ethyl Benzene, Fluoranthene, Formaldehyde, Hexane, Indeno[1,2,3-c,d]Pyrene, Lead, Manganese, Mercury, Naphthalene, Nickel, Phenanthrene, Propionaldehyde, Pyrene, Styrene, Toluene, Xylenes (Mixture of o, m, and p Isomers)

# of HAPs in File: 33 HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Pennsylvania

State/Local Agency Name:

Contact Name, Address, Phone Number, Email:

Counties Included/Number in State: 57 out of 67

Inventory Year: 1999

Inventory Type - Criteria, toxics, both: Criteria, daily

CO, CO_2, NO_X, PM_{10}-PRI, SO_X, VOC

# of HAPs in File: 0 HAPs

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Rhode Island

State/Local Agency Name: RIDEM

Contact Name, Address, Phone Number, Email:

Karen Slattery
karen.slattery@dem.ri.gov
(401) 222-2808

Counties Included/Number in State: 5 out of 5

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Tennessee

State/Local Agency Name: TDEC APC

Contact Name, Address, Phone Number, Email:

James R. Redus
ron.redus@state.tn.us
(615) 532-0577

Counties Included/Number in State: 57 out of 95

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Tennessee (Nashville/Davidson County)

State/Local Agency Name: Metro Public Health Department Nashville/Davidson Cty

Contact Name, Address, Phone Number, Email:

Laura Artates
laura.artates@nashville.gov
(615) 340-5653

Counties Included/Number in State: 1 out of 95

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Tennessee

State/Local Agency Name: Chattanooga- Hamilton County Air Pollution Control Bureau

Contact Name, Address, Phone Number, Email:

Heather Sandner
sandner_h@mail.chattanoonga.gov
(423) 867-4321

Counties Included/Number in State: 1

Inventory Year: 1999

Inventory Type - Criteria, toxics, both:Criteria

CO, HC, NO_X, SO_X

# of HAPs in File: 0 HAPs

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Texas

State/Local Agency Name: TCEQ

Contact Name, Address, Phone Number, Email:

Melinda Torres
Metorres@tceq.state.tx.us
(512) 239-0058

Counties Included/Number in State: 254 out of 254

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

Acrolein and Chromium & Compounds.

# of HAPs in File: No HAPs

General Comments on File, if any:

SCCs were updated to reflect current EPA SCCs.

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Texas

State/Local Agency Name: Texas Natural Resources Conservation

Contact Name, Address, Phone Number, Email:

Peter Ogbeide
pogbeide@tnrcc.state.tx.us
(512) 239-1937

Counties Included/Number in State: 254 out of 254

Inventory Year: 1999

Inventory Type - Criteria, toxics, both: Toxics

1,3-butadiene, 16-PAH, 7-PAH, Acetaldehyde, Acrolein, Arsenic & Compounds (Inorganic Including Arsine), Benzene, Beryllium & Compounds, Cadmium & Compounds, Chromium & Compounds, Ethylbenzene, Formaldehyde, Hexane, Lead & Compounds, Manganese & Compounds, Mercury & Compounds, Methyl tert-butyl ether, Nickel & Compounds, Propionaldehyde, Selenium & Compounds, Styrene, Toluene, Xylenes (Mixture of o, m, and p isomers)

# of HAPs in File: 23 HAPs

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Utah

State/Local Agency Name: UT Division of Air Quality

Contact Name, Address, Phone Number, Email:

Carol A. Nielsen
Canielsen@utah.gov
(801) 536-4073

Counties Included/Number in State: 29 out of 29

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

Pollutant codes were updated to reflect current EPA pollutant codes.

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Utah

State/Local Agency Name:

Contact Name, Address, Phone Number, Email:

Counties Included/Number in State:

Data acquired from railroads that operate in Utah were used to adjust EPA estimated emissions from railroads. The distribution was made using information on where train tracks are located in the state and the amount of traffic on those tracks.

Inventory Year: 1996

Inventory Type - Criteria, toxics, both: HAPs

# of HAPs in File:

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Utah

State/Local Agency Name: Utah Division of Air Quality

Contact Name, Address, Phone Number, Email:

Carol Neilsen
cneilsen@deq.state.ut.us
(801) 536-4073

Counties Included/Number in State: 29 out of 29

Inventory Year: 1999

Inventory Type - Criteria, toxics, both: Criteria

CO, NH_3, NO_x, PM_{10}-PRI, SO_x, VOC

# of HAPs in File: 0 HAPs

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Virginia

State/Local Agency Name: Virginia Department of Environmental Quality

Contact Name, Address, Phone Number, Email:

Thomas C. Foster
tcfoster@deq.state.va.us
(804) 698-4411

Counties Included/Number in State: 136 out of 136

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, and VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

SCCs were updated to reflect current EPA SCCs.

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Washington

State/Local Agency Name: WA Dept. of Ecology

Contact Name, Address, Phone Number, Email:

Sally Otterson
sott461@ecy.wa.gov
(360) 407-6806

Counties Included/Number in State: 34 out of 39

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Both

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

1,3-Butadiene, 2,2,4-Trimethylpentane, Acenaphthene, Acenaphthylene, Acetaldehyde, Acrolein, Anthracene, Arsenic, Benz[a]Anthracene, Benzene, Benzo[a]Pyrene, Benzo[b]Fluoranthene, Benzo[g,h,i,]Perylene, Benzo[k]Fluoranthene, Beryllium, Cadmium, Chromium, Chrysene, Dibenzo[a,h]Anthracene, Ethyl Benzene, Flouranthene, Fluorene, Formaldehyde, Hexane, Indeno[a]pyrene, Lead, Manganese, Mercury, Naphthalene, Nickel, Phenanthrene, Propionaldehyde, Pyrene, Styrene, Toluene, Xylenes (Mixture of o, m, and p Isomers)

# of HAPs in File: 36 HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Wisconsin

State/Local Agency Name: Wisconsin Department of Natural Resources

Contact Name, Address, Phone Number, Email:

Grant Hetherington
ww.dnr.state.wi.us
(608) 267-7539

Counties Included/Number in State: 72 out of 72

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Both

CO, NH_3, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, PM-PRI, SO_2, VOC

Acenaphthene, Acenaphthylene, Anthracene, Arsenic, Benz[a]Anthracene, Benzo[b]Fluoranthene, Benzo[g,h,i,]Perylene, Benzo[k]Fluoranthene, Beryllium, Cadmium, Chrysene, Ethyl Benzene, Fluoranthene, Fluorene, Hexane, Indeno[1,2,3-c,d]Pyrene, Lead, Manganese, Naphthalene, Nickel, Phenanthrene, Propionaldehyde, Pyrene, Styrene, Toluene , Xylenes (Mixture of o, m, and p Isomers)

# of HAPs in File: 21 HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: West Virginia

State/Local Agency Name: WVDEP Division of Air Quality

Contact Name, Address, Phone Number, Email:

David Porter
dporter@wvdep.org
(304) 926-3647

Counties Included/Number in State: 44 out of 55

Inventory Year: 2002

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_x, PM_{10}-PRI, $PM_{2.5}$-PRI, SO_2, VOC

# of HAPs in File: No HAPs

General Comments on File, if any:

STATE DATABASE SUMMARY REPORT

Source Category: Locomotives

State: Wisconsin

State/Local Agency Name: Wisconsin Department of Natural Resources

Contact Name, Address, Phone Number, Email:

Grant D. Hetherington
hetheg@dnr.state.wi.us
608-267-7539

Counties Included/Number in State: 72 out of N/A

Inventory Year: 1999

Inventory Type - Criteria, toxics, both: Criteria

CO, NO_X, VOC

# of HAPs in File: 0 HAPs

Other Nonroad

STATE DATABASE SUMMARY REPORT

Source Category: Other Nonroad

State: California

State/Local Agency Name: California Air Resources Board

Contact Name, Address, Phone Number, Email:

Andy Alexis
aalexis@arb.ca.gov
(916) 323-1085

Counties Included/Number in State: 58 out of 58

Inventory Year: 1999

Inventory Type - Criteria, toxics both: Toxics

1,3-Butadiene, 2,2,4-Trimethylpentane, Acetaldehyde, Acrolein, Antimony, Arsenic, Benzene, Cadmium, Chlorine, Chromium, Cobalt, Cumene, Ethyl Benzene, Formaldehyde, Hexane, Lead, m-Xylene, Manganese, Mercury, Methanol, Methyl Ethyl Ketone, Methyl Tert-Butyl Ether, Naphthalene, Nickel, o-Xylene, p-Xylene, Phosphorus, Propionaldehyde, Selenium, Styrene, Toluene

(Other pollutants not on the 188 HAP list were also included but not used)

# of HAPs in File: 52 HAPs

General Comments on File, if any:

- The file had to be split up because they put area, mobile, and point together.

STATE DATABASE SUMMARY REPORT

Source Category: Other Nonroad

State: Puerto Rico and the Virgin Islands

State/Local Agency Name: Region II

Contact Name, Address, Phone Number, Email:

Raymond Forde
EPA Region II
NY, NY
Forde.raymond@epamail.epa.gov

Counties Included/Number in State:

Inventory Year: 1996

Inventory Type - Criteria, toxics, both: HAPs

# of HAPs in File: 19

STATE DATABASE SUMMARY REPORT

Source Category: Other Nonroad

State: Tennessee - Davidson County

State/Local Agency Name: Tennessee Division of Air Pollution Control

Contact Name, Address, Phone Number, Email:

Eric Hutton
Tennessee Division of Air Pollution Control
9th floor L&C Annex
401 Church Street
Nashville, TN 97243
ehutton@mail.state.tn.us
(615) 532-0542

Counties Included/Number in State: 1

Inventory Year: 1996

Inventory Type - Criteria, toxics, both: HAPs

# of HAPs in File: 6

STATE DATABASE SUMMARY REPORT

Source Category: Other Nonroad

State: Texas

State/Local Agency Name: Texas Natural Resources Conservation

Contact Name, Address, Phone Number, Email:

Peter Ogbeide
No address given
pogbeide@tnrcc.state.tx.us
(512) 239-1937

Counties Included/Number in State: 254 out of 254

Inventory Year: 1999

Inventory Type - Criteria, toxics, both: Toxics

1,3-Butadiene, 16-PAH, 7-PAH, Acetaldehyde, Acrolein, Arsenic & Compounds (Inorganic Including Arsine), Benzene, Chromium & Compounds, Ethyl Benzene, Formaldehyde, Hexane, Manganese & Compounds, Mercury & Compounds, Methyl Tert-Butyl Ether, Nickel & Compounds, Propionaldehyde, Styrene, Toluene, Xylenes (Mixture of o, m, and p Isomers)

# of HAPs in File: 19 HAPs

General Comments on File, if any:

Appendix F

NEI Pollutant Codes for Hazardous Air Pollutants

Table F-1. NEI Pollutant Codes for Hazardous Air Pollutants

Pollutant Code	Pollutant Name	HAP Group
100027	4-Nitrophenol	4-Nitrophenol
10025873	Phosphorus Oxychloride	Phosphorus Compounds
10025919	Antimony Trichloride	Antimony Compounds
1002671	Diethylene Glycol Ethyl Methyl Ether	Glycol Ethers
10031137	Lead Arsenite	Lead Compounds
10034829	Sodium Chromate(VI)	Chromium Compounds
100414	Ethyl Benzene	Ethylbenzene
100425	Styrene	Styrene
100447	Benzyl Chloride	Benzyl Chloride
10060125	Chromium Chloride	Chromium Compounds
10099748	Lead Nitrate	Lead Compounds
10101505	Permanganic acid	Manganese Compounds
10101538	Chromic Sulfate	Chromium Compounds
10101970	Nickel (II) Sulfate Hexahydrate	Nickel Compounds
101020	Triphenyl Phosphite	Phosphorus Compounds
10108642	Cadmium Chloride	Cadmium Compounds
101144	4,4'-Methylenebis(2-Chloraniline)	4,4'-Methylenebis(2-Chloroaniline)
10124364	Cadmium Sulfate	Cadmium Compounds
10124433	Cobalt Sulfate	Cobalt Compounds
10137969	Ethyleneglycol Mono-2-Methylpentyl Ether	Glycol Ethers
10137981	Ethyleneglycolmono-2,6,8-Trimethyl-4-Nonyl Ether	Glycol Ethers
10143530	Diethylene Glycol Ethylvinyl Ether	Glycol Ethers
10143541	Diethylene Glycol Mono-2-Cyanoethyl Ether	Glycol Ethers
10143563	Diethyleneglycol-Mono-2-Methyl-Pentyl Ether	Glycol Ethers
101688	4,4'-Methylenediphenyl Diisocyanate	4,4'-Methylenediphenyl Diisocyanate (MDI)
101779	4,4'-Methylenedianiline	4,4'-Methylenedianiline
102	Benzo[b+k]Fluoranthene	Polycyclic Organic Matter as 7-PAH
10215335	3-Butoxy-1-Propanol	Glycol Ethers
10294403	Barium Chromate	Chromium Compounds
10294561	Phosphorous Acid	Phosphorus Compounds
103	Benz(a)Anthracene/Chrysene	Polycylic Organic Matter as 7-PAH
10325947	Cadmium Nitrate	Cadmium Compounds
10377669	Manganese Nitrate	Manganese Compounds
10588019	Sodium Dichromate	Chromium Compounds
106423	p-Xylene	Xylenes (Mixed Isomers)
106445	p-Cresol	Cresol/Cresylic Acid (Mixed Isomers)
106467	1,4-Dichlorobenzene	1,4-Dichlorobenzene
106503	p-Phenylenediamine	p-Phenylenediamine
106514	Quinone	Quinone (p-Benzoquinone)
106887	1,2-Epoxybutane	1,2-Epoxybutane

Table F-1. NEI Pollutant Codes for Hazardous Air Pollutants (Continued)

Pollutant Code	Pollutant Name	HAP Group
106898	1-Chloro-2,3-Epoxypropane	Epichlorohydrin (1-Chloro-2,3-Epoxypropane)
106934	Ethylene Dibromide	Ethylene Dibromide (Dibromoethane)
106990	1,3-Butadiene	1,3-Butadiene
107028	Acrolein	Acrolein
107051	Allyl Chloride	Allyl Chloride
107062	Ethylene Dichloride	Ethylene Dichloride (1,2-Dichloroethane)
107131	Acrylonitrile	Acrylonitrile
107211	Ethylene Glycol	Ethylene Glycol
107302	Chloromethyl Methyl Ether	Chloromethyl Methyl Ether
108054	Vinyl Acetate	Vinyl Acetate
108101	Methyl Isobutyl Ketone	Methyl Isobutyl Ketone (Hexone)
108316	Maleic Anhydride	Maleic Anhydride
108383	m-Xylene	Xylenes (Mixed Isomers)
108394	m-Cresol	Cresol/Cresylic Acid (Mixed Isomers)
108883	Toluene	Toluene
108907	Chlorobenzene	Chlorobenzene
108952	Phenol	Phenol
109	Beryllium & Compounds	Beryllium Compounds
109864	Ethylene Glycol Methyl Ether	Glycol Ethers
110496	Ethylene Glycol Monomethyl Ether Acetate	Glycol Ethers
110543	Hexane	Hexane
110714	1,2-Dimethoxyethane	Glycol Ethers
110805	Cellosolve Solvent	Glycol Ethers
11103869	Zinc Potassium Chromate	Chromium Compounds
111104	Methoxyethyl Oleate	Glycol Ethers
11115745	Chromic Acid	Chromium Compounds
111159	Cellosolve Acetate	Glycol Ethers
111422	Diethanolamine	Diethanolamine
111444	Dichloroethyl Ether	Dichloroethyl Ether (Bis[2-Chloroethyl]Ether)
111762	Butyl Cellosolve	Glycol Ethers
111773	Diethylene Glycol Monomethyl Ether	Glycol Ethers
111900	Diethylene Glycol Monoethyl Ether	Glycol Ethers
111966	Diethylene Glycol Dimethyl Ether	Glycol Ethers
1120714	1,3-Propanesultone	1,3-Propane Sultone
112072	2-Butoxyethyl Acetate	Glycol Ethers
112152	Carbitol Acetate	Glycol Ethers
112254	2-(Hexyloxy)Ethanol	Glycol Ethers
112276	Triethylene glycol	Glycol Ethers
112345	Diethylene Glycol Monobutyl Ether	Glycol Ethers
112356	Methoxytriglycol	Glycol Ethers
112367	Diethylene glycol diethyl ether	Glycol Ethers
112492	Triethylene Glycol Dimethyl Ether	Glycol Ethers
112505	Ethoxytriglycol	Glycol Ethers

Table F-1. NEI Pollutant Codes for Hazardous Air Pollutants (Continued)

Pollutant Code	Pollutant Name	HAP Group
112594	N-Hexyl Carbitol	Glycol Ethers
114261	Propoxur	Propoxur (Baygon)
115866	Triphenyl Phosphate	Phosphorus Compounds
117817	Bis(2-Ethylhexyl)Phthalate	Bis(2-Ethylhexyl)Phthalate (Dehp)
118741	Hexachlorobenzene	Hexachlorobenzene
119904	3,3'-Dimethoxybenzidine	3,3'-Dimethoxybenzidine
119937	3,3'-Dimethylbenzidine	3,3'-Dimethylbenzidine
120127	Anthracene	Polycyclic Organic Matter as 15-PAH
12018018	Chromium Dioxide	Chromium Compounds
12018198	Chromium Zinc Oxide	Chromium Compounds
12035722	Nickel Subsulfide	Nickel Compounds
12054487	Nickel Hydroxide	Nickel Compounds
120558	Diethylene Glycol Dibenzoate	Glycol Ethers
12060003	Lead Titanate	Lead Compounds
120809	Catechol	Catechol
120821	1,2,4-Trichlorobenzene	1,2,4-Trichlorobenzene
121142	2,4-Dinitrotoluene	2,4-Dinitrotoluene
12136913	Phosphorous Nitride	Phosphorus Compounds
121448	Triethylamine	Triethylamine
121697	N,N-Dimethylaniline	N,N-Dimethylaniline
122667	1,2-Diphenylhydrazine	1,2-Diphenylhydrazine
122996	Phenyl Cellosolve	Glycol Ethers
123319	Hydroquinone	Hydroquinone
123386	Propionaldehyde	Propionaldehyde
123911	p-Dioxane	p-Dioxane
124174	Butyl Carbitol Acetate	Glycol Ethers
125	Cadmium & Compounds	Cadmium Compounds
12626812	Lead Titanate Zircon	Lead Compounds
12640890	Selenium Oxide	Selenium Compounds
126998	Chloroprene	Chloroprene
12710360	Nickel Carbide	Nickel Compounds
1271289	Nickelocene	Nickel Compounds
127184	Tetrachloroethylene	Tetrachloroethylene (Perchloroethylene)
129000	Pyrene	Polycyclic Organic Matter as 15-PAH
13011546	Phosphorous Salt	Phosphorus Compounds
1303282	Arsenic Pentoxide	Arsenic Compounds(Inorganic Including Arsine)
1304569	Beryllium Oxide	Beryllium Compounds
1306190	Cadmium Oxide	Cadmium Compounds
1306236	Cadmium Sulfide	Cadmium Compounds
1307966	Cobalt Oxide	Cobalt Compounds
1308061	Cobalt Oxide (II,III)	Cobalt Compounds
1308130	Zinc Chromate	Chromium Compounds
1308141	Chromium Hydroxide	Chromium Compounds

Table F-1. NEI Pollutant Codes for Hazardous Air Pollutants (Continued)

Pollutant Code	Pollutant Name	HAP Group
1308389	Chromic Oxide	Chromium Compounds
1309600	Lead Dioxide	Lead Compounds
1309644	Antimony Trioxide	Antimony Compounds
131113	Dimethyl Phthalate	Dimethyl Phthalate
1313139	Manganese Dioxide	Manganese Compounds
13138459	Nickel Nitrate	Nickel Compounds
1313991	Nickel Oxide	Nickel Compounds
1314063	Nickel Peroxide	Nickel Compounds
1314245	Phosphorus Trioxide	Phosphorus Compounds
1314416	Lead (II, IV) Oxide	Lead Compounds
1314563	Phosphorus Pentoxide	Phosphorus Compounds
1314803	Phosphorus Pentasulfide	Phosphorus Compounds
1317346	Manganese Trioxide	Manganese Compounds
1317357	Manganese Tetroxide	Manganese Compounds
1317368	Lead (II) Oxide	Lead Compounds
1317426	Cobalt Sulfide	Cobalt Compounds
1319773	Cresol	Cresol/Cresylic Acid (Mixed Isomers)
132649	Dibenzofuran	Dibenzofuran
1327339	Antimony Oxide	Antimony Compounds
1327522	Arsenic Acid	Arsenic Compounds(Inorganic Including Arsine)
1327533	Arsenic Trioxide	Arsenic Compounds(Inorganic Including Arsine)
1330207	Xylenes (Mixture of o, m, and p Isomers)	Xylenes (Mixed Isomers)
133062	Captan	Captan
1332214	Asbestos	Asbestos
1333820	Chromium Trioxide	Chromium Compounds
1335257	Lead Oxide	Lead Compounds
1335326	Lead Subacetate	Lead Compounds
1336363	Polychlorinated Biphenyls	Polychlorinated Biphenyls (Aroclors)
1336932	Manganese Napthenate	Manganese Compounds
133904	Chloramben	Chloramben
1345046	Antimony Trisulfide	Antimony Compounds
1345160	Cobalt Aluminate	Cobalt Compounds
13462889	Nickel Bromide	Nickel Compounds
13463393	Nickel Carbonyl	Nickel Compounds
13510491	Beryllium Sulfate	Beryllium Compounds
13530659	Zinc Chromate	Chromium Compounds
13530682	Chromic Sulfuric Acid	Chromium Compounds
136	Chromium & Compounds	Chromium Compounds
136527	Cobalt 2-ethylhexanoate	Cobalt Compounds
13765190	Calcium Chromate	Chromium Compounds
13770893	Nickel Sulfamate	Nickel Compounds
13814965	Lead Fluoroborate	Lead Compounds
139	Cobalt & Compounds	Cobalt Compounds

Table F-1. NEI Pollutant Codes for Hazardous Air Pollutants (Continued)

Pollutant Code	Pollutant Name	HAP Group
13943583	Potassium Ferrocyani	Cyanide Compounds
13967505	Gold (I) Potassium Cyanide	Cyanide Compounds
140	Coke Oven Emissions	Coke Oven Emissions
140056	Methyl Cellosolve Acetylricinoleate	Glycol Ethers
140294	Benzyl Cyanide	Cyanide Compounds
140885	Ethyl Acrylate	Ethyl Acrylate
141	Benzene Soluble Organics (BSO)	Coke Oven Emissions
142	Methylene Chloride Soluble Organics (MCSO)	Coke Oven Emissions
14220178	Potass Nickel Cyanid	Cyanide Compounds
14307358	Lithium Chromate	Chromium Compounds
143226	Triglycol Monobutyl Ether	Glycol Ethers
143339	Sodium Cyanide	Cyanide Compounds
144	Cyanide & Compounds	Cyanide Compounds
14977618	Chromyl Chloride	Chromium Compounds
151508	Potassium Cyanide	Cyanide Compounds
151564	Ethyleneimine	Ethyleneimine (Aziridine)
155	Dioxins	Dioxins/Furans (total, non TEQ)
156627	Calcium Cyanamide	Calcium Cyanamide
1582098	Trifluralin	Trifluralin
1589497	3-Methoxy-1-Propanol	Glycol Ethers
16065831	Chromium III	Chromium Compounds
1634044	Methyl Tert-Butyl Ether	Methyl Tert-Butyl Ether
16672392	Di(Ethylene Glycol Monobutyl Ether) Phthalate	Glycol Ethers
16842038	Cobalt Carbonate	Cobalt Compounds
16925250	Sodium hexafluoroantimenate	Antimony Compounds
171	Glycol Ethers	Glycol Ethers
1746016	2,3,7,8-Tetrachlorodibenzo-p-Dioxin	Dioxins/Furans as 2,3,7,8-TCDD TEQs
18454121	Lead Chromate Oxide	Lead Compounds
18540299	Chromium (VI)	Chromium Compounds
18912806	Diethylene Glycol Monoisobutyl Ether	Glycol Ethers
189559	Dibenzo[a,i]Pyrene	Polycyclic Organic Matter
189640	Dibenzo[a,h]Pyrene	Polycyclic Organic Matter
191242	Benzo[g,h,i,]Perylene	Polycyclic Organic Matter as 15-PAH
191300	Dibenzo[a,l]Pyrene	Polycyclic Organic Matter
192654	Dibenzo[a,e]Pyrene	Polycyclic Organic Matter
192972	Benzo[e]Pyrene	Polycyclic Organic Matter
193395	Indeno[1,2,3-c,d]Pyrene	Polycyclic Organic Matter as 7-PAH
19408743	1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin	Dioxins/Furans as 2,3,7,8-TCDD TEQs
195	Lead & Compounds	Lead Compounds
195197	Benzo(c)phenanthrene	Polycyclic Organic Matter
198	Manganese & Compounds	Manganese Compounds

Table F-1. NEI Pollutant Codes for Hazardous Air Pollutants (Continued)

Pollutant Code	Pollutant Name	HAP Group
198550	Perylene	Polycyclic Organic Matter
199	Mercury & Compounds	Mercury Compounds
200	Elemental Gaseous Mercury	Mercury Compounds
201	Gaseous Divalent Mercury	Mercury Compounds
202	Particulate Divalent Mercury	Mercury Compounds
203123	Benzo(g,h,i)Fluoranthene	Polycyclic Organic Matter
203338	Benzo(a)fluoranthene	Polycyclic Organic Matter
205823	B[j]Fluoranthen	Polycyclic Organic Matter
205992	Benzo[b]Fluoranthene	Polycyclic Organic Matter as 7-PAH
206440	Fluoranthene	Polycyclic Organic Matter as 15-PAH
20706256	2-Propoxyethyl Acetate	Glycol Ethers
207089	Benzo[k]Fluoranthene	Polycyclic Organic Matter as 7-PAH
208968	Acenaphthylene	Polycyclic Organic Matter as 15-PAH
218019	Chrysene	Polycyclic Organic Matter as 7-PAH
224420	Dibenzo[a,j]Acridine	Polycyclic Organic Matter
226	Nickel & Compounds	Nickel Compounds
22967926	Mercury (Organic)	Mercury Compounds
234	PAH, Total	Polycyclic Organic Matter as 7-PAH
23436193	1-Isobutoxy-2-Propanol	Glycol Ethers
23495127	Ethyleneglycol Monophenyl Ether Propionate	Glycol Ethers
2381217	1-Methylpyrene	Polycyclic Organic Matter
2422799	12-Methylbenz(a)Anthracene	Polycylic Organic Matter
24267569	Iodine-131	Radionuclides (Including Radon)
246	Polycyclic Organic Matter	Polycyclic Organic Matter as 7-PAH
247	Methylbenzopyrenes	Polycyclic Organic Matter
248	Methylchrysene	Polycyclic Organic Matter
253	Selenium & Compounds	Selenium Compounds
262124	Dibenzo-p-Dioxin	Dioxins/Furans (total, non TEQ)
26914181	Methylanthracene	Polycyclic Organic Matter
27253287	Lead Neodecanoate	Lead Compounds
27310210	2-(2,4-Hexadienyloxy)Ethanol	Glycol Ethers
2807309	Propyl Cellosolve	Glycol Ethers
284	Extractable Organic Matter (EOM)	Polycyclic Organic Matter
2921882	Phosphorothioic Acid	Phosphorus Compounds
301042	Lead Acetate	Lead Compounds
302012	Hydrazine	Hydrazine
30402143	Total Tetrachlorodibenzofuran	Dioxins/Furans (total, non TEQ)
30402154	Total Pentachlorodibenzofuran	Dioxins/Furans (total, non TEQ)
3121617	Methyl Cellosolve Acrylate	Glycol Ethers
3141126	Arsenous Acid	Arsenic Compounds(Inorganic Including Arsine)
3268879	Octachlorodibenzo-p-Dioxin	Dioxins/Furans as 2,3,7,8-TCDD TEQs
331	Cresols (Includes o, m, & p)/Cresylic Acids	Cresol/Cresylic Acid (Mixed Isomers)

Table F-1. NEI Pollutant Codes for Hazardous Air Pollutants (Continued)

Pollutant Code	Pollutant Name	HAP Group
3333393	Nickel Carbonate	Nickel Compounds
334883	Diazomethane	Diazomethane
34465468	Hexachlorodibenzo-p-Dioxin	Dioxins/Furans (total, non TEQ)
35822469	1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin	Dioxins/Furans as 2,3,7,8-TCDD TEQs
36088229	Total Pentachlorodibenzo-p-Dioxin	Dioxins/Furans (total, non TEQ)
3697243	5-Methylchrysene	Polycyclic Organic Matter
37187647	Gold Cyanide	Cyanide Compounds
373024	Nickel Acetate	Nickel Compounds
3775857	Ethylene Glycol Bis(2,3-Epoxy-2-Methylpropyl) Ether	Glycol Ethers
37871004	Total Heptachlorodibenzo-p-Dioxin	Dioxins/Furans (total, non TEQ)
383	Fine Mineral Fibers	Fine Mineral Fibers
38998753	Total Heptachlorodibenzofuran	Dioxins/Furans (total, non TEQ)
39001020	Octachlorodibenzofuran	Dioxins/Furans as 2,3,7,8-TCDD TEQs
39227286	1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin	Dioxins/Furans as 2,3,7,8-TCDD TEQs
398	Phosphorus & Compounds	Phosphorus Compounds
40	16-PAH	Polycyclic Organic Matter as 16-PAH
400	Radionuclides (Including Radon)	Radionuclides (Including Radon)
40321764	1,2,3,7,8-Pentachlorodibenzo-p-Dioxin	Dioxins/Furans as 2,3,7,8-TCDD TEQs
41903575	Total Tetrachlorodibenzo-p-Dioxin	Dioxins/Furans (total, non TEQ)
4206615	Diethylene Glycol Diglycidyl Ether	Glycol Ethers
42397648	1,6-Dinitropyrene	Polycyclic Organic Matter
42397659	1,8-Dinitropyrene	Polycyclic Organic Matter
4439241	Isobutyl Cellosolve	Glycol Ethers
463581	Carbonyl Sulfide	Carbonyl Sulfide
50000	Formaldehyde	Formaldehyde
50328	Benzo[a]Pyrene	Polycyclic Organic Matter as 7-PAH
506649	Silver Cyanide	Cyanide Compounds
50922297	Zinc Chromite	Chromium Compounds
510156	Chlorobenzilate	Chlorobenzilate
51207319	2,3,7,8-Tetrachlorodibenzofuran	Dioxins/Furans as 2,3,7,8-TCDD TEQs
51285	2,4-Dinitrophenol	2,4-Dinitrophenol
51796	Ethyl Carbamate Chloride	Ethyl Carbamate (Urethane) Chloride (Chloroethane)
532274	2-Chloroacetophenone	2-Chloroacetophenone
534521	4,6-Dinitro-o-Cresol	4,6-Dinitro-o-Cresol (Including Salts)
53703	Dibenzo[a,h]Anthracene	Polycyclic Organic Matter as 7-PAH
53963	2-Acetylaminofluorene	2-Acetylaminofluorene
540841	2,2,4-Trimethylpentane	2,2,4-Trimethylpentane
542756	1,3-Dichloropropene	1,3-Dichloropropene
542881	Bis(Chloromethyl)Ether	Bis(Chloromethyl) Ether
544923	Copper Cyanide	Cyanide Compounds
5522430	1-Nitropyrene	Polycyclic Organic Matter
554074	Gold Potassium Cyanide	Cyanide Compounds

Table F-1. NEI Pollutant Codes for Hazardous Air Pollutants (Continued)

Pollutant Code	Pollutant Name	HAP Group
55673897	1,2,3,4,7,8,9-Heptachlorodibenzofuran	Dioxins/Furans as 2,3,7,8-TCDD TEQs
55684941	Total Hexachlorodibenzofuran	Dioxins/Furans (total, non TEQ)
557211	Zinc Cyanide	Cyanide Compounds
56235	Carbon Tetrachloride	Carbon Tetrachloride
56382	Parathion	Parathion
56495	3-Methylcholanthrene	Polycyclic Organic Matter
56553	Benz[a]Anthracene	Polycyclic Organic Matter as 7-PAH
56832736	Benzofluoranthenes	Polycyclic Organic Matter as 7-PAH
57117314	2,3,4,7,8-Pentachlorodibenzofuran	Dioxins/Furans as 2,3,7,8-TCDD TEQs
57117416	1,2,3,7,8-Pentachlorodibenzofuran	Dioxins/Furans as 2,3,7,8-TCDD TEQs
57117449	1,2,3,6,7,8-Hexachlorodibenzofuran	Dioxins/Furans as 2,3,7,8-TCDD TEQs
57125	Cyanide	Cyanide Compounds
57147	1,1-Dimethyl Hydrazine	1,1-Dimethylhydrazine
57578	Beta-Propiolactone	Beta-Propiolactone
57653857	1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin	Dioxins/Furans as 2,3,7,8-TCDD TEQs
57749	Chlordane	Chlordane
57976	7,12-Dimethylbenz[a]Anthracene	Polycyclic Organic Matter
584849	2,4-Toluene Diisocyanate	2,4-Toluene Diisocyanate
58899	1,2,3,4,5,6-Hexachlorocyclyhexane	1,2,3,4,5,6-Hexachlorocyclyhexane (All Stereo Isomers, Including Lindane)
593602	Vinyl Bromide	Vinyl Bromide
593748	Methyl Mercury	Mercury Compounds
598630	Lead Carbonate	Lead Compounds
59892	N-Nitrosomorpholine	N-Nitrosomorpholine
600	2,3,7,8-TCDD TEQ	Dioxins/Furans as 2,3,7,8-TCDD TEQs
60117	4-Dimethylaminoazobenzene	4-Dimethylaminoazobenzene
6018899	Nickel Diacetate TET	Nickel Compounds
602	Lead Compounds (Inorganic)	Lead Compounds
603	Lead Compounds (Other Than Inorganic)	Lead Compounds
60344	Methylhydrazine	Methylhydrazine
60355	Acetamide	Acetamide
604	Nickel Refinery Dust	Nickel Compounds
605	Radionuclides	Radionuclides (Including Radon)
606	Radon And Its Decay Products	Radionuclides (Including Radon)
607578	2-Nitrofluorene	Polycyclic Organic Matter
608	Ceramic Fibers (Man-Made)	Fine Mineral Fibers
60851345	2,3,4,6,7,8-Hexachlorodibenzofuran	Dioxins/Furans as 2,3,7,8-TCDD TEQs
609	Dibenzofurans (Chlorinated) {PCDFs}	Dioxins/Furans (total, non TEQ)
610	Dioxins, Total, w/o Individ. Isomers Reported {PCDDs}	Dioxins/Furans (total, non TEQ)
613	Glasswool (Man-Made Fibers)	Fine Mineral Fibers
616	Slagwool (Man-Made Fibers)	Fine Mineral Fibers
617	Rockwool (Man-Made Fibers)	Fine Mineral Fibers

Table F-1. NEI Pollutant Codes for Hazardous Air Pollutants (Continued)

Pollutant Code	Pollutant Name	HAP Group
61789513	Cobalt Naphtha	Cobalt Compounds
61790145	Lead Naphthenate	Lead Compounds
618	Cobalt Hydrocarbonyl	Cobalt Compounds
620	Lead Dioxide, Unknown CAS #	Lead Compounds
622	Hexachlorodibenzo-p-Dioxins, Total	Dioxins/Furans (total, non TEQ)
623	Polychlorinated Dibenzo-p-Dioxins, Total	Dioxins/Furans (total, non TEQ)
62384	Mercury Acetato Phen	Mercury Compounds
624	Polychlorinated Dibenzofurans, Total	Dioxins/Furans (total, non TEQ)
624839	Methyl Isocyanate	Methyl Isocyanate
625	Naphthenes (Cyclo)	Polycyclic Organic Matter
62533	Aniline	Aniline
62737	Dichlorvos	Dichlorvos
62759	N-Nitrosodimethylamine	N-Nitrosodimethylamine
629141	Ethylene Glycol Diethyl Ether	Glycol Ethers
63252	Carbaryl	Carbaryl
64675	Diethyl Sulfate	Diethyl Sulfate
662082	Ethylene Glycol Monobenzyl Ether	Glycol Ethers
67425	(Ethylenebis(Oxyethylenenitrilo)) Tetraacetic Acid	Glycol Ethers
67561	Methanol	Methanol
67562394	1,2,3,4,6,7,8-Heptachlorodibenzofuran	Dioxins/Furans as 2,3,7,8-TCDD TEQs
67663	Chloroform	Chloroform
67721	Hexachloroethane	Hexachloroethane
680319	Hexamethylphosphoramide	Hexamethylphosphoramide
68122	N,N-Dimethylformamide	N,N-Dimethylformamide
684935	N-Nitroso-N-Methylurea	N-Nitroso-N-Methylurea
693210	Diethylene Glycol Dinitrate	Glycol Ethers
70648269	1,2,3,4,7,8-Hexachlorodibenzofuran	Dioxins/Furans as 2,3,7,8-TCDD TEQs
71432	Benzene	Benzene (Including Benzene From Gasoline)
71556	Methyl Chloroform	Methyl Chloroform (1,1,1-Trichloroethane)
72435	Methoxychlor	Methoxychlor
72559	Dde (1,1-Dichloro-2,2-Bis(p-Chlorophenyl) Ethylene)	Dde (1,1-Dichloro-2,2-Bis(p- Chlorophenyl) Ethylene)
72918219	1,2,3,7,8,9-Hexachlorodibenzofuran	Dioxins/Furans as 2,3,7,8-TCDD TEQs
7428480	Lead Stearate	Lead Compounds
7439921	Lead	Lead Compounds
7439965	Manganese	Manganese Compounds
7439976	Mercury	Mercury Compounds
7440020	Nickel	Nickel Compounds
7440360	Antimony	Antimony Compounds
7440382	Arsenic	Arsenic Compounds(Inorganic Including Arsine)
7440417	Beryllium	Beryllium Compounds
7440439	Cadmium	Cadmium Compounds

Table F-1. NEI Pollutant Codes for Hazardous Air Pollutants (Continued)

Pollutant Code	Pollutant Name	HAP Group
7440473	Chromium	Chromium Compounds
7440484	Cobalt	Cobalt Compounds
7440611	Uranium	Radionuclides (Including Radon)
7446084	Selenium Dioxide	Selenium Compounds
7446142	Lead Sulfate	Lead Compounds
7446277	Lead Phosphate	Lead Compounds
7446346	Selenium Monosulfide	Selenium Compounds
74839	Methyl Bromide	Methyl Bromide (Bromomethane)
74873	Methyl Chloride	Methyl Chloride (Chloromethane)
7487947	Mercuric Chloride	Mercury Compounds
74884	Methyl Iodide	Methyl Iodide (Iodomethane)
7488564	Selenium Disulfide	Selenium Compounds
74908	Hydrogen Cyanide	Cyanide Compounds
7496028	6-Nitrochrysene	Polycyclic Organic Matter
75	7-PAH	Polycyclic Organic Matter as 7-PAH
75003	Ethyl Chloride	Ethyl Chloride
75014	Vinyl Chloride	Vinyl Chloride
75058	Acetonitrile	Acetonitrile
75070	Acetaldehyde	Acetaldehyde
75092	Methylene Chloride	Methylene Chloride (Dichloromethane)
75150	Carbon Disulfide	Carbon Disulfide
75218	Ethylene Oxide	Ethylene Oxide
75252	Bromoform	Bromoform
7529273	Ethylene Glycol Diallyl Ether	Glycol Ethers
75343	Ethylidene Dichloride	Ethylidene Dichloride (1,1-Dichloroethane)
75354	Vinylidene Chloride	Vinylidene Chloride (1,1-Dichloroethylene)
75445	Phosgene	Phosgene
7550450	Titanium Tetrachloride	Titanium Tetrachloride
75558	1,2-Propylenimine	1,2-Propylenimine (2-Methylaziridine)
75569	Propylene Oxide	Propylene Oxide
76448	Heptachlor	Heptachlor
764487	Ethylene Glycol Monovinyl Ether	Glycol Ethers
7647010	Hydrochloric Acid	Hydrochloric Acid (Hydrogen Chloride [Gas Only])
764998	Diethylene Glycol Divinyl Ether	Glycol Ethers
7664382	Phosphoric Acid	Phosphorus Compounds
7664393	Hydrogen Fluoride	Hydrogen Fluoride (Hydrofluoric Acid)
7718549	Nickel Chloride	Nickel Compounds
7719122	Phosphorus Trichloride	Phosphorus Compounds
7722647	Potassium permanganate	Manganese Compounds
7723140	Phosphorus	Phosphorus Compounds
7738945	Chromic Acid (VI)	Chromium Compounds
77474	Hexachlorocyclopentadiene	Hexachlorocyclopentadiene
7758976	Lead Chromate	Lead Compounds

Table F-1. NEI Pollutant Codes for Hazardous Air Pollutants (Continued)

Pollutant Code	Pollutant Name	HAP Group
7775113	Sodium Chromate	Chromium Compounds
77781	Dimethyl Sulfate	Dimethyl Sulfate
7778509	Potassium Dichromate	Chromium Compounds
7779900	Zinc Phosphate	Phosphorus Compounds
7782492	Selenium	Selenium Compounds
7782505	Chlorine	Chlorine
7783008	Selenous Acid	Selenium Compounds
7783166	Manganesehypophosphi	Manganese Compounds
7783702	Antimony Pentafluoride	Antimony Compounds
7783791	Selenium Hexafluoride	Selenium Compounds
7784409	Lead Arsenate	Lead Compounds
7784421	Arsine	Arsenic Compounds(Inorganic Including Arsine)
7785877	Manganese Sulfate	Manganese Compounds
7786814	Nickel Sulfate	Nickel Compounds
7787497	Beryllium Fluoride	Beryllium Compounds
7788967	Chromyl Fluoride	Chromium Compounds
7789006	Potassium Chromate	Chromium Compounds
7789062	Strontium Chromate	Chromium Compounds
7789095	Ammonium Dichromate	Chromium Compounds
779022	9-Methylbenz(a)Anthracene	Polycylic Organic Matter
7790809	Cadmium Iodide	Cadmium Compounds
7795917	Ethylene Glycol Mono-Sec-Butyl Ether	Glycol Ethers
78002	Tetraethyl Lead	Lead Compounds
7803512	Phosphine	Phosphine
78308	Triorthocresyl Phosphate	Phosphorus Compounds
78591	Isophorone	Isophorone
78820	2-Methyl-Propanenitrile	Cyanide Compounds
78875	Propylene Dichloride	Propylene Dichloride (1,2-Dichloropropane)
78933	Methyl Ethyl Ketone	Methyl Ethyl Ketone (2-Butanone)
79005	1,1,2-Trichloroethane	1,1,2-Trichloroethane
79016	Trichloroethylene	Trichloroethylene
79061	Acrylamide	Acrylamide
79107	Acrylic Acid	Acrylic Acid
79118	Chloroacetic Acid	Chloroacetic Acid
79345	1,1,2,2-Tetrachloroethane	1,1,2,2-Tetrachloroethane
79447	Dimethylcarbamoyl Chloride	Dimethylcarbamoyl Chloride
79469	2-Nitropropane	2-Nitropropane
8001352	Toxaphene	Toxaphene (Chlorinated Camphene)
8007452	Coal Tar	Coke Oven Emissions
8030704	Manganese Tallate	Manganese Compounds
80626	Methyl Methacrylate	Methyl Methacrylate
822060	Hexamethylene Diisocyanate	Hexamethylene Diisocyanate
82688	Pentachloronitrobenzene	Pentachloronitrobenzene (Quintobenzene)

Table F-1. NEI Pollutant Codes for Hazardous Air Pollutants (Continued)

Pollutant Code	Pollutant Name	HAP Group
832699	1-Methylphenanthrene	Polycyclic Organic Matter
83329	Acenaphthene	Polycyclic Organic Matter as 15-PAH
84742	Dibutyl Phthalate	Dibutyl Phthalate
85018	Phenanthrene	Polycyclic Organic Matter as 15-PAH
85449	Phthalic Anhydride	Phthalic Anhydride
86737	Fluorene	Polycyclic Organic Matter as 15-PAH
87683	Hexachlorobutadiene	Hexachlorobutadiene
87865	Pentachlorophenol	Pentachlorophenol
88	Alkylated Lead	Lead Compounds
88062	2,4,6-Trichlorophenol	2,4,6-Trichlorophenol
90040	o-Anisidine	o-Anisidine
90120	1-Methylnaphthalene	Polycyclic Organic Matter
91203	Naphthalene	Naphthalene
91225	Quinoline	Quinoline
91576	2-Methylnaphthalene	Polycyclic Organic Matter
91587	2-Chloronaphthalene	Polycyclic Organic Matter
91941	3,3'-Dichlorobenzidene	3,3'-Dichlorobenzidene
92	Antimony & Compounds	Antimony Compounds
92203026	Phosphoric Acid,Rx P	Phosphorus Compounds
92524	Biphenyl	Biphenyl
92671	4-Aminobiphenyl	4-Aminobiphenyl
92875	Benzidine	Benzidine
92933	4-Nitrobiphenyl	4-Nitrobiphenyl
929373	Diethylene Glycol Monovinyl Ether	Glycol Ethers
93	Arsenic & Compounds (Inorganic Including Arsine)	Arsenic Compounds(Inorganic Including Arsine)
94757	2,4-Dichlorophenoxy Acetic Acid	2,4-D (2,4-Dichlorophenoxyacetic Acid)(Including Salts And Esters)
95476	o-Xylene	Xylenes (Mixed Isomers)
95487	o-Cresol	Cresol/Cresylic Acid (Mixed Isomers)
95534	o-Toluidine	o-Toluidine
95807	Toluene-2,4-Diamine	Toluene-2,4-Diamine
95954	2,4,5-Trichlorophenol	2,4,5-Trichlorophenol
96093	Styrene Oxide	Styrene Oxide
96128	1,2-Dibromo-3-Chloropropane	1,2-Dibromo-3-Chloropropane
96457	Ethylene Thiourea	Ethylene Thiourea
98077	Benzotrichloride	Benzotrichloride
98828	Cumene	Cumene
98862	Acetophenone	Acetophenone
98953	Nitrobenzene	Nitrobenzene
NY059280	Nickel (NI 059)	Nickel Compounds

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