United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

EPA-454/R-01-006
March 2001

Air

PROCEDURES DOCUMENT FOR NATIONAL EMISSION INVENTORY, CRITERIA AIR POLLUTANTS 1985-1999

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ACRONYMS AND ABBREVIATIONS

AADT	annual average daily traffic
AAMA	American Automotive Manufacturer's Association
AAR	Association of American Railroads
ACT	Alternative Control Technology
ADTV	average daily traffic volume
AIRS	Aerometric Information Retrieval System
AIRS/AMS	AIRS Area and Mobile Source Subsystem
AIRS/FS	AIRS Facility Subsystem
ARD	Acid Rain Division
ASTM	American Society for Testing and Materials
BEA	U.S. Department of Commerce, Bureau of Economic Analysis
BLS	U.S. Bureau of Labor Statistics
CAAA	Clean Air Act Amendments of 1990
CEM	continuous emissions monitor(ing)
CNOI	Census number of inhabitants
CO	carbon monoxide
CTG	Control Techniques Guidelines
CTIC	Conservation Information Technology Center
DOE	U.S. Department of Energy
DOT	Department of Transportation
DVMT	daily vehicle miles traveled
EIA	U.S. DOE, Energy Information Administration
EFIG	EPA, OAQPS, Emission Factor and Inventory Group
EG	earnings growth
EPA	U.S. Environmental Protection Agency
ERCAM	Emission Reductions and Cost Analysis Model
ESD	EPA, OAQPS, Emission Standards Division
ETS/CEM	Emissions Tracking System/Continuous Emissions Monitoring
FAA	Federal Aviation Adminstration
FCC	fluid catalytic cracking unit
FGD	flue gas desulfurization
FHWA	U.S. Federal Highway Adminstration
FID	Flame Ionization Detector
FREDS	Flexible Regional Emissions Data System
FTP	Federal Test Procedure
GCVTC	Grand Canyon Visibility Transport Commission
GT	gas turbines
HC	hydrocarbon
HCPREP	FREDS Hydrocarbon Preprocessor
HDV	heavy duty vehicle
hp	horsepower
HPMS	Highway Performance Monitoring System
IC	internal combustion (engine)
I/M	inspection and maintenance
LDT	light duty truck

ACRONYMS AND ABBREVIATIONS (continued)

LDV	light duty vehicle
LTO	landing and takeoff
MACT	maximum available control technology
MRI	Midwest Research Institute
MW	megawatts
NAA	nonattainment area
NADB	National Allowance Data Base
NAPAP	National Acid Precipitation Assessment Program
NEDS	National Emission Data System
NESHAP	National Emission Standards for Hazardous Air Pollutants
NET	National Emissions Trends (inventory)
NH_3	ammonia
NO_x	oxides of nitrogen
NPI	National Particulates Inventory
NSPS	New Source Performance Standards
OAQPS	EPA, Office of Air Quality Standards and Planning
OSD	ozone season daily
OTAG	Ozone Transport Assessment Group
OTAQ	Office of Air Transportation and Quality
OTR	ozone transport region
Pb	lead
PCE	personal consumption expenditures
PM	particulate matter
PM-2.5	particulate matter less than 2.5 microns in diameter
PM-10	particulate matter less than 10 microns in diameter
ppm	parts per million
QA	quality assurance
QC	quality control
RACT	Reasonably Available Control Technology
RCRA	Resource Conservation and Recovery Act
ROM	Regional Oxidant Model
RVP	Reid vapor pressure
SCC	source classification code
SEDS	State Energy Data System
SIC	Standard Industrial Classification (code)
SIP	State Implementation Plan
SO_2	sulfur dioxide
SO_4	sulfates
SUPROXA	Super Regional Oxidant A
TOG	total organics
tpy	tons per year
TSDF	hazardous waste treatment, storage, and disposal facility
TSP	total suspended particulate matter
USDA	U.S. Department of Agriculture
USFS	USDA Forest Service

ACRONYMS AND ABBREVIATIONS (continued)

VMT	vehicle miles traveled
VOC	volatile organic compound(s)

SECTION 1.0
INTRODUCTION

1.1 WHAT IS THE NATIONAL EMISSIONS INVENTORY (NEI) PROCEDURES DOCUMENT?

The Emission Factors and Inventory Group (EFIG) of the U.S. Environmental Protection Agency (EPA) is responsible for compiling and maintaining national emission data for the criteria and hazardous air pollutants. To promote the consolidation of criteria and toxic pollutant data in one national inventory, in 1999 EFIG combined the National Emission Trends (NET) criteria air pollutant inventory, and the National Toxics Inventory (NTI) into one "National Emission Inventory." The procedures EPA applies to prepare criteria air pollutant emissions (plus ammonia) for the NEI are documented separately from the procedures EPA uses to prepare hazardous air pollutant emissions for the NEI. It is expected that in the future, the methodology descriptions for developing both the criteria and toxic emissions data, will be consolidated into one document.

This document includes methodologies for estimating emissions , 1985-1999, for the following criteria pollutants: carbon monoxide (CO), nitrogen oxides (NO_x), lead (Pb), particulate matter less than 10 and 2.5 microns in diameter (PM-10/PM-2.5), sulfur dioxide (SO_2), volatile organic compounds (VOC), and ammonia (NH_3). This document does not include the data results, only method descriptions. EPA has published criteria emission estimates for years prior to 1999 in the "National Air Pollutant Emission Trends" and "National Air Quality and Emission Trends" Reports. Collectively, these are known as the *Trends* Reports. Beginning with the 1999 data, it is expected that EPA will summarize and publish emission trends annually in the one combined "National Air Quality and Emission Trends" Report, including an electronic distribution on EPA Internet sites.

1.2 HOW IS THIS DOCUMENT ORGANIZED?

The emission estimating methodologies presented in this document are organized by the following categories: 1985-1989 Methodology, 1990-1999 Methodology, Pb Methodology, and Projections Methodology. The methodology used to make specific estimates depends on the pollutant and the year of the estimated emissions. Emission estimates presented in the *Trends* Reports are summarized using the EPA's Tier structure. Table 1-1 provides an overview of the Tier I categories, time periods, pollutants, and methodologies covered by sections 2 through 6. A description of the correspondence between the emission source categories, the methodology descriptions, and the Tier structure is included in each section of this document.

Section 2 distinguishes the current methods from those used for historical years, specifically for 1900-1939 and 1940-1984, respectively. The emission estimation methods used for these historical years are considered 'top-down approaches', e.g., pollutant emissions were estimated by using national average emission characterization techniques. Only SO_2, NO_x, and VOC emissions were developed for the historical time period before 1940. For the time period 1940-1984, methods were used to estimate all criteria emissions, e.g., SO_2, NO_x, and VOC, CO, Pb, PM-10, and TSP.

Section 3 discusses some changes that are expected to be made to the format of this document in the future. Expected changes include the consolidation the procedures documentation for both the criteria and toxic emissions data development.

Section 4 describes the methodologies for estimating emissions for 1985-1999. The 1990 Clean Air Act Amendments included provision that 'base year' inventories be prepared periodically by state and local agencies - for areas not attaining the National Ambient Air Quality Standards (NAAQS). In anticipation of receiving data results from the states, the EPA reassessed its historical emission estimation practices, and with the help of state / local agency input, developed improved methods, and an improved national emission inventory which is referred to as the Interim Inventory.[1] The Interim Inventory represents an evolution of methods at that time, for the years 1985-1989. Those methodologies are also discussed in Section 4, and were used to estimate emissions for all pollutants, except Pb and total suspended particulate (TSP) matter. (TSP estimates were last developed for the year 1992, after which particulate matter emissions have been characterized as PM10, or more recently, PM2.5). Beginning with the 1990 NET inventory, EPA placed emphasis on incorporating emissions data submitted by State/local agencies, and any improved methods available at the time, for filling in gaps when State/local agency data were not available.

To navigate through Section 4, be aware that for a given source category, the estimating procedure is described for all pollutants collectively, unless differences exist in the methods used for different pollutants. In this case, the methods used for each pollutant are described separately. This allows each section to be used independently.

Section 5 discusses the methodology used to estimate the lead emissions that are included in the National Emission Trends (NET) criteria air pollutant inventory. Lead emissions for 1996 are also estimated in the National Toxics Inventory (NTI)[2] and were used in the nationwide dispersion modeling as part of EPA's National Air Toxics Assessment (NATA). For 1996, the NTI estimates would be the preferred source for data. Section 6 presents general information and procedures that EPA uses in projecting air pollutant emissions for the: point, area, and mobile sectors of the inventory, emphasizing the objective to account for as many of the important variables that affect future year emissions as possible.

One of the distinct and natural occurrences in inventory development is the evolution and improvement of emission estimate methods over time. In some cases, an improved estimation method for a source category may be applied 'backwards' to previous year estimates for that same category. It is unlikely that the methodologies and references presented in this document for estimating emissions for period 1900-1984 will change. However, this Procedures Document does note method updates that have been made over time to improve emission estimates for the year 1985 to the current year reported. Any changes in the data or methodologies used to estimate the emissions for this time period will continue to be noted in future updates to this document.

1.3 REFERENCES

1. *Regional Interim Emission Inventories (1987-1991), Volume I: Development Methodologies.* EPA-454/R-93-021a. Source Receptor Analysis Branch, U.S. Environmental Protection Agency, Research Triangle Park, NC. May 1993.

2. U.S. Environmental Protection Agency. National Toxics Inventory, 1996. ___ http://www.epa.gov/ttn/chief/nti (March 2001) .

Table 1-1. Emission Estimating Methods For Criteria Air Pollutants and Ammonia

Tier Category	Time Period	Pollutant(s)	Methodology	Section
Fuel Combustion - Electric Utilities Fuel Combustion - Industrial Fuel Combustion - Other Chemical & Allied Product Mfg. Metals Processing Petroleum & Related Industries Other Industrial Processes Solvent Utilization Storage & Transport Waste Disposal & Recycling Natural Sources (Biogenic) Miscellaneous	1900-1969, excluding 1940, 1950, and 1960	VOC, SO_2, and NO_x	1900-1939 Methodology	2
	1940, 1950, 1960, and 1970 through 1984	VOC, SO_2, NO_x, CO, and PM-10	1940-1984 Methodology	2
		Pb	Lead Methodology	5
	1985 through 1989 and 1990 through 1999	VOC, SO_2, NO_x, CO, and PM-10	1985-1989 Methodology	4
		VOC, SO_2, NO_x, CO, PM-10, PM-2.5, and NH_3	1990-1999 Methodology	4
		Pb	Lead Methodology	5
	Post-1999	VOC, SO_2, NO_x, CO, PM-10, PM-2.5, and NH_3	Projection Methodology	6
Onroad Vehicles Nonroad Vehicles and Engines	1900-1939	VOC, SO_2, NO_x	1900-1939 Methodology	2
	1940 through 1969	VOC, SO_2, NO_x, CO, and PM-10	1940-1984 Methodology	2
		Pb	Lead Methodology	5
	1970 through 1999	VOC, SO_2, NO_x, CO, and PM-10	1985-1999 Methodology	4
		PM-2.5 and NH_3	1990-1999 Methodology	4
		Pb	Lead Methodology	5
	Post-1999	VOC, SO_2, NO_x, CO, PM-10, PM-2.5, and NH_3	Projection Methodology	6

NOTE(S): SO_2, VOC, and NO_x estimated 1900-1999.
CO and PM-10 estimated 1940-1999.
Lead estimated 1970-1998.
PM-10 fugitive dust estimated 1985-1999.
PM-2.5 and NH_3 estimated 1990-1999.
Biogenic 1998, 1990, 1991, 1995-1997.

SECTION 2.0
CHANGES IN METHODOLOGY

2.1 HOW DO CURRENT METHODOLOGIES RELATE TO PREVIOUS METHODS ?

Each year the EPA produces a National Emissions Inventory, using improved estimation methods where available and practical. Section 4 describes significant method changes that have occurred over time for the inventory years 1985-1999. All of these changes are a broad effort to update and improve the emission estimates. As estimation methods change and improve over time, EPA may re-compute emission estimates for specific categories. This document describes the most recent data development procedures for the NEI and indicates where previous year estimates have been recalculated as part of a methodology change. No such changes are planned for emission estimates for the years prior to 1985. Updates are likely to be made however, to the emissions for the years 1985 to the current year of the report. Any changes in the data or methodologies used to estimate emissions for this time period will be discussed in future revisions to this procedures document.

2.2 1900 - 1939 METHODOLOGY

Only SO_2, NOx, and VOC emissions were estimated for the time period prior to 1940. The methodology used to produce SO_2, NOx estimates included some use of state-level data where it was available. The basic technique for estimating VOC emissions was a 'top-down' method using national activity indicators and national emission factors. In addition, interpolation methods were used to derive national emissions data for some years. These top-down estimation techniques used to generate emissions for historic years, while generally no longer employed, are discussed in previous versions of the National Emission Trends Procedures Document [1].

2.3 1940 - 1984 METHODOLOGY

The methodology used to estimate emissions for the time period 1940-1984 was based on a top-down approach where national information was used to create national emission estimates. For these historic years, emissions were generated for all the criteria pollutants, e.g., CO, NO_X, PM-10, SO_2, VOC, Pb, and TSP. These top-down estimation techniques used to generate emissions for historic years, while generally no longer employed, are discussed in previous versions of the National Emission Trends Procedures Document [1].

2.4 REFERENCES

1. *National Air Pollutant Emission Trends Procedures Document, 1900-1996*, EPA-454/R-98-008a. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. June 1998.

SECTION 3.0
FUTURE CHANGES TO THIS DOCUMENT

3.1 NEW FORMAT

It is expected that future updates and distribution of this procedures document will include a new 'look and feel' to improve how the information is organized. The new format is expected to provide consistency across category methodology descriptions. The existing Procedures Document(s) will be divided into the following volumes:

An "archive years" volume and will contain emissions information for the historical years of 1900-1984. It is anticipated that this volume would not change once developed, as there are no plans on revising any of these data based on updated activity, factors, or methods.

Our "current years" volume will contain emissions information for the historical years of 1985 through our most recent year inventory of data development. It is anticipated that the information in this volume may change as updated activity, factors, or methods become available and recent historical 'anchor' years (i.e., 1990, 1996, 1999, etc.) require modification.

Our "anchor year" volume and will contain emissions information for all versions of the most recent base year inventory we are developing (i.e., NEI99 v.1, NEI99 v.2, etc.) and the projection year inventories based on this anchor year (i.e., 2000, 2001, 2002). It is anticipated that for any given year, it is this volume where the majority of documented procedure changes would occur.

3.2 EMPHASIS ON MOST CURRENT YEAR BEING DEVELOPED

The primary objective of re-formatting the Procedures Document is to fully concentrate on the activity, factors, and methods used to develop to the current base anchor year data set that is being developed or updated. This may include any related future or previous year emissions inventories that are projected or backcast from the current base year inventory that is being improved and updated. Most of the interest in EPA's methodologies is directed toward the most recent base year of data under development. As the base, or anchor year changes, i.e., 1999 to 2002, the procedural description for estimating emissions for the last anchor year inventory will be added into the "current years' volume.

SECTION 4.0
NATIONAL CRITERIA POLLUTANT ESTIMATES
1985 - 1999 METHODOLOGY

4.1 WHAT CATEGORIES AND POLLUTANTS ARE REVIEWED IN THIS SECTION?

Section 4 describes the methodologies used to generate emissions for the years 1985 through 1999 for carbon monoxide (CO), oxides of nitrogen (NO_x), volatile organic compounds (VOC), sulfur dioxide (SO_2), and particulate matter less than 10 microns in diameter (PM-10). Section 4 also describes the methodologies used to generate emissions for the years 1990 through 1999 for particulate matter less than 2.5 microns in diameter (PM-2.5) and ammonia (NH_3). Categories reviewed in this section include fuel combustion - electric utility, industrial, other combustion (i.e., commercial/institutional and residential), solvent utilization, on-road vehicles, nonroad engines and vehicles, fugitive dust, and biogenic sources. The descriptions are divided into subsections based on similar approaches in estimating the emissions. The beginning of each subsection lists the Tier I category, as well as other Tier categories, if necessary. Table 4.1-1 shows the subsection/Tier I and II category relationships. If a Tier II category is not listed, it is currently not estimated within the National Emissions Trends (NET) Inventory.

In 2000, EPA combined the NET and National Toxics Inventories into one inventory called the National Emissions Inventory (NEI). However, due to resource constraints associated with revising section 4, we have continued to use "NET inventory" to refer to the criteria pollutant (and ammonia) component of the NEI.

4.1.1 What Significant Methodology Changes Have Occurred?

Each year, the U.S. Environmental Protection Agency (EPA) prepares national emissions estimates to assess trends in criteria air pollutant emissions. Historically, EPA prepared these estimates by using consistent top-down methodologies that employed national statistics on economic activity, material flows, etc. for the years ranging from 1940 to the year of the report. Although useful for evaluating year-to-year changes, these estimates did not provide a geographically detailed measure of emissions for any given year.

Over the past several years, EPA has revised its methodologies to incorporate bottom-up inventories and allow for an evaluation of changes in emissions from year to year. Bottom-up inventories, in which emissions are derived at the plant or county level, are extremely useful in many applications, such as providing inputs into atmospheric models. Starting with the *National Air Pollutant Emission Trends, 1900-1996*[1] *(Emission Trends)* report, EPA began to incorporate these methodological changes. EPA now derives its emissions estimates starting at the county level, which enables it to incorporate more detailed State/local agency data, including emissions estimates.

For most source categories, EPA developed emission estimates at the county and Source Classification Code (SCC) level and then summed these emissions to the Tier level. The Tier categorization contains four levels. The first and second level, referred to as Tier I and Tier II, respectively, are the same for each of the seven pollutants and are listed in Table 4.1-2. The third level, Tier III, is unique for each of the seven pollutants. The fourth level, Tier 4, is the SCC level. For a

current list of the SCCs assigned to Tier levels I through III, contact EPA's Emission Factor and Inventory Group (EFIG).

4.1.2 What Methodologies Does EPA Use to Develop Emissions Estimates?

EPA estimated the 1985 through 1989 CO, NO_x, SO_2, and VOC emissions according to the methodologies presented in the *Regional Interim Emission Inventories (1987-1991),*[2] although with several exceptions. EPA developed a similar methodology for preparing a national 1990 particulate matter inventory as documented in the *Development of the OPPE Particulate Programs Implementation Evaluation System*.[3] To generate the necessary emissions for the *Emissions Trends* report, EPA expanded the methodology used in the *Regional Interim Emission Inventories* to generate 1985 and 1986 emissions estimates for CO, NO_x, SO_2, and VOC; and PM-10 emission estimates for the years 1985 through 1989.

After preparing the 1990 Interim Inventory, EPA developed a new 1990 base year for the NET inventory. EPA revised the 1990 Interim Inventory with State/local agency emissions when available. The Ozone Transport Assessment Group (OTAG), the Grand Canyon Visibility Transport Commission (GCVTC), and the Aerometric Information Retrieval System/Facility Subsystem (AIRS/FS) provided data on State non-utility point source emissions. OTAG and the States of California and Oregon provided area source emissions. EPA calculated on-road emissions from State-provided emission factor inputs and vehicle miles traveled (VMT), and it used the 1990 Interim Inventory emissions to fill all gaps in emissions. The 1990 State/local agency emissions serve as the basis for the 1991 through 1996 emissions.

Starting with the *1996 Emission Trends* report, EPA added PM-2.5 and NH_3 to the list of pollutants inventoried by EPA's EFIG. Emissions and associated data for these two pollutants are available for the years 1990 through 1999.

Since the 1996 NET was initially completed in December 1997, EPA has revised the 1996 NET to include base year emissions data submitted by State/local agencies to comply with the CAAA requirements to submit (1) periodic emissions inventories (PEI) every 3 years for ozone nonattainment areas (NAAs), and (2) emissions data for major point sources annually. States with ozone NAAs needed to submit their PEI for 1996 by July 1997. While the CAAA only require submittal of ozone precursor pollutant data for the PEI requirements, annual point source reporting covers all criteria air pollutants. EPA began assigning version numbers to the 1996 through 1999 NET inventories in EPA fiscal year 1997 to track revisions to the 1996 base year inventory as it was updated each year to incorporate emissions data submitted by State/local agencies, and the effects of changes to emission estimation methodologies. The first 1996 NET inventory is Version 1.[1] Version 2 of the NET contains revised 1996 emissions and a new inventory for 1997.[4] Version 3 contains revisions to the 1996 and 1997 inventories and a new inventory for 1998.[5] Version 4 contains revisions to the 1996 through 1998 inventories and a new inventory for 1999.[6] The method descriptions in this section, include those applied to prepare 1996 through 1999 emissions included in Version 4 of the NET inventories.

To develop 1997 through 1999 emission estimates for nonutility point sources and the majority of area sources, EPA compiled a set of emission growth and control factors for each year that were applied to the 1996 NET inventory. EPA prepared Version 2 of the 1997 NET using growth factors developed from U.S. Department of Energy's (DOE) State Energy Data System (SEDS) annual fuel consumption

data or Bureau of Economic Analysis (BEA) historic earnings by industry. For Versions 3 and 4, the growth factors for estimating 1997 through 1999 emissions for the continental United States were developed using the inputs developed for EGAS 4.0. BEA data were used to prepare growth factors for Alaska and Hawaii in Versions 2 through 4 of the NET inventory. Energy efficiency factors compiled from DOE energy projections data were applied to the growth factors for fuel combustion sources in all three versions of the NET inventory. For several point and area VOC emission sources, EPA incorporated the effects of maximum achievable control technology (MACT) controls implemented from 1997 through 1999. For some area source categories, EPA compiled current activity data to estimate emissions for 1997 through 1999.

4.1.3 References

1. *National Air Pollutant Emission Trends, 1900-1996*, EPA-454/R-97-011. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. December 1997.

2. *Regional Interim Emission Inventories (1987-1991), Volume I: Development Methodologies*. EPA-454/R-93-021a. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. May 1993.

3. *Development of the OPPE Particulate Programs Implementation Evaluation System*, Final, Prepared for the Office of Policy, Planning and Evaluation/Office of Policy Analysis, U.S. Environmental Protection Agency, under EPA Contract No. 68-D3-0035, Work Assignment No. 0-10, Washington, DC. July 1994.

4. *National Air Pollutant Emission Trends, 1900-1997*, EPA-454/E-98-007. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. December 1998.

5. *National Air Pollutant Emission Trends, 1900-1998*, EPA-454/R-00-002. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. March 2000.

6. A National Air Pollutant Emission Trends report for 1900-1999 was not available when Volume I, Section 4 of the NEI Procedures Document was revised in March 2001.

Table 4.1-1. Section 4.0 Structure

Subsection	Tier I	Tier II
4.1 Introduction		
4.2 Fuel Combustion - Electric Utility	Fuel Combustion - Electric Utility (01)	Majority of Coal (01), Oil (02), Gas (03), and Other (04). The point level - steam generated fossil fuel sources.
4.3 Industrial	Fuel Combustion - Electric Utility (01)	Gas Turbines and Internal Combustion (05). The area source level - steam generated Coal (01), Oil (02), Gas (03).
	Fuel Combustion - Industrial (02)	All
	Chemical & Allied Product Manufacturing (04)	All
	Metals Processing (05)	All
	Petroleum & Related Industries (06)	All
	Other Industrial Processes (07)	All
	Storage & Transport (09)	All
	Waste Disposal & Recycling (10)	All
	Miscellaneous (14)	Health services (05)
4.4 Other Combustion	Other Combustion (03)	All
	Miscellaneous (14)	Other combustion (02)
4.5 Solvents	Solvent Utilization (08)	All
4.6 On-road Vehicles	On-road Vehicles (11)	All
4.7 Nonroad Engines and Vehicles	Nonroad Engines and Vehicles (12)	All
	Storage & Transport (09)	Petroleum & Petroleum Product Storage (02)
	Miscellaneous (14)	Fugitive dust (07)
4.8 Fugitive Dust	Miscellaneous (14)	Agriculture & Forestry [(01), agricultural crops and livestock only] Fugitive dust (07)
4.9 Natural Sources	Natural Sources (13)	Biogenic (01)

NOTE: Numbers in parentheses after Tier name are the Tier category codes.

Table 4.1-2. Major Source Categories

Tier I Code	Tier I Category	Tier II Code	Tier II Category
01	FUEL COMBUSTION-ELECTRIC UTILITIES		
		01	Coal
		02	Oil
		03	Gas
		04	Other
		05	Internal Combustion
02	FUEL COMBUSTION-INDUSTRIAL		
		01	Coal
		02	Oil
		03	Gas
		04	Other
		05	Internal Combustion
03	FUEL COMBUSTION-OTHER		
		01	Commercial / Institutional Coal
		02	Commercial / Institutional Oil
		03	Commercial / Institutional Gas
		04	Misc. Fuel Combustion (except residential)
		05	Residential Wood
		06	Residential Other
04	CHEMICAL & ALLIED PRODUCT MFG.		
		01	Organic Chemical Mfg.
		02	Inorganic Chemical Mfg.
		03	Polymer & Resin Mfg.
		04	Agricultural Chemical Mfg.
		05	Paint, Varnish, Lacquer, Enamel Mfg.
		06	Pharmaceutical Mfg.
		07	Other Chemical Mfg.
05	METALS PROCESSING		
		01	Nonferrous
		02	Ferrous
		03	Not elsewhere classified (NEC)
06	PETROLEUM & RELATED INDUSTRIES		
		01	Oil & Gas Production
		02	Petroleum Refineries & Related Industries
		03	Asphalt Manufacturing
07	OTHER INDUSTRIAL PROCESSES		
		01	Agriculture, Food, & Kindred Products
		02	Textiles, Leather, & Apparel Products
		03	Wood, Pulp & Paper, & Publishing Products
		04	Rubber & Miscellaneous Plastic Products
		05	Mineral Products
		06	Machinery Products
		07	Electronic Equipment
		08	Transportation Equipment
		09	Construction
		10	Miscellaneous Industrial Processes
08	SOLVENT UTILIZATION		
		01	Degreasing
		02	Graphic Arts
		03	Dry Cleaning
		04	Surface Coating
		05	Other Industrial
		06	Nonindustrial
		07	Solvent Utilization NEC

Table 4.1-2. (continued)

Tier I Code	Tier I Category	Tier II Code	Tier II Category
09	STORAGE & TRANSPORT		
		01	Bulk Terminals & Plants
		02	Petroleum & Petroleum Product Storage
		03	Petroleum & Petroleum Product Transport
		04	Service Stations: Stage I
		05	Service Stations: Stage II
		06	Service Stations: Breathing & Emptying
		07	Organic Chemical Storage
		08	Organic Chemical Transport
		09	Inorganic Chemical Storage
		10	Inorganic Chemical Transport
		11	Bulk Materials Storage
		12	Bulk Materials Transport
10	WASTE DISPOSAL & RECYCLING		
		01	Incineration
		02	Open Burning
		03	Publicly Owned Treatment Works
		04	Industrial Waste Water
		05	Treatment Storage and Disposal Facility
		06	Landfills
		07	Other
11	ON-ROAD VEHICLES		
		01	Light-Duty Gas Vehicles & Motorcycles
		02	Light-Duty Gas Trucks
		03	Heavy-Duty Gas Vehicles
		04	Diesels
12	NONROAD ENGINES AND VEHICLES		
		01	Non-road Gasoline
		02	Non-road Diesel
		03	Aircraft
		04	Marine Vessels
		05	Railroads
		06	Other
13	NATURAL SOURCES		
		01	Biogenic
		02	Geogenic
		03	Miscellaneous (lightning, freshwater, saltwater)
14	MISCELLANEOUS		
		01	Agriculture & Forestry
		02	Other Combustion (forest fires)
		03	Catastrophic / Accidental Releases
		04	Repair Shops
		05	Health Services
		06	Cooling Towers
		07	Fugitive Dust

NOTE(S): For the purposes of this report, forest fires are considered anthropogenic sources although many fires do occur naturally.

4.2 FUEL COMBUSTION - ELECTRIC UTILITY

4.2.1 Which sources does EPA include in the Fuel Combustion - Electric Utility category?

The point and area source categories under the "Electric Utility" heading include the following Tier I and Tier II categories:

Tier I Category	Tier II Category
(01) FUEL COMBUSTION - ELECTRIC UTILITY	(01) Coal
	(02) Oil
	(03) Gas
	(04) Other

The emissions from the combustion of fuel by electric utilities are divided into two classifications: (1) steam generated fossil-fuel units (boilers) with SCCs = 101xxxxx; and (2) non-steam generated fossil-fuel units such as gas turbines (GT) and internal combustion (IC) engines with SCCs = 201xxxxx. Estimating emissions for these two classes requires two very different methodologies, each of which is described separately. Section 4.2 describes the methodology for fossil-fuel steam utility boilers. The methodology used to estimate emissions for nonsteam generated fossil-fuel units is described in section 4.3.

4.2.2 What emissions data for electric utilities are included in the Trends inventory?

The *Trends* data bases for fossil-fuel steam electric utility boilers include emission estimates of VOC, NO_x, CO, SO_2, PM-10, and PM-2.5 for the years 1985 through 1999. In addition, NH_3 emissions were added in 1996 and CO_2 emissions were added in 1997. Table 4.2-1 summarizes the methods applied to estimate emissions for each pollutant for 1989 through 1999. Table 4.2-2 identifies the SCCs by fuel type and boiler firing and bottom type for which emissions were estimated. Estimates for fossil-fuel steam electric utilities do not include emissions from the combustion of anthracite coal because anthracite coal accounts for less than 1 percent of the overall emissions from fuel combustion by fossil-fuel steam electric utility units. EPA does not develop emissions estimates for sulfates (SO_4) because no known utility emission factors exist for this pollutant.

4.2.3 How does EPA develop emission estimates for fossil-fuel fired steam electric utilities?

Six basic factors are used to estimate emissions for fossil-fuel steam electric utility units for the years 1985 through 1998: (1) fuel consumption; (2) emission factor, which relates the quantity of fuel consumed to the quantity of pollutant emitted; (3) fuel characteristics, such as sulfur content, ash content, and heating value of fuels; (4) control efficiency, which indicates the percent of pollutant emissions not removed through control methods; (5) rule effectiveness (which, according to EPA, measures a regulatory program's ability to achieve all the emissions reductions that could be achieved by full compliance with the applicable regulations at all sources at all times); and (6) whether Emissions Tracking System/Continuous Emissions Monitoring (ETS/CEM) data exist for SO_2, NO_x, and heat input. Fuel consumption characteristics and control efficiencies are determined at the boiler-level, whereas emission factors are specified at the SCC-level.

To derive 1999 emissions estimates, EPA extrapolates the 1999 emissions and heat input from the 1998 boiler-level emissions based on the ratio of plant-level 1999 fuel consumption to 1998 fuel consumption. If the ratio is unknown, perhaps because this methodology does not account for fuels other than coal, oil, or gas, the ratio is defaulted to 1. Finally, ETS/CEM SO_2, NO_x, and heat input values, if they exist, are overlaid. Note that if a boiler reports ETS/CEM data but does not report to the EIA-767, its ETS/CEM data are not used.

4.2.4 Where does EPA obtain the utility data necessary for emissions estimates?

Primary utility data collected by the Department of Energy's (DOE) Energy Information Administration (EIA) serves as the basis for the fossil-fuel-fired steam electric utility component of the *Trends* inventory. The EIA uses Form EIA-767 (*Steam-Electric Plant Operation and Design Report*[1]) to collect monthly boiler-level data on a yearly basis and Form EIA-759 (*Monthly Power Plant Report*[2]) to collect plant-level fossil-fuel steam data from all filing electric utility plants. Currently, data from Form EIA-767 are available for the years 1985 through 1998, while data from Form EIA-759 are available through the year 1999. The fossil-fuel steam electric utility component of the *Trend*s emission inventories for 1985 through 1999 includes data derived from the two EIA forms. Additionally, beginning in 1998, EIA has determined that plants that have previously reported to Form EIA-767 must continue to do so -- even if they have been sold to a nonutility, so that this file does contain some fossil-fuel steam utility boilers that are presently owned by nonutilities. This steam component does not include data from GT or IC engines (which account for a very small share of electric utility fuel use and corresponding emissions) unless companies report that data to EIA.

The steam emission inventory data for 1985 through 1998 are initially based on the aggregated monthly electric utility steam boiler-level data provided by Form EIA-767. All plants of at least 10 megawatts (MW) that have at least one operating boiler are required to provide this information to EIA, although the amount of data required from plants with less than 100 MW of steam-electric generating capacity is not as extensive as the amount required from those plants of at least 100 MW. For plants with a generator nameplate rating from 10 MW to less than 100 MW, only those pages of Form EIA-767 containing identification (ID) information (i.e., plant ORIS code, State name, county name, plant name, operator name, boiler ID), boiler fuel quantity and quality, and flue gas desulfurization (FGD) information must be completed. Other sources of data for NO_x, SO_2, and heat input are used in place of the EIA-based estimated data when the data are known to be better: EPA's ETS/CEM annual Scorecard NO_x and SO_2 emissions and heat input overlay the EIA-based data for affected acid rain utility boilers beginning in 1995 (the data are also available for Phase 1 units for 1994).[3] These sources are summarized in Table 4.2-3.

4.2.4.1 What data does Form EIA-767 contain?

The EIA requires that the operating utility for each plant with fossil-fuel steam utility boilers of 10 MW or greater submit at least some sections of Form EIA-767. This form is designed so that information for each plant is reported on separate pages that relate to different levels of data. The relevant levels of data include the following:

- Plant-level: Delineation of the plant configuration, which establishes the number of boilers and the IDs for each boiler, as well as the associated generator(s), FGD unit(s) (SO_2 scrubbers), flue

gas particulate collectors, flue(s), and stack(s). These do not necessarily have a one-to-one correspondence. In addition, plant name, location, and operating utility are provided.

- Boiler-level: Monthly fuel consumption and quality data (for coal, oil, gas, and other), regulatory data, and design parameters (including NO_x control device and annual SO_2 operating efficiency).

- Generator-level: Monthly generator and maximum nameplate capacity.

- FGD-level: One page per five FGD units for annual operating data (including SO_2 control efficiency) and design parameter data (including type of SO_2 control device).

- Flue gas particulate collector-level: One page each for (up to five) collectors with annual operating data [including total particulate (TSP) control efficiency] and design specifications (including type of particulate control device).

- Flue- and stack-level: Design parameter data.

Form EIA-767 data for 1985 through 1997 are processed in a series of steps aimed at converting the mainframe-level computerized data into usable data base form. Only certain information is extracted. For example, Form EIA-767 includes fuel-related boiler data such as monthly values for each fuel burned, along with the fuel's associated sulfur, ash, and heat content. Only information regarding coal, oil, and gas fuel type data is processed for the Trends inventory and only data from the first stack associated with a boiler is used. Beginning with the 1998 data, EIA provided 15 data base files to include the EIA-767 data, and for the first time, all fuel types' data were processed.

The data are aggregated for each fuel to produce annual estimates for each boiler before they are combined with other data (such as control devices and efficiencies, plant location data, associated generator generation, and associated stack parameters). Once SCCs are assigned to each boiler's fuel data in a given plant, the SCC-specific data are then separated so that each new data base record is on the plant-boiler-SCC level.

4.2.4.2 What information does Form EIA-759 provide?

Form EIA-759 provides information on electric power generation, energy source consumption, and end-of-month fossil fuel stock from all electric utilities that operate electric power generators and provide electric power for public use. The Form EIA-759 data are also processed in a series of steps, although it uses a less intricate method than for Form EIA-767, since the data for each plant are not reported at the boiler level but instead are reported by fuel type and prime mover (for example, steam, hydro, IC, and GT).

For each plant-prime mover combination (in this case, for the steam prime mover), plant ID data, as well as monthly fuel-specific generation and consumption data, are reported. EPA aggregates the monthly plant steam prime mover data to annual estimates for each fuel reported and categorized as coal, residual oil, distillate oil, and natural gas only, and combines to produce a single annual steam plant-level data observation. (Beginning with 1996, EIA collects only annual, not monthly, data for small (less than 25 MW) plants, making the intermediate aggregation of monthly data unnecessary.)

Since actual 1999 EIA-767 data are unavailable, Form EIA-759 data is used to "grow" the 1998 fuel and emissions data for 1999, as described later in section 4.2.8.

4.2.5 How does EPA develop the necessary data not supplied by the EIA forms?

To obtain data not contained in the computerized EIA data files, or converted to other measurement units, algorithms (utilized since the 1980s) are used to develop values for SCC, heat input, pollutant emissions, and NO_x control efficiency.

Although Form EIA-767 reports generator nameplate capacity, this information cannot be used to represent the boiler size when a one-to-one correspondence does not exist between boiler and generator (referred to as a multiheader situation–for example, if one boiler is associated with two or more generators or if several boilers are reciprocally associated with several generators). Therefore, EPA developed a boiler design capacity variable (in MMBtu/hr) based on the reported maximum continuous boiler steam flow at 100 percent load (in thousand pounds per hour) by multiplying the steam flow value by a units conversion of 1.36. (EPA revised the boiler capacity methodology and updated the previous value of 1.25 to 1.36 beginning with the 1997 data year.)

AP-42[4] emission factors are used to calculate emissions. The emission factor used depends upon the SCC and pollutant, as explained below.

- The appropriate SCC is assigned to each source based on its fuel and boiler characteristics. For sources using coal, the SCC is based on the American Society for Testing and Materials (ASTM) criteria for moisture, mineral-free matter basis (if greater than 11,500 Btu/lb, coal type is designated to be bituminous; if between 8,300 and 11,500 Btu/lb, coal type is designated to be subbituminous; and if less than 8,300 Btu/lb, coal type is designated to be lignite) and the boiler type (firing configuration and bottom type) as specified by AP-42. Fluidized bed combustion boilers have SCCs assigned based on the fuel type. If both coal and oil are burned in the same boiler, it is assumed that the oil is distillate; if coal is not burned, the oil burned is assumed to be residual. See Table 4.2-2 for a complete list of the relationships among fuel type, firing type, bottom type, and SCC.

Since Form EIA-767 does not provide control efficiencies for NO_x, PM-10, and PM-2.5, control efficiencies are derived using the following methods:

- NO_x control efficiency is based on the assumption that the boiler would be controlled so that its emission rate would equal its emission limit, expressed on an annual equivalent basis. After calculating the heat input, EPA back-calculates controlled emissions assuming compliance with the applicable standard. The NO_x net control efficiency is calculated by dividing the controlled by the uncontrolled NO_x emissions.

- Since Form EIA-767 only reports TSP control efficiency, EPA uses the (updated) PM-10 Calculator[5] to derive PM-10 and PM-2.5 control efficiencies. (The PM Calculator estimates PM-10 and PM-2.5 control efficiencies based on the SCC and the primary and secondary control devices. The control efficiencies from the PM Calculator are based on particle size distribution data from AP-42 for specific SCCs, where available. These control efficiencies were revised beginning with the 1998 data file.)

EPA computes the SO_2 emissions as controlled emissions assuming 100 percent rule effectiveness and using the sulfur content of the fuel as specified in the EIA-767 data. The PM-10 and PM-2.5 emissions are also computed as controlled emissions assuming 100 percent rule effectiveness. The ash content of the fuel used to calculate uncontrolled PM-10 and PM-2.5 emissions is also specified in the EIA-767 data. The NO_x emissions are computed as controlled emissions assuming 80 percent rule effectiveness for 1985-1994 data; beginning with 1995 data, NO_x rule effectiveness is assumed to be 100 percent. The CO and VOC emissions are calculated as uncontrolled emissions. Although no NH_3 AP-42 emission factors officially exist for utility fossil-fuels, in 1998 EPA developed coal, oil, and gas NH_3 emission factors that are applied to the specified quantity of fuel used. Thus, beginning with the 1996 data year, NH_3 estimates are included in the *Trends* data base.

Due to EPA's increased interest in CO_2 emissions, CO_2 emissions were estimated for the data year 1997. Although it is possible to overlay EIA-based calculations with ETS/CEM data, EPA made a policy decision to not do this until such time that the ETS/CEM data undergo thorough QA/QC review by EPA's Clean Air Markets Division (CAMD), formerly known as the Acid Rain Division. Therefore, CO_2 emission estimates are calculated using a methodology recommended by the Intergovernmental Panel on Climate Change (IPCC)[8] and used by both EIA and EPA in the annual report on CO_2 emissions in response to the April 15, 1999 Presidential Directive.[9] This methodology includes using fuel consumption, carbon content coefficient, and conversion factors to yield CO_2 tons. The algorithms to compute all pollutant emissions are presented in Tables 4.2-4 and 4.2-5.

The PM-10 and PM-2.5 emissions included in the *Trends* inventory for all years through the 1999 data year represent filterable PM-10 and PM-2.5 emissions. For data years 1996 through 1998, condensible PM (PMCD) emissions were estimated and summed with filterable PM-10 and PM-2.5 emissions to eatimate total PM-10 and total PM-2.5 emissions. To keep the basis for the PM-10 and total PM-2.5 emissions for steam generated fossil-fuel utility boilers consistent with all other source categories, EPA did not include PMCD or total PM-10 and total PM-2.5 emissions for steam generated fossil-fuel utility boilers in the *Trends* inventory.

Since fewer required data elements (identification data, boiler fuel quantity and quality data, and FGD data, if applicable) exist for those plants with a total capacity between 10 MW and 100 MW, many values are missing. Most data elements are assigned a default value of zero; however, if values for boiler firing and bottom type are missing (these are needed in the SCC assignment), the default values for wall-fired and dry bottom types are assigned. In the past, discrepancies have occurred in the boiler bottom and firing type data as reported to EIA and CAMD. Based on a coordinated effort in 1996, all differences in bottom and firing types for coal boilers were resolved for previous years (i.e., 1985 through 1995).

4.2.6 What EIA data have been replaced with data from other sources?

EPA replaced the 1985 SO_2 emissions and heat input calculated from the 1985 Form EIA-767 data with corresponding boiler-level data (disaggregated to the SCC level) from the National Allowance Data Base Version 3.11 (NADBV311).[6] These data underwent two public comment periods in 1991 and 1992 and are considered the best available data for 1985. Aggregations at the fuel levels (Tier III) are approximations only and are based on the methodology described in Section 4.2.1.

In 1996, CAMD completed research on utility coal boiler-level NO_x rates. Approximately 90 percent of the rates were based on relative accuracy tests performed in 1993 and 1994 as a requirement for continuous emissions monitor (CEM) certification, while the remaining boilers' rates were obtained from utility stack tests from various years. These coal boiler-specific NO_x rates were considered, on the whole, to be significantly better than those calculated from EPA's NO_x AP-42 emission factors, which are SCC-category averages.

Thus, whenever these new NO_x rates were available, EPA recalculated NO_x coal emissions at the coal SCC level, using the heat input (EIA's 767 fuel throughput multiplied by the fuel heat content) and adjusting units, according to the following equation:

$$NOXCOAL_{SCC} = NOXRT_{coal} * HTI_{SCC} * \frac{1}{2000} \qquad \text{(Eq. 4.2-1)}$$

where: NOXCOAL = NO_x emissions for the boiler coal SCC (in tons)
NOXRT = CAMD's coal NO_x rate for the given boiler (in lbs/MMBtu)
HTI = heat input for the boiler's coal SCC (in MMBtu)

These new NO_x SCC-level coal emissions replaced the AP-42 calculated emissions for most of the coal SCCs in the 1985-1994 data years (when ETS/CEM data were unavailable).

As of January 1, 1994, Title IV (Acid Deposition Control) of the Clean Air Act Amendments of 1990 (CAAA) required Phase I affected utility units to report heat input, SO_2, and NO_x data to EPA. Beginning January 1, 1995, all affected units were required to report heat input and SO_2 emissions; most also had to report NO_x emissions, although some units received extensions until July 1, 1995 or January 1, 1996 for NO_x reporting.

The ETS/CEM data contain actual, rather than estimated, data. Thus, if a complete set of ETS/CEM annual SO_2 and/or NO_x emissions and/or heat input data existed for 1994 and 1995, those data values replaced the data estimated from EIA-767 data. This process involved the following steps:

- Aggregation of ETS/CEM hourly or quarterly data to annual data.
- Assignment of ETS/CEM data, reported on a monitoring stack or pipe level, to the boiler level.
- Matching the ETS/CEM boiler-level annual data to the processed EIA-767 annual data.
- Disaggregating the boiler-level ETS/CEM data to the boiler SCC level based on each SCC's fractional share of the boiler EIA-based heat input, SO_2, and NO_x, respectively. The algorithms used are included in Table 4.2-6.

Beginning with 1996 data, the ETS/CEM annual Scorecard data replaced EIA-derived SO_2 and NO_x emissions and heat input for all boilers included in EIA-767 and in ETS/CEM. For those records in which the ETS/CEM heat input replaces the EIA-calculated value, the heat input does not equal the product of the EIA-reported fuel throughput and heat content. Additionally, CO_2 and PMCD values are recalculated using the ETS/CEM heat input value, thus also changing the values of TOTPM10 and TOTPM25.

4.2.7 How does EPA calculate ozone season daily emissions?

Ozone season daily (OSD) emissions are estimated for data years 1990-1997 by assuming the day to be a typical or average summer July day. Emissions for VOC, NO_x, CO, SO_2, PM-10, PM-2.5, and NH_3 (SO_4 is zero) are calculated at the SCC level by taking the ratio of the Form EIA-767 July monthly to annual heat input, dividing it by 31, and then multiplying this value by the already calculated annual emissions. Beginning in data year 1998, a weighted average of the heat inputs for the five ozone season months (July-September) was used in place of the July month heat input. The equation is:

$$EOSD_{SCC} = \frac{HTISUM_{SCC}}{31 * HTIANN_{SCC}} * EANN_{SCC} \qquad \text{(Eq. 4.2-2)}$$

where:

EOSD	=	Ozone season daily emissions for a given pollutant at the SCC level (in tons)
HTISUM	=	July monthly or ozone season monthly average Form EIA-767 calculated heat input for the given boiler's SCC (in MMBtu)
HTIANN	=	annual Form EIA-767 calculated heat input for the given boiler's SCC (in MMBtu)
EANN	=	Annual emissions for a given pollutant at the SCC level (in tons) for that year

For the OSD emissions for projected 1999, the projected 1999 annual emissions are used, but the Form EIA-767 calculated 1998 average summer month to annual heat input ratio is also used in the above equation since the 1999 ratio is unknown.

4.2.8 1998 projected fossil-fuel steam emission inventory

The 1999 computerized fossil-fuel steam utility plant-level data from Form EIA-759 are used in conjunction with the 1998 fossil-fuel steam electric utility component data to develop the 1999 steam emission inventory file, since the 1999 Form EIA-767 data are not available. The fuel quantity, heat input, and emissions values are grown by a factor based on the ratio of the 1999 Form EIA-759 plant-level, fuel-specific data to the data for 1998.

The projected 1999 fossil-fuel steam utility inventory includes the same records that are in the 1998 file. That is, no new plants are added or subtracted from the 1998 steam inventory to produce the projected 1999 steam inventory. However, the 1999 Form EIA-759 plant-level data should reflect boiler retirement or additions for plants in 1999 and their fuel data would be incorporated in the growth ratios and should be reflected in the 1999 data for the other boilers at a plant. As a result, the 1999 figures should be considered to be preliminary estimates only.

4.2.9 What additional emissions estimates adjustments does EPA make?

To derive VOC emissions estimates, an adjustment is made due to the underestimation of aldehydes which are not accounted for in the VOC emission factors for the following SCCs: 10100401, 10100404, 10100501, 10100601, and 10100604. The VOC emissions are augmented according to the methodology used in the Hydrocarbon Preprocessor (HCPREP) of the Flexible Regional Emissions Data System (FREDS).[7] This augmentation was made on steam emission inventories for the years 1985 through projected 1999.

4.2.10 How does EPA perform its calculations?

The following provides an example calculation for estimating SO_2 emissions for a tangentially-fired dry-bottom utility boiler burning bituminous coal. This example shows how the emissions are initially calculated using data reported to EIA-767 and an AP-42 emission factor, and then overlaid with SO_2 emissions reported to ETS/CEM. The methods shown in the example calculation are used to estimate emissions for all steam generated fossil-fuel boilers and pollutants. See section 4.2.7 for details on what EIA-767 data are replaced with ETS/CEM data for calculating emissions.

- 1995 boiler SCC data:

Variable Description	Variable Name	Value	Units
Source classification code	SCC	10100212	–
Annual fuel throughput	thruput	1300000	SCC units
Heat content of fuel	heatcon	23.18 (really 23.1849046)	MMBtu/SCC units
Sulfur content of fuel	sulfcon	3.17 (really 3.1716)	%
SO_2 control efficiency	coneff4	89.30	%
Final emissions for inventory	emiss4	9332.5590	tons
Final heat input for inventory	htinpt	31782453.38	MMBtu
Annual heat input calculated from EIA-767 data	eiahti	30140376.00	MMBtu
Annual SO_2 emissions calculated from EIA 767 data	eiaso2	8382.2216	tons
SO_2 emission factor	emf4	39 (38 beginning with 1996 data)	lbs SO_2/ton coal
Annual SO_2 emissions reported to ETS/CEM	so2ets	9332.5590	tons
Annual heat input reported to ETS/CEM	htiets	31782453.38	MMBtu

- Equation:

$$EIASO_2 = \frac{coal\ thruput * EMF4 * sulfcon * (1-(coneff4/100))}{2000} \qquad \text{(Eq. 4.2-3)}$$

- Calculation:

$$EIASO_2 = \frac{(1{,}300{,}000)\ (38)\ (3.1716)\ (1-0.893)}{2000}$$

- Result:

$EIASO_2$ = 8,382 (*tons/year*) *to nearest integer*
But replaced by 1995 *ETS/CEM* SO_2 *emissions* (SO_2ets) = 9,332.5590 (*tons/year*) = *final emissions* (*EMISS4*)
Therefore $EIASO_2$ = 8,382 (*tons/year*); *and* SO_2ets = *EMISS4* = 9,333 (*tons/year*) *in the Inventory*

Note that the AP-42 SO_2 emission factor for SCC 10100212 was changed from 39 to 38 lbs/ton of coal beginning with data year 1996, reflecting the updated emission factor value.

4.2.11 References

1. *Monthly Power Plant Report*, Form EIA-759, data files for 1990 - 1999, U.S. Department of Energy, Energy Information Administration, Washington, DC, 2000.

2. *Steam-Electric Plant Operation and Design Report*, Form EIA-767, data files for 1985 - 1998, U.S. Department of Energy, Energy Information Administration, Washington, DC, 2000.

3. *Acid Rain Program CEMS Submissions Instructions for Monitoring Plans, Certification Test Notifications, and Quarterly Reports*, U.S. Environmental Protection Agency, Washington, DC, May 1995.

4. *Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, Fifth Edition*, AP-42, U.S. Environmental Protection Agency, Research Triangle Park, NC.

5. *Enhanced Particulate Matter Controlled Emissions Calculator, Draft User's Manual*, Emission Factor and Inventory Group, Emissions Monitoring and Analysis Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC. Prepared by E.H. Pechan & Associates, Inc., Durham, NC under EPA Contract No. 68-D7-0067, Work Assignment No. 3-09, November 1999.

6. *The National Allowance Data Base Version 3.11: Technical Support Document*, Acid Rain Division, Office of Atmospheric Programs, U.S. Environmental Protection Agency, Washington, DC, March 1993.

7. *The Flexible Regional Emissions Data System (FREDS) Documentation for the 1985 NAPAP Emission Inventory: Preparation for the National Acid Precipitation Assessment Program*. Appendix A. EPA-600/9-89-047. U.S. Environmental Protection Agency, Office of Research and Development, Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, May 1989.

8. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-1998. U.S. Environmental Protection Agency, Washington, DC, 2000.

9. Carbon Dioxide Emissions from the Generation of Electric Power in the United States; http://www.epa.gov/globalwarming/publications/emissions/co2emiss.pdf.

Table 4.2-1. Methods for Developing Annual Emission Estimates for Steam Generated Fossil-Fuel Utility Boilers for the Years 1989-1999

For the data years	For the pollutant(s)	EPA estimated emissions by
1989-1993	NO_x	If coal is burned, EIA data and EPA/ARD emission factors and heat input are used; if coal is not burned, EIA data and AP-42 emission factors applied to fuel quantity are used.
1994-1995	NO_x	If the boiler reports to both EIA-767 and ETS/CEM, and the ETS/CEM NO_x data are complete for the year, then the ETS/CEM data are used. Otherwise, if a boiler burned coal, EIA data and EPA/ARD emission factors and heat input are used; if coal is not burned, EIA data and AP-42 emission factors applied to fuel quantity are used.
1996-1998	NO_x	If the boiler reports to both EIA-767 and ETS/CEM, then the ETS/CEM data are used. Otherwise, EIA data and AP-42 emission factors applied to fuel quantity are used. Note that AP-42 emission factors for some SCCs changed from data years 1985-1995 to data year 1996, and again in data year 1997.
1989-1993	SO_2	EIA data and AP-42 emission factors applied to fuel quantity are used.
1994-1998	SO_2	If the boiler reports to both EIA-767 and ETS/CEM, then the ETS/CEM data are used. Otherwise, EIA data and AP-42 emission factors applied to fuel quantity are used. Note that AP-42 emission factors for some SCCs changed from data years 1985-1995 to data year 1996.
1989-1998	VOC, CO	EIA data and AP-42 emission factors applied to fuel quantity are used. Note that AP-42 emission factors for some SCCs changed from data years 1985-1995 to data year 1996 for VOC and CO.
1989-1997	PM-10, PM-2.5 (Filterable)	EIA data and AP-42 emission factors applied to fuel quantity are used. Note that AP-42 emission factors for some SCCs changed from data years 1985-1995 to data year 1996 for PM_{10}.
1998	PM-10, PM-2.5 (Filterable)	EIA data and AP-42 emission factors applied to fuel quantity are used. Note that AP-42 emission factors for some SCCs changed from data year 1996 to data year 1998 for PM_{10} and $PM_{2.5}$. Since the PM_{10} Calculator Program was updated in 1999-2000, updated PM efficiencies are derived for emissions calculations.
1996-1998	PM Condensible (PMCD), Total PM-10, Total PM-2.5	EIA data and AP-42 emission factors applied to heat input are used to estimate PMCD. PMCD is summed with filterable PM_{10} and $PM_{2.5}$, respectively, to estimate total PM_{10} and $PM_{2.5}$. However, if the boiler reports to both EIA-767 and ETS/CEM, then the ETS/CEM heat input overlays EIA-based heat input, PM condensible is recalculated, and total PM_{10} and $PM_{2.5}$ emissions are updated. Note that filterable PM_{10} and $PM_{2.5}$ emissions for utility boilers are included in the National Emissions Inventory to keep the basis for PM_{10} and $PM_{2.5}$ emissions for utility boilers consistent with all other source categories.

Table 4.2-1 (continued)

For the data years	For the pollutant(s)	EPA estimated emissions by
1996-1998	NH_3	EIA data and emission factors applied to heat input are used to estimate ammonia emissions. However, if the boiler reports to both EIA-767 and ETS/CEM, then the ETS/CEM heat input overlays EIA-based heat input, NH_3 is recalculated, and the emissions are updated. For data years prior to 1996, NH_3 emissions were not estimated for utility boilers.
1997-1998	CO_2	EIA data and carbon coefficients (as emission factors) are applied to heat input to estimate CO_2. However, if the boiler reports to both EIA-767 and ETS/CEM, then the ETS/CEM heat input overlays EIA-based heat input, CO_2 is recalculated, and the emissions are updated, too. Note than for boilers burning coal, carbon coefficients changed slightly from data year 1997 to data year 1998.
1999	NO_x, SO_2, VOC, CO, CO_2, PM-10, PM-2.5, NH_3	Projecting 1998 boiler-level emissions using ratio of plant-level 1999 fuel consumption to 1998 fuel consumption.

Table 4.2-2. Steam Electric Utility Unit Source Classification Code Relationships

Fossil-Fuel	Firing Type	Bottom Type	SCC
Coal			
Bituminous	No data	No data	10100202
		Wet	10100201
		Dry	10100202
	Wall*	No data	10100202
		Wet	10100201
		Dry	10100202
	Opposed	No data	10100202
		Wet	10100201
		Dry	10100202
	Tangential	No data	10100212
		Wet	10100201
		Dry	10100212
	Stoker	All	10100204
	Cyclone	All	10100203
	Fluidized Bed	N/A	10100217
Subbituminous	No data	No data	10100222
		Wet	10100221
		Dry	10100222
	Wall	No data	10100222
		Wet	10100221
		Dry	10100222
	Opposed	No data	10100222
		Wet	10100221
		Dry	10100222
	Tangential	No data	10100226
		Wet	10100221
		Dry	10100226
	Stoker	All	10100224
	Cyclone	All	10100223
	Fluidized Bed	N/A	10100238
Lignite	No data	All	10100301
	Wall	All	10100301
	Opposed	All	10100301
	Tangential	All	10100302
	Stoker	All	10100306
	Cyclone	All	10100303
	Fluidized Bed	N/A	10100317

Table 4.2-2 (continued)

Fossil-Fuel	Firing Type	Bottom Type	SCC
Residual Oil	No data	All	10100401
	Wall	All	10100401
	Opposed	All	10100401
	Tangential	All	10100404
	Stoker	All	10100401
	Cyclone	All	10100401
Distillate Oil	No data	All	10100501
	Wall	All	10100501
	Opposed	All	10100501
	Tangential	All	10100501
	Stoker	All	10100501
	Cyclone	All	10100501
Natural Gas	No data	All	10100601
	Wall	All	10100601
	Opposed	All	10100601
	Tangential	All	10100604
	Stoker	All	10100601
	Cyclone	All	10100601
Process Gas	N/A	N/A	10100701
Petroleum Coke	N/A	N/A	10100801
Biomass/Wood/Wood Waste	N/A	N/A	10100902
Propane	N/A	N/A	10101002
Refuse/Solid Waste	N/A	N/A	10101202
Other Liquid Oil	N/A	N/A	10101302

*Wall firing includes front, arch, concentric, rear, side, vertical, and duct burner firing.

Table 4.2-3. Boiler Emissions Data Sources (Other than EIA-767) for NO_x, SO_2, and Heat Input Data by Year

Year	NO_x	SO_2
1985	Overlaid CAMD coal NO_x rate calculations when possible	NADBV311 data
1986	Overlaid CAMD coal NO_x rate calculations when possible	Calculated from EIA-767 data
1987	Overlaid CAMD coal NO_x rate calculations when possible	Calculated from EIA-767 data
1988	Overlaid CAMD coal NO_x rate calculations when possible	Calculated from EIA-767 data
1989	Overlaid CAMD coal NO_x rate calculations when possible	Calculated from EIA-767 data
1990	Overlaid CAMD coal NO_x rate calculations when possible	Calculated from EIA-767 data
1991	Overlaid CAMD coal NO_x rate calculations when possible	Calculated from EIA-767 data
1992	Overlaid CAMD coal NO_x rate calculations when possible	Calculated from EIA-767 data
1993	Overlaid CAMD coal NO_x rate calculations when possible	Calculated from EIA-767 data
1994	Overlaid CAMD coal NO_x rate calculations when possible; overlaid ETS/CEM data when possible	Overlaid ETS/CEM data when possible
1995	Overlaid ETS/CEM data when possible	Overlaid ETS/CEM data when possible
1996	Overlaid ETS/CEM data when possible	Overlaid ETS/CEM data when possible
1997	Overlaid ETS/CEM data when possible	Overlaid ETS/CEM data when possible
1998	Overlaid ETS/CEM data when possible	Overlaid ETS/CEM data when possible
1999	Grew from 1998 data and overlaid the ETS/CEM data, when possible, for the given 1998 universe of boilers.	Grew from 1998 data and overlaid the ETS/CEM data, when possible, for the given 1998 universe of boilers.

CAMD = EPA's Clean Air Markets Division
NADBv311 = National Allowance Data Base Version 3.11
ETS/CEM = Emissions Tracking System/Continuous Emissions Monitoring data

4.2-4. Algorithms Used to Estimate EIA-Based VOC, NO_x, CO, SO_2, PM-10, PM-2.5, and NH_3 Annual Emissions from Electric Utility Boilers

$$E_{NO_x,\,SCC} = FC_{SCC} * EF_{NO_x,\,SCC} * (1 - (RE_{NO_x} * CE_{NO_x,b})) * UCF$$

$$E_{CO\ or\ VOC,\dagger SCC} = FC_{SCC} * EF_{CO\ or\ VOC,\,SCC} * RE_{CO\ or\ VOC}$$

$$E_{PM_{10}\ or\ PM_{2.5},\,SCC} = FC_{SCC} * EF_{PM_{10}\ or\ PM_{2.5},\,SCC} * A_f * (1 - CE_{PM_{10}\ or\ PM_{2.5},b}) * UCF$$

$$E_{SO_2,\,SCC} = FC_{SCC} * EF_{SO_2,\,SCC} * S_f * (1 - CE_{SO_2,b}) * UCF$$

$$E_{NH_3,\,SCC} = FC_{SCC} * EF_{NH_3,\,SCC} * UCF$$

where:	***E***	=	annual estimated emission (in tons/year)
	FC	=	annual fuel consumption (in units/$year_f$)
	EF	=	emission factor (in lbs/$unit_f$)
	S	=	sulfur content (expressed as a decimal)
	A	=	ash content (expressed as a decimal)
	RE	=	rule effectiveness (expressed as a decimal: 0.8 for CO_2 and VOC; 0.8 for NO_x until 1995, then 1.0; 1.0 for all other pollutants)
	CE	=	control efficiency (expressed as a decimal)
	b	=	boiler
	f	=	fuel type
	UCF	=	units conversion factor (1 ton/2000 lbs)
	$unit_{coal}$	=	tons burned
	$unit_{oil}$	=	1000 gallons burned
	$unit_{gas}$	=	million cubic feet burned

† Note that VOC also undergoes an augmentation procedure.

Table 4.2-5. Algorithms Used to Estimate EIA-Based Condensible PM, Total PM-10, Total PM-2.5, and CO_2 Annual Emissions for Electric Utility Boilers

$$E_{PMCD,\ SCC} = HTI_{SCC} * EF_{PMCD,\ SCC} * CF$$

$$E_{TotPM_{10}\ or\ TotPM_{2.5},\ SCC} = E_{PM_{10}\ or\ PM_{2.5},\ SCC} * E_{PMCD,\ SCC}$$

$$E_{CO_2,\ SCC} = HTI_{SCC} * CC_{SCC} * .99 * \frac{44}{12} * CF$$

where:

PMCD	=	particulate matter condensible
E	=	annual estimated emissions (in tons/year)
HTI	=	annual heat input (in MMBtu/year)[$]
EF	=	emission factor (in tons/MMBtu)
CC	=	carbon content coefficient in million metric tons of carbon equivalent per quad (in MMTCE/10^{15} Btu)
.99	=	fraction oxidized to yield carbon
$\frac{44}{12}$	=	ratio of CO_2 molecular weight to carbon molecular weight
CF	=	units conversion factor to convert to short tons

$ Calculate using EIA fuel consumption and heat content values, but use ETS/CEM heat input data if available and recalculate PMCD, TOTPM10, TOTPM25, and CO_2.

Table 4.2-6. Algorithms Used to Disaggregate ETS/CEM Boiler Data to the Boiler-SCC Level

$$CEMSO2_{SCC} = \left(\frac{767SO2_{SCC,b}}{767SO2_b} \right) * CEMSO2_b$$

$$CEMNOX_{SCC} = \left(\frac{767NOX_{SCC,b}}{767NOX_b} \right) * CEMNOX_b$$

$$CEMHTI_{SCC} = \left(\frac{767HTI_{SCC,b}}{767HTI_b} \right) * CEMHTI_b$$

where: ***b*** = boiler-level

CEMSO2, CEMNOX, CEMHTI = ETS/CEM annual boiler data for given parameter

767SO2, 767NOX, 767HTI = Form EIA-767-based calculated data for given parameter

4.3 INDUSTRIAL

4.3.1 What Source Categories Does the Industrial Sector Include?

The point and area source categories under the "Industrial" heading include the following Tier I and Tier II categories:

Tier I Category		Tier II Category
(01)	FUEL COMBUSTION - ELECTRIC UTILITY	(05) Gas Turbines and Internal Combustion
(02)	FUEL COMBUSTION - INDUSTRIAL	All
(04)	CHEMICAL & ALLIED PRODUCT MANUFACTURING	All
(05)	METALS PROCESSING	All
(06)	PETROLEUM & RELATED INDUSTRIES	All
(07)	OTHER INDUSTRIAL PROCESSES	All
(09)	STORAGE & TRANSPORT	All
(10)	WASTE DISPOSAL & RECYCLING	All
(14)	MISCELLANEOUS	(05) Health Services

The methodologies for estimating emissions for gas turbines and internal combustion engines at electric utilities are included in this section because they are the same as the methodologies for the industrial sector.

See section 4.1.3 for instructions on how to identify the SCCs for the point and area source categories assigned to these tier categories.

4.3.2 What Information Does This Section Provide?

This section describes the methods used to estimate 1985 through 1989 emissions, 1990 emissions for the 1990 Interim Inventory, and 1990 through 1999 emissions in the National Emission Trends (NET) inventory. Table 4.3-1 summarizes the methods applied and the pollutants for which emissions were estimated for each year. Section 4.3.3 explains the methods for preparing the 1990 Interim Inventory. Section 4.3.4 explains how emissions for 1985 through 1989 were developed from the 1990 Interim Inventory.

After preparing the 1990 Interim Inventory, EPA developed a new 1990 base year inventory called the NET) inventory. The NET inventory was prepared by combining State/local agency data from the Ozone Transport Assessment Group (OTAG) emission inventory, the Grand Canyon Visibility Transport Commission (GCVTC) emission inventory, and Aerometric Information Retrieval System/Facility Subsystem (AIRS/FS). Data gaps were filled with information from the 1990 Interim Inventory. In 1997, PM-2.5 and NH_3 emissions were added to the 1990 inventory. This 1990 inventory was then used to grow emissions to 1991 through 1995. Subsequently, EPA has updated the 1990 to 1995 NET inventories with data submitted by State and local agencies to comply with the CAAA requirement to submit emissions data for major point sources every year. Section 4.3.5 provides details on how the 1990 NET inventory was developed. The methodologies for the 1991 through 1994 and the 1995 NET emissions are presented in section 4.3.6 and 4.3.7, respectively.

Initially, EPA prepared the 1996 emission inventory by merging the 1995 AIRS/FS emissions with 1995 emissions grown from 1990 emissions for the States that did not submit emissions data to AIRS/FS. Sections 4.3.8.1 through 4.3.8.3 provide details on how this initial 1996 inventory was prepared. Subsequently, EPA has been revising the 1996 NET to include base year emissions data submitted by State/local agencies to comply with the CAAA requirements to submit (1) periodic emissions inventories (PEI) every 3 years for ozone nonattainment areas (NAAs), and (2) emissions data for major point sources annually. States with ozone NAAs needed to submit their PEI for 1996 by July 1997. While the CAAA only require submittal of ozone precursor pollutant data for the PEI requirements, annual point source reporting covers all criteria air pollutants. In its guidance provided to the State/local agencies on the PEI submittal process, EPA encouraged State/local agencies to submit emission estimates for all pollutants because the NET contains estimates for all criteria pollutants and is to be the ultimate repository of the State/local agency data. To reduce the burden of preparing this inventory, EPA gave each State/local agency a copy of the 1996 NET inventory as a starting point in preparing their 1996 base year emissions. The methodologies used to prepare and revise the 1996 NET emissions are presented in section 4.3.8.4.

EPA developed 1997, 1998, and 1999 emissions for the NET inventory. Emissions for nonutility point sources and many area sources were developed using growth and control factors. Section 4.3.9 describes the methodologies used to prepare the 1997 through 1999 NET emissions.

4.3.3 How did EPA Develop the 1990 Interim Inventory?

The 1990 Interim Inventory is based on the 1985 NAPAP Inventory. The database includes annual and average summer day emission estimates for 48 States and the District of Columbia. Five pollutants (CO, NO_x, VOC, SO_2, and PM-10) were estimated for 1990.

The 1985 NAPAP Emission Inventory estimates for the **point** sources were projected to 1990 based on the growth in Bureau of Economic Analysis (BEA) historic earnings for the appropriate State and industry, as identified by the 2-digit SIC code.[1] To remove the effects of inflation, the earnings data were converted to 1982 constant dollars using the implicit price deflator for personal consumption expenditures (PCE).[2] State and SIC code-level growth factors were calculated as the ratio of the 1990 earnings data to the 1985 earnings data. Additional details on point source growth indicators are presented in section 4.3.3.6.

The **area** source emissions from the 1985 NAPAP Emission Inventory were projected to 1990 based on BEA historic earnings data, BEA historic population data, DOE SEDS data, or other growth indicators. The specific growth indicator was assigned based on the source category. The BEA earnings data were converted to 1982 dollars as described above. The 1990 SEDS data were extrapolated from data for the years 1985 through 1989.[3] All growth factors were calculated as the ratio of the 1990 data to the 1985 data for the appropriate growth indicator. Additional details on area source growth indicators are presented in section 4.3.3.7.

When creating the 1990 emission inventory, changes were made to emission factors, control efficiencies, and emissions from the 1985 inventory for all sources. The PM-10 control efficiencies were obtained from the PM Calculator.[4] In addition, rule effectiveness, which was not applied in the 1985 NAPAP Emission Inventory, was applied to the 1990 emissions estimated for the point sources. The CO,

NO_x, and VOC point source controls were assumed to be 80 percent effective; PM-10 and SO_2 controls were assumed to be 100 percent effective.

The 1990 emissions for CO, NO_x, SO_2, and VOC were calculated using the following steps: (1) projected 1985 controlled emissions to 1990 using the appropriate growth factors, (2) calculated the uncontrolled emissions using control efficiencies from the 1985 NAPAP Emission Inventory, and (3) calculated the final 1990 controlled emissions using revised control efficiencies and the appropriate rule effectiveness. The 1990 PM-10 emissions were calculated using the TSP emissions from the 1985 NAPAP Emission Inventory. The 1990 uncontrolled TSP emissions were estimated in the same manner as the other pollutants. The 1990 uncontrolled PM-10 estimates were calculated from these uncontrolled TSP emissions by applying SCC-specific uncontrolled particle size distribution factors.[5] The controlled PM-10 emissions were estimated in the same manner as the other pollutants. Because the majority of area source emissions for all pollutants represented uncontrolled emissions, the second and third steps were not required to estimate the 1990 area source emissions.

4.3.3.1 What Control Efficiency Revisions did EPA Make?

In the 1985 NAPAP point source estimates, control efficiencies for VOC, NO_x, CO, and SO_2 sources in Texas were judged to be too high for their process/control device combination. These high control efficiencies occurred because Texas did not ask for control efficiency information, and simply applied the maximum efficiency for the reported control device.[6] High control efficiencies lead to high future growth in modeling scenarios based on uncontrolled emissions (which are based on the control efficiency and reported actual emissions). High control efficiencies also lead to extreme increases in emissions when rule effectiveness is incorporated.

Revised VOC control efficiencies were developed for Texas from the Emission Reduction and Cost Analysis Model for VOC (ERCAM-VOC).[7] For this analysis, revised efficiencies were also developed by SCC and control device combination for NO_x, SO_2, and CO using engineering judgement. These revised control efficiencies were applied to sources in Texas. A large number of point sources outside of Texas had VOC and CO control efficiencies that were also judged to be too high. The VOC and CO control efficiencies used for Texas were also applied to these sources.

Control efficiencies not applied in the 1985 NAPAP Emission Inventory were incorporated in the data files for VOC emissions from gasoline marketing (Stage I and vehicle refueling) and bulk gasoline plants and terminals, since many areas already have regulations in place for controlling Stage I and Stage II gasoline marketing emissions. Many current State regulations require the use of Stage I controls (except at small volume service stations) to reduce emissions by 95 percent. Emissions were revised to reflect these controls in areas designated as having these requirements as part of their SIPs.[8] Stage II vapor recovery systems are estimated to reduce emissions by 84 percent.[9] Stage II controls are already in place in the District of Columbia, St. Louis, Missouri, and parts of California. Stage II controls also reduce underground tank breathing/emptying losses. Emissions in these area were revised to reflect these controls.

Gasoline bulk plants and terminals are covered by existing Control Techniques Guidelines (CTGs) and are included in many State regulations. Emissions were revised to reflect these controls in areas with regulations.[8] Control efficiencies assumed for these area source categories were 51 percent for gasoline bulk plants and terminals. The 1985 NAPAP area source estimates have control levels built into these

emissions. These control levels were first backed out of the emissions. In areas with no controls, the emissions remained at uncontrolled levels. In areas with regulation, the uncontrolled emissions were reduced to reflect the above efficiencies.

4.3.3.2 What Rule Effectiveness Assumptions did EPA Make?

Controlled emissions for each inventory year were recalculated, assuming that reported VOC, NO_x, and CO controls were 80 percent effective. Sulfur dioxide and PM-10 controls were assumed to be 100 percent effective. The 80 percent rule effectiveness assumption was judged to be unreasonable for several VOC and CO source categories. The VOC rule effectiveness was changed to 100 percent for bulk storage tank sources that had VOC control devices codes 90, 91, or 92. These three codes represent conversion to variable vapor space tank, conversion to floating roof tank, and conversion to pressurized tank, respectively. These controls were judged to be irreversible process modifications (there are SCCs which represent these type of tanks), and, therefore, 100 percent rule effectiveness was applied. VOC and CO rule effectiveness was changed to 100 percent for all Petroleum Industry - Fluid Catalytic Cracking Units (FCCs), SCC 30600201. AP-42 lists CO waste heat boilers as a control for these units with both CO and hydrocarbon emissions reduced to negligible levels. Since these boilers handle VOC and CO as fuels rather than as emissions, they are treated as a process instead of as control device, and, therefore, are not subject to rule effectiveness.

There is no control device code for CO boilers in the 1985 NAPAP Inventory. To implement this set of revisions, all FCCs were assumed to have CO boilers. In addition, the CO rule effectiveness was changed to 100 percent for sources in five other SCCs that burn CO as a fuel. The CO rule effectiveness was also changed to 100 percent for sources with In-Process Fuel Use SCCs. According to AP-42, there should be no CO emissions from these sources. Emissions were not deleted from the inventory, however applying 80 percent rule effectiveness resulted in CO emissions of up to 36,000 short tons from some In-Process Fuel Use sources. Changing the rule effectiveness to 100 percent for sources in these SCCs retains the emissions, but at more reasonable levels. Table 4.3-2 lists the SCCs for which the CO rule effectiveness was changed to 100 percent.

Rule effectiveness was also adjusted for all chemical and allied product point sources from 80 to 100 percent.

4.3.3.3 What Emission Factor Changes Occurred?

The VOC emission factors for vehicle refueling were updated to reflect changes in gasoline Reid vapor pressure (RVP). The 1985 NAPAP gasoline marketing service station emissions were divided into two components: evaporative losses from underground tanks (Stage I) and Stage II vehicle refueling (including spillage). The 1985 NAPAP emissions were derived based on gasoline usage combined with the following uncontrolled emissions factors from AP-42:

Stage I: 7.3 lbs/1,000 gallons
Stage II: 11.0 lbs/1,000 gallons
Spillage: 0.7 lbs/1,000 gallons

These emission factors were used to calculate the fraction of total emissions attributable to each of the components above. The total percentage is 38.4 percent for Stage I emissions and 61.6 percent for Stage II emissions, plus spillage.

The Stage II emissions were also revised to reflect changes in emission factors. Stage II emission factors are a function of gasoline RVP and temperature. Gasoline RVPs have decreased since 1985 in response to the phase I and phase II RVP regulations. MOBILE5 was used to calculate Stage II emission factors for five sample States (Maryland, Illinois, New York, Texas, and North Carolina). Factors for each season were calculated based on the seasonal RVP and temperature (see Tables 4.3-3 to 4.3-5) based on engineering judgement. The national average annual factors for each inventory year are shown in Table 4.3-6. The 1987 value was used to estimate the 1985 and 1986 emissions.

In addition to updating the emission factor for Stage II, underground tank breathing/emptying losses were also added to the inventory. The AP-42 emission factor of 1.0 lbs/1,000 gallons was used to estimate emissions for each inventory year. Gasoline usage was back-calculated from the Stage II VOC emissions and emission factor.

4.3.3.4 What Emissions Calculations Did EPA Use?

A three-step process was used to calculate emissions incorporating rule effectiveness. First, base year controlled emissions are projected to the inventory year using the following formula (Equation 4.3-1):

$$CE_i = CE_{BY} + (CE_{BY} \times EG_i) \qquad \text{(Eq. 4.3-1)}$$

where: CE_i = controlled emissions for inventory year i
CE_{BY} = controlled emissions for base year
EG_i = earnings growth for inventory year i

Earnings growth (EG) is calculated using Equation 4.3-2:

$$EG_i = 1 - \frac{DAT_i}{DAT_{BY}} \qquad \text{(Eq. 4.3-2)}$$

where: DAT_i = earnings data for inventory year i
DAT_{BY} = earnings data in the base year

Second, uncontrolled emissions in the inventory year are back-calculated from the controlled emissions based on the control efficiency with the following formula (Equation 4.3-3):

$$UE_i = \frac{CE_i}{\left(1 - \frac{CEFF}{100}\right)} \qquad \text{(Eq. 4.3-3)}$$

where: UE_i = uncontrolled emissions for inventory year i
CE_i = controlled emissions for inventory year I
CEFF = control efficiency (%)

Third, controlled emissions are recalculated incorporating rule effectiveness using the following equation (Equation 4.3-4):

$$CER_i = UC_i \times \left(1 - \left(\frac{REFF}{100}\right) \times \left(\frac{CEFF}{100}\right)\right) \times \left(\frac{EF_i}{EF_{BY}}\right) \qquad \text{(Eq. 4.3-4)}$$

where: CER_i = controlled emissions incorporating rule effectiveness
UC_i = uncontrolled emissions
REFF = rule effectiveness (%)
CEFF = control efficiency (%)
EF_i = emission factor for inventory year i
EF_{BY} = emission factor for base year

In many cases, the PM-10 emissions calculated based on the particle size distribution and PM-10 control efficiency were higher than the TSP emissions because of inconsistencies between the TSP control efficiencies from the 1985 NAPAP inventory and the control efficiencies determined using the PM Calculator. This error may have been compounded in the following steps with the values selected for particle size distribution and efficiency. In the instances where the controlled PM-10 emissions were calculated to be higher than the controlled TSP emissions, the controlled PM-10 emissions were replaced with the controlled TSP emissions. The uncontrolled PM-10 was then recalculated using the revised PM-10 emissions and the control efficiency from the PM Calculator. It was assumed that in these instances, virtually all of the particles above 10 microns are being controlled and that particles emitted after the control device are all particles of 10 microns or less.

The basis for replacing the PM-10 emissions with the TSP emissions in these cases is the assumption that the controlled TSP emissions from the 1985 NAPAP inventory are the best data that are available as a measure of point source particulate emissions. If it is assumed that the uncontrolled emissions were the best data available, then an adjustment to the TSP control efficiency (resulting in an increase to actual TSP emissions) would be performed rather than replacing the PM-10 emissions.

4.3.3.5 For What Source Categories Did EPA Revise VOC and SO_2 Emissions?

The EPA revised the NAPAP projected VOC emissions for hazardous waste treatment, storage, and disposal facilities (TSDF) in the point source inventory, petroleum refinery fugitive emissions in the area source inventory, and point source SO_2 emissions for a copper smelter based on current data available for these categories.

Hazardous waste TSDF emissions were updated using an April 1989 file from EPA's Emission Standards Division (ESD).[10a] This file provided estimates of TSDF emissions with longitude and latitude as the geographical indicator for each facility. The longitude and latitude were used to match emissions to the appropriate State and county. The emissions were generated by using the Hazardous Waste Data Management System (HWDMS)[10b] which includes data on facility-specific process descriptions, waste characterization and quantities, and VOC speciation. HWDMS generated national emissions estimates by summing emissions from each plant process at a TSDF. Speciated emissions from each plant process were calculated as the quantity of a specific waste handled, multiplied by a process-specific emission factor. Emission factors were taken from the *Background Information Documents for TSDFs*.[10c] The emission estimates displayed in Table 4.3-7 for eight counties were removed based on comments EPA received from various State and Regional Emission Inventory personnel.

Area source petroleum refinery fugitive emissions were re-estimated based on a revised estimate of national petroleum refinery emissions. The national petroleum refinery emissions used to estimate area source emissions in the 1985 NAPAP were obtained from the Emissions Trends report.[11] The emissions for blowdown systems were revised to reflect the high level of control as shown in the point source inventory.

The area source petroleum refinery fugitive emissions were re-estimated using the revised national emission total by applying the methodology used to develop the 1985 NAPAP estimate.[12] Total county fugitive petroleum refinery emissions were determined by distributing the revised Emission Trends estimate (excluding process heaters and catalytic cracking units) based on 1985 county refinery capacity from the DOE Petroleum Supply Annual.[13] Refinery capacity from this publication was allocated to counties based on the designated location of the refinery. The 1985 NAPAP Emission Inventory was used to aid in the matching of refineries to location.

Total area source petroleum refinery fugitive emissions were then estimated by subtracting the point source emissions (SCCs 3-06-004 through 3-06-888) from the total county-level emissions. Negative values (indicating higher point source emissions than the totals shown for the county), were re-allocated to counties exhibiting positive emission values based on the proportion of total refinery capacity for each county to avoid double-counting of emissions. This resulted in an estimate of 351,000 short tons for 1985 compared with the earlier 1985 NAPAP estimate of 728,000 short tons (area source refinery fugitives). This revised 1985 estimate was projected to the inventory years, as described in section 4.3.3.1.

The SO_2 emissions for 1987 through 1989 were adjusted to correct for the permanent closing of the Phelps Dodge copper smelter in Arizona in January 1987. This adjustment was made by subtracting the 1985 emissions for State=04, County=003, and NEDS ID=0013 from the inventory for 1987 through 1989.

4.3.3.6 How Did EPA Grow Point Source Emissions?

The changes in the point source emissions were equated with the changes in historic earnings by State and industry. Emissions from each point source in the 1985 NAPAP Emissions Inventory were projected to the years 1985 through 1990 based on the growth in earnings by industry (2-digit SIC code). Historical annual State and industry earnings data from BEA's Table SA-5[1] were used to represent growth in earnings from 1985 through 1990.

The 1985 through 1990 earnings data in Table SA-5 are expressed in nominal dollars. To be used to estimate growth, these values were converted to constant dollars to remove the effects of inflation. Earnings data for each year were converted to 1982 constant dollars using the implicit price deflator for PCE.[2] The PCE deflators used to convert each year's earnings data to 1982 dollars are:

Year	1982 PCE Deflator
1985	111.6
1987	114.3
1988	124.2
1989	129.6
1990	136.4

Several BEA categories did not contain a complete time series of data for the years 1985 through 1990. Because the SA-5 data must contain 1985 earnings and earnings for each inventory year (1985 through 1990) to be useful for estimating growth, a log linear regression equation was used where possible to fill in missing data elements. This regression procedure was performed on all categories that were missing at least one data point and which contained at least three data points in the time series.

Each record in the point source inventory was matched to the BEA earnings data based on the State and the 2-digit SIC. Table 4.3-8 shows the BEA earnings category used to project growth for each of the 2-digit SICs found in the 1985 NAPAP Emission Inventory. No growth in emissions was assumed for all point sources for which the matching BEA earnings data were not complete. Table 4.3-8 also shows the national average growth and earnings by industry from Table SA-5.

4.3.3.7 How Did EPA Grow Area Source Emissions?

Emissions from the 1985 NAPAP Inventory were grown to the Emission Trends years based on historical BEA earnings data (section 4.3.3.6), historical estimates of fuel consumption, or other category-specific growth indicators. Table 4.3-9 shows the growth indicators used for each area source by 1985 NAPAP category.

The SEDS data were used as an indicator of emissions growth for the area source fuel combustion categories and for the gasoline marketing categories shown in Table 4.3-10. (SEDS reports fuel consumption by sector and fuel type.) Since fuel consumption was the activity level used to estimate emissions for these categories, fuel consumption was a more accurate predictor of changes in emissions, compared to other surrogate indicators such as earnings or population. SEDS fuel consumption data were available through 1989 at the time the emission estimates were developed. The 1990 values were extrapolated from the 1985 through 1989 data using a log linear regression technique. In addition to

projecting 1990 data for all fuel consumption categories, the regression procedure was used to fill in missing data points for fuel consumption categories if at least three data points in the time series (1985 to 1989) were available.

The last step in the creation of the area source inventory was matching the 1985 NAPAP categories to the new AIRS Area and Mobile Source Subsystem (AMS) categories. This matching is provided in Table 4.3-11. Note that there is not always a one-to-one correspondence between 1985 NAPAP and AMS categories. For example, the gasoline marketing NAPAP category was split into two separate AMS categories representing Stage I and Stage II emissions. In addition, three 1985 NAPAP SCCs are not included in the AMS system of codes. Therefore, AMS codes were created for process emissions from pharmaceutical manufacture, synthetic fiber manufacture, and SOCMI fugitive emissions.

4.3.4 How Did EPA Develop Emissions for 1985 to 1989?

The 1990 Interim Inventory was used as the base year from which emissions for 1985 to 1989 were estimated. As discussed under section 4.3.3, the 1985 NAPAP controlled emissions were grown to 1990 to serve as the starting point for preparing the 1990 Interim Inventory emissions. However, several changes were made to the 1990 emissions to improve the inventory prior to backcasting the emissions to 1985 through 1989. Consequently, the 1985 emissions estimated by this method do not match the 1985 NAPAP Emission Inventory. The factors used to backcast 1990 emissions to prior years are the same as the factors used to grow 1985 NAPAP emissions to 1990.

4.3.5 What is the 1990 NET Inventory?

The 1990 NET inventory is based primarily on State data, with the 1990 Interim Inventory data filling in the gaps. The database houses U.S. annual and average summer day emission estimates for the 50 States and the District of Columbia. Seven pollutants (CO, NO_x, VOC, SO_2, PM-10, PM-2.5, and NH_3) were estimated for 1990. The State data were extracted from three sources, the OTAG inventory, the GCVTC inventory, and AIRS/FS. Sections 4.3.5.1, 4.3.5.2, and 4.3.5.3 give brief descriptions of these efforts. Section 4.3.5.4 describes the efforts necessary to supplement the inventory gaps that are either temporal, spacial, or pollutant. Since EPA did not receive documentation on how these inventories were developed, this section only describes the effort to collect the data and any modifications or additions made to the data.

4.3.5.1 OTAG

The OTAG inventory for 1990 was completed in December 1996. The database houses emission estimates for those States in the Super Regional Oxidant A (SUPROXA) domain. The estimates were developed to represent average summer day emissions for the ozone pollutants (VOC, NO_x, and CO). This section gives a background of the OTAG emission inventory and the data collection process.

4.3.5.1.1 Inventory Components —

The OTAG inventory contains data for all States that are partially or fully in the SUPROXA modeling domain. The SUPROXA domain was developed in the late 1980s as part of the EPA regional oxidant modeling (ROM) applications. EPA had initially used three smaller regional domains (Northeast, Midwest, and Southeast) for ozone modeling, but wanted to model the full effects of transport in the eastern United States without having to deal with estimating boundary conditions along relatively high

emission areas. Therefore, these three domains were combined and expanded to form the Super Domain. The western extent of the domain was designed to allow for coverage of the largest urban areas in the eastern United States without extending too far west to encounter terrain difficulties associated with the Rocky Mountains. The Northern boundary was designed to include the major urban areas of eastern Canada. The southern boundary was designed to include as much of the United States as possible, but was limited to latitude 26°N, due to computational limitations of the photochemical models. (Emission estimates for Canada were not extracted from OTAG for inclusion in the NET inventory.)

The current SUPROXA domain is defined by the following coordinates:

North:	47.00°N	East:	67.00°W
South:	26.00°N	West:	99.00°W

Its eastern boundary is the Atlantic Ocean and its western border runs from north to south through North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas. In total, the OTAG Inventory completely covers 37 States and the District of Columbia.

The OTAG inventory is primarily an ozone precursor inventory. It includes emission estimates of VOC, NO_x, and CO for all applicable source categories throughout the domain. It also includes a small amount of SO_2 and PM-10 emission data that was sent by States along with their ozone precursor data. No quality assurance (QA) was performed on the SO_2 and PM-10 emission estimates for the OTAG inventory effort.

Since the underlying purpose of the OTAG inventory is to support photochemical modeling for ozone, it is primarily an average summer day inventory. Emission estimates that were submitted as annual emission estimates were converted to average summer day estimates using operating schedule data and default temporal profiles and vice versa.

The OTAG inventory is made up of three major components: (1) the point source component, which includes segment/pollutant level emission estimates and other relevant data (e.g., stack parameters, geographic coordinates, and base year control information) for all stationary point sources in the domain; (2) the area source component, which includes county level emission estimates for all stationary area sources and non-road engines; and (3) the on-road vehicle component, which includes county/roadway functional class/vehicle type estimates of VMT and MOBILE5a input files for the entire domain. Of these three components, the NET inventory extracted all but the utility emissions. (See section 4.2 for a description of the utility NET emissions and section 4.6 for the on-road mobile NET emissions.)

4.3.5.1.2 Interim Emissions Inventory (OTAG Default) —

The primary data sources for the OTAG inventory were the individual States. Where States were unable to provide data, the 1990 Interim Inventory was used for default inventory data.[14] A more detailed description of the 1990 Interim Inventory is presented in section 4.3.3.

4.3.5.1.3 State Data Collection Procedures —

Since the completion of the Interim Inventory in 1992, many States had completed 1990 inventories for ozone nonattainment areas as required for preparing SIPs. In addition to these SIP inventories, many States had developed more comprehensive 1990 emission estimates covering their entire State. Since these State inventories were both more recent and more comprehensive than the Interim Inventory, a new inventory was developed based on State inventory data (where available) in an effort to develop the most accurate emission inventory to use in the OTAG modeling.

On May 5, 1995, a letter from John Seitz (Director of EPA's Office of Air Quality Planning and Standards [OAQPS]) and Mary Gade (Vice President of ECOS) to State Air Directors, States were requested to supply available emission inventory data for incorporation into the OTAG inventory.[15] Specifically, States were requested to supply all available point and area source emissions data for VOC, NO_x, CO, SO_2, and PM-10, with the primary focus on emissions of ozone precursors. Some emission inventory data were received from 36 of the 38 States in the OTAG domain. To minimize the burden to the States, there was no specified format for submitting State data. The majority of the State data was submitted in one of three formats:

1) an Emissions Preprocessor System Version 2.0 (EPS2.0) Workfile
2) an ad hoc report from AIRS/FS
3) data files extracted from a State emission inventory database

The origin of data submitted by each State is described in section 4.3.5.1.4.1 for point sources and 4.3.5.1.4.2 for area sources.

4.3.5.1.4. State Data Incorporation Procedures/Guidelines —

The general procedure for incorporating State data into the OTAG Inventory was to take the data "as is" from the State submissions. There were two main exceptions to this policy. First, any inventory data for years other than 1990 was backcast to 1990 using BEA Industrial Earnings data by State and 2-digit SIC code.[1] This conversion was required for five States that submitted point source data for the years 1992 through 1994. All other data submitted were for 1990.

Second, any emission inventory data that included annual emission estimates but not average summer day values were temporally allocated to produce average summer day values. This temporal allocation was performed for point and area data supplied by several States. For point sources, the operating schedule data, if supplied, were used to temporally allocate annual emissions to average summer weekday using the following equation:

$$EMISSIONS_{ASD} = EMISSIONS_{ANNUAL} * SUMTHRU * 1/(13 * DPW) \qquad \text{(Eq. 4.3-5)}$$

where:

$EMISSIONS_{ASD}$	=	average summer day emissions
$EMISSIONS_{ANNUAL}$	=	annual emissions
SUMTHRU	=	summer throughput percentage
DPW	=	days per week in operation

If operating schedule data were not supplied for the point source, annual emissions were temporally allocated to an average summer weekday using EPA's default Temporal Allocation file. This computer file contains default seasonal and daily temporal profiles by SCC. The following equation was used:

$$EMISSIONS_{ASD} = EMISSIONS_{ANNUAL} / (SUMFAC_{SCC} * WDFAC_{SCC}) \quad \text{(Eq. 4.3-6)}$$

where: $EMISSIONS_{ASD}$ = average summer day emissions
$EMISSIONS_{ANNUAL}$ = annual emissions
$SUMFAC_{SCC}$ = default summer season temporal factor for SCC
$WDFAC_{SCC}$ = default summer weekday temporal factor for SCC

There were a small number of SCCs that were not in the Temporal Allocation file. For these SCCs, average summer weekday emissions were assumed to be the same as those for an average day during the year and were calculated using the following equation:

$$EMISSIONS_{ASD} = EMISSIONS_{ANNUAL} / 365 \quad \text{(Eq. 4.3-7)}$$

where: $EMISSIONS_{ASD}$ = average summer day emissions
$EMISSIONS_{ANNUAL}$ = annual emissions

4.3.5.1.4.1 Point. For stationary point sources, 36 of the 38 States in the OTAG domain supplied emission estimates covering the entire State. Data from the Interim Inventory were used for the two States (Iowa and Mississippi) that did not supply data. Most States supplied 1990 point source data, although some States supplied data for later years because the later year data reflected significant improvements over their 1990 data. Inventory data for years other than 1990 were backcast to 1990 using BEA historical estimates of industrial earnings at the 2-digit SIC level. Table 4.3-12 provides a brief description of the point source data supplied by each State. Figure 4.3-1 shows the States that supplied point source data and whether the data were for 1990 or a later year.

4.3.5.1.4.2 Area. For area sources, 17 of the 38 States in the OTAG domain supplied 1990 emission estimates covering the entire State, and an additional nine States supplied 1990 emission estimates covering part of their State (partial coverage was mostly in ozone nonattainment areas). Interim Inventory data were the sole data source for 12 States. Where the area source data supplied included annual emission estimates, the default temporal factors were used to develop average summer daily emission estimates. Table 4.3-13 provides a brief description of the area source data supplied by each State. Figure 4.3-2 shows the States that supplied area source data.

4.3.5.1.4.3 Rule Effectiveness. For the OTAG inventory, States were asked to submit their best estimate of 1990 emissions. There was no requirement that State-submitted point source data include rule effectiveness for plants with controls in place in that year. States were instructed to use their judgment about whether to include rule effectiveness in the emission estimates. As a result, some States submitted estimates that were calculated using rule effectiveness, while other States submitted estimates that were calculated without using rule effectiveness.

The use of rule effectiveness in estimating emissions can result in emission estimates that are much higher than estimates for the same source calculated without using rule effectiveness, especially for sources with high control efficiencies (95 percent or above). Because of this problem, there was concern that the OTAG emission estimates for States that used rule effectiveness would be biased to larger estimates relative to States that did not include rule effectiveness in their computations.

To test if this bias existed, county level maps of point source emissions were developed for the OTAG domain. If this bias did exist, one would expect to see sharp differences at State borders between States using rule effectiveness and States not using rule effectiveness. Sharp State boundaries were not evident in any of the maps created. Based on this analysis, it was determined that impact of rule effectiveness inconsistencies was not causing large biases in the inventory.

4.3.5.2 Grand Canyon Visibility Transport Commission Inventory

The GCVTC inventory includes detailed emissions data for 11 States: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.[16] This inventory was developed by compiling and merging existing inventory databases. The primary data sources used were State inventories for California and Oregon, AIRS/FS for VOC, NO_x, and SO_2 point source data for the other nine States, the 1990 Interim Inventory for area source data for the other nine States, and the 1985 NAPAP inventory for NH_3 and TSP data. In addition to these existing data, the GCVTC inventory includes newly developed emission estimates for forest wildfires and prescribed burning.

After a detailed analysis of the GCVTC inventory, it was determined that the following portions of the GCVTC inventory would be incorporated into the PM inventory:

- complete point and area source data for California
- complete point and area source data for Oregon
- forest wildfire data for the entire 11 State region
- prescribed burning data for the entire 11 State region

State data from California and Oregon were incorporated because they are complete inventories developed by the States and are presumably based on more recent, detailed and accurate data than the Interim Inventory (some of which is still based on the 1985 NAPAP inventory). The wildfire data in the GCVTC inventory represent a detailed survey of forest fires in the study area and are clearly more accurate than the wildfire data in the Interim Inventory. The prescribed burning data in the GCVTC inventory are the same as the data in the Interim Inventory at the state level, but contain more detailed county-level data.

Non-utility point source emission estimates in the GCVTC inventory from States other than California and Oregon came from AIRS/FS. Corrections were made to this inventory to the VOC and PM emissions. The organic emissions reported in GCVTC inventory for California are total organics (TOG). These emissions were converted to VOC using the profiles from EPA's SPECIATE[17] database. Since the PM emissions in the GCVTC were reported as both TSP and PM-2.5, EPA estimated PM-10 from the TSP in a similar manner as described in section 4.3.3.4.

4.3.5.3 AIRS/FS

SO_2 and PM-10 (or PM-10 estimated from TSP) sources of greater than 250 tons per year as reported to AIRS/FS that were not included in either the OTAG or GCVTC inventories were appended to the NET inventory. The data were extracted from AIRS/FS using the data criteria set listed in Table 4.3-14. The data elements extracted are also listed in Table 4.3-14. The data were extracted in late November 1996. It is important to note that *estimated* emissions were extracted.

4.3.5.4 Data Gaps

As stated above, the starting point for the 1990 NET inventory is the OTAG, GCVTC, AIRS, and 1990 Interim inventories. Data added to these inventories include estimates of SO_2, PM-10, PM-2.5, and NH_3, as well as annual or ozone season daily (depending on the inventory) emission estimates for all pollutants. This section describes the steps taken to fill in the gaps from the other inventories.

4.3.5.4.1 SO_2 and PM Emissions —

For SO_2 and PM-10, State data from OTAG were used where possible. (The GCVTC inventory contained SO_2 and PM annual emissions.) In most cases, OTAG data for these pollutants were not available. For point sources, data for plants over 250 tons per year for SO_2 and PM-10 were added from AIRS/FS. The AIRS/FS data were also matched to the OTAG plants and the emissions were attached to existing plants from the OTAG data where a match was found. Where no match was found to the plants in the OTAG data, new plants were added to the inventory. For OTAG plants where there were no matching data in AIRS/FS and for all area sources of SO_2 and PM-10, emissions were calculated based on the emission estimates for other pollutants.

The approach to developing SO_2 and PM-10 emissions from unmatched point and area sources involved using uncontrolled emission factor ratios to calculate uncontrolled emissions. This method used SO_2 or PM-10 ratios to NO_x. NO_x was the pollutant utilized to calculate the ratio because (1) the types of sources likely to be important SO_2 and PM-10 emitters are likely to be similar to important NO_x sources and (2) the generally high quality of the NO_x emissions data. Ratios of SO_2/NO_x and PM-10/NO_x based on uncontrolled emission factors were developed. These ratios were multiplied by uncontrolled NO_x emissions to determine either uncontrolled SO_2 or PM-10 emissions. Once the uncontrolled emissions were calculated, information on VOC, NO_x, and CO control devices was used to determine if they also controlled SO_2 and/or PM-10. If this review determined that the control devices listed did not control SO_2 and/or PM-10, plant matches between the OTAG and Interim Inventory were performed to ascertain the SO_2 and PM-10 controls applicable for those sources. The plant matching component of this work involved only simple matching based on information related to the State and county Federal Information Processing Standards (FIPS) code, along with the plant and point IDs.

There was one exception to the procedures used to develop the PM-10 point source estimates. For South Carolina, PM-10 emission estimates came from the Interim Inventory. This was because South Carolina had no PM data in AIRS/FS for 1990 and using the emission factor ratios resulted in unrealistically high PM-10 emissions.

There were no PM-2.5 data in either OTAG or AIRS/FS. Therefore, the point and area PM-2.5 emission estimates were developed based on the PM-10 estimates using source-specific uncontrolled particle size distributions and particle size specific control efficiencies for sources with PM-10 controls.

To estimate PM-2.5, uncontrolled PM-10 was first estimated by removing the impact of any PM-10 controls on sources in the inventory. Next, the uncontrolled PM-2.5 was calculated by multiplying the uncontrolled PM-10 emission estimates by the ratio of the PM-2.5 particle size multiplier to the PM-10 particle size multiplier. (These particle size multipliers represent the percentage to total particulates below the specified size.) Finally, controls were reapplied to sources with PM-10 controls by multiplying the uncontrolled PM-2.5 by source/control device particle size specific control efficiencies.

4.3.5.4.2 NH_3 Emissions —

All NH_3 emission estimates incorporated into the NET Inventory came directly from EPA's National Particulate Inventory (NPI).[18] This methodology is the same as that reported in section 4.3.3 for the 1990 Interim Inventory, with the exception of agricultural sources. The NPI contained the only NH_3 emissions inventory available. (Any NH_3 estimates included in the OTAG or AIRS/FS inventory were eliminated due to sparseness of data.) As with SO_2 and PM-10, plant matching was performed for point sources. Emissions were attached to existing plants where there was a match. New plants were added for plants where there was no match.

4.3.5.4.3 Other Modifications —

Additional data were also used to fill data gaps for residential wood combustion and prescribed burning. Although these categories were in the OTAG inventory, the data from OTAG were not usable since the average summer day emissions were often very small or zero. Therefore, annual and average summer day emission estimates for these two sources were taken from the NET.

Additional QA/quality control (QC) of the inventory resulted in the following changes:

- Emissions with SCCs of fewer than eight digits or starting with a digit greater than the number "6" were deleted because they are invalid codes.
- Area source PM-10 and PM-2.5 utility emissions were deleted.
- A correction was made to a point (State 13/county 313/plant 0084) where the ozone season daily value had been revised but not the annual value.
- Tier assignments were made for all SCCs.
- Checked and fixed sources with PM-2.5 emissions which were greater than their PM-10 emissions.
- Checked and fixed sources with PM-10 emissions greater than zero and PM-2.5 emissions equal to zero.
- TSDFs - The 1990 TSDF emission estimates provided by the States through the OTAG effort were replaced with the 1990 emission estimates modified as described in section 4.3.3.5.

4.3.6 How Did EPA Develop Emissions for 1991 to 1994?

The 1991 through 1994 area source emissions were grown in a similar manner as the 1985 through 1989 estimates, except for using a different base year inventory. The base year for the 1991 through 1994 emissions is the 1990 NET inventory. The point source inventory was also grown for those States that did not want their AIRS/FS data used. (The list of States are detailed in the AIRS/FS subsection, 4.3.6.2.). For those States requesting that EPA extract their data from AIRS/FS, the years 1990 through 1995 were downloaded from the EPA IBM Mainframe. The 1996 emissions were not extracted since States are not required to have the 1996 data uploaded into AIRS/FS until July 1997.

4.3.6.1 Grown Estimates

The 1991 through 1994 point and area source emissions were grown using the 1990 NET inventory as the basis. The algorithm for determining the estimates is detailed in section 4.3.3.4. The 1990 through 1996 SEDS and BEA data are presented in Tables 4.3-15 and 4.3-16. The 1996 BEA and SEDS data were determined based on linear interpretation of the 1988 through 1995 data. Point sources were projected using the first two digits of the SIC code by State. Area source emissions were projected using either BEA or SEDS. Table 4.3-17 lists the SCC and the source for growth.

The 1990 through 1996 earnings data in BEA Table SA-5 (or estimated from this table) are expressed in nominal dollars. In order to be used to estimate growth, these values were converted to constant dollars to remove the effects of inflation. Earnings data for each year were converted to 1992 constant dollars using the implicit price deflator for PCE. The PCE deflators used to convert each year's earnings data to 1992 dollars are:

Year	1992 PCE Deflator
1990	93.6
1991	97.3
1992	100.0
1993	102.6
1994	104.9
1995	107.6
1996	109.7

4.3.6.2 AIRS/FS

Several States responded to EPA's survey and requested that their 1991 through 1995 estimates reflect their emissions as reported in AIRS/FS. The list of these States, along with the years available in AIRS/FS is given in Table 4.3-18. As described in section 4.3.5.3, default estimated annual and ozone season daily emissions (where available) were extracted from AIRS/FS. Some changes were made to these AIRS/FS files. For example, the default emissions for some States contain rule effectiveness and the emissions were determined to be too high by EPA. The emissions without rule effectiveness were extracted from AIRS/FS and replaced the previously high estimates. The changes made to select State and/or plant AIRS/FS data are listed below.

- Louisiana — All VOC source emissions were re-extracted to obtain emissions without rule effectiveness for the year 1994.
- Colorado - Mastercraft — The VOC emissions were reported as ton/year in the initial download from AIRS. The units were changed to pounds/ year in AIRS.
- Wisconsin - Briggs and Stratton — The VOC emissions for two SCCs were changed from with rule effectiveness to without rule effectiveness for the years 1991, 1993, and 1994.

As noted in Table 4.3-18, several States did not report emissions for all pollutants for all years for the 1990 to 1995 time period. To fill these data gaps, EPA applied linear interpolation or extrapolated the closest 2 years worth of emissions at the plant level. If only 1 year of emissions data were available, the emission estimates were held constant for all the years. The segment-SCC level emissions were derived using the average split for all available years. The non-emission data gaps were filled by using the most recent data available for the plant.

As described in section 4.3.5.4.1, many States do not provide PM-10 emissions to AIRS. These States' TSP emissions were converted to PM-10 emissions using uncontrolled particle size distributions and AP-42 derived control efficiencies. The PM-10 emissions are then converted to PM-2.5 in the same manner as described in section 4.3.3.4. The State of South Carolina provided its own conversion factor for estimating PM-10 from TSP.[18]

For all sources that did not report ozone season daily emissions, these emissions were estimated using the algorithm described in section 4.3.5.1.4 and equations 4.3-5 through 4.3-7.

4.3.7 How were 1995 Emissions Prepared?

The 1995 emission estimates were derived in a similar manner as the 1991 through 1994 emissions. The estimates were either extracted from AIRS/FS for 1995, estimated using AIRS/FS data for the years 1990 through 1994, or projected using the 1990 NET inventory. The method used depended on the States' responses to a survey conducted by EPA early in 1997. A description of the AIRS/FS methodology is described in section 4.3.6.2. The following three subsections describe the projected emissions. In addition, EPA has added the source category cotton ginning to the NET area source inventory. The methodology is detailed in section 4.3.7.4.

4.3.7.1 Grown Estimate

The 1995 point and area source emissions were grown using the 1990 NET inventory as the basis. Growth factors were prepared for each year using either SEDS annual fuel consumption data or BEA national earnings by industry. The 1990 through 1996 SEDS and BEA data are presented in Tables 4.3-15 and 4.3-16. The algorithm for determining the estimates is detailed in section 4.3.3.4.

4.3.7.2 NO_x RACT

Major stationary source NO_x emitters in marginal and above nonattainment areas and in ozone transport regions (OTRs) are required to install RACT-level controls under the ozone nonattainment related provisions of Title I of the CAAA. The definition of major stationary source for NO_x differs by the severity of the ozone problem as shown in Table 4.3-19.

NO_x RACT controls for non-utility sources that were modeled for the 1995 NET emissions are shown in Table 4.3-20. These RACT-level controls were applied to point source emitters with emissions at or above the major source size definition for each area. The application of NO_x RACT controls was only applied to grown sources.

4.3.7.3 Rule Effectiveness

Rule effectiveness was revised in 1995 for all grown sources using the information in the 1990 database file. If the rule effectiveness value was between 0 and 100 percent in 1990 and the control efficiency was greater than 0 percent, the uncontrolled emissions were calculated for 1990. The 1995 emissions were calculated by multiplying the growth factor by the 1990 uncontrolled emissions and the control efficiency and a rule effectiveness of 100 percent. The adjustment for rule effectiveness was only applied to grown sources.

4.3.7.4 Cotton Ginning

Emissions for cotton ginning are classified under SCC 2801000000. Cotton ginning estimates for 1995 through 1999 were calculated using the following methodology. Ginning activity occurs from August/September through March, covering parts of two calendar years,[19] with the majority of ginning activity occurring between September and January. Ginning activity occurs in the 16 States where cotton is grown, i.e., Alabama, Arizona, Arkansas, California, Florida, Georgia, Louisiana, Mississippi, Missouri, New Mexico, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia. The majority of the ginning facilities are located in Arkansas, California, Louisiana, Mississippi, and Texas.

The general equation for estimating emissions from this category is given below.

$$E = (P_c * B) * EF_c + (P_f * B) * EF_f \qquad \text{(Eq. 4.3-8)}$$

where:
- E = annual county emissions (lbs/year)
- B = number of bales ginned in the county
- P_c = fraction of total bales at gins with conventional controls
- EF_c = emission factor for gins with conventional controls (lbs/bale)
- P_f = fraction of total bales at gins with full controls
- EF_f = emission factor for gins with full controls (lbs/bale)

4.3.7.4.1 Activity Indicator —

The activity factor for this category is the number of bales of cotton ginned. The U.S. Department of Agriculture (USDA) compiles and reports data on the amount of cotton ginned by State, district, and county for each crop year in its *Cotton Ginnings* reports.[20] (A crop year runs from September through March.) These reports are published once or twice per month during the crop year and give the amount of cotton ginned as running totals.

The number of bales ginned in a county can be obtained from Reference 19. However, since these data are reported as running totals for the growing season (which spans parts of two calendar years), the number of bales ginned for a calendar year will need to be determined using data from two crop years. The amount of cotton ginned from January 1 to the end of the season (March) for calendar year *x* (crop year *x*) and the amount of cotton ginned from the beginning of the season (August/ September) for calendar year *x* (crop year *y*) should be summed to get the calendar year *x* total. To determine the amount ginned from January 1 to the end of the season, subtract the amount ginned by January 1 (in the early January *Cotton Ginnings* report) from the total reported in the March or end of season *Cotton*

Ginnings report. To determine the amount ginned from the beginning of the season to January 1, use the total recorded by January 1 in the early January *Cotton Ginnings* report.

It should be noted that for confidentiality purposes, the *Cotton Ginnings* report may not show detailed data for a county, but may include those data in the district, State, or U.S. totals. Data for a gin may be considered confidential if (1) there are fewer than three gins operating in the county, or (2) more than 60 percent of the cotton ginned in the county is ginned at one mill. The standard *Cotton Ginnings* report lists the following four footnotes to its table of running bales ginned:

1/ withheld to avoid disclosing individual gins
2/ withheld to avoid disclosing individual gins, but included in State total
3/ excludes some gins' data to avoid disclosing individual gins, but included in the State total
4/ withheld to avoid disclosing individual gins but included in the U.S. total

The following methodology can be used for estimating the number of bales ginned from those counties with confidential data.

(1) If all counties in the district show confidentiality, but there is a district total, divide district total by the number of counties to get individual county estimates.

(2) If some (but not all) counties in a district show confidentiality and there is a district total, subtract county totals from district total and divide the remainder by the number of counties showing confidentiality to get estimates for the "confidential" counties.

(3) If both county and district totals are considered confidential within a State, divide the State total by the number of counties to get individual county estimates.

(4) If some (but not all) districts show confidentiality, subtract recorded district totals from the State total and divide the remainder by the number of counties showing confidentiality to get estimates for the "confidential" counties.

Although this method of apportioning is time consuming, it is preferable to using the ginning distribution from previous years to determine current estimates of number of bales ginned in confidential counties. The variability of the cotton harvest from year to year, the possibility of past claims of confidentiality, and the industry trend from numerous small gins to fewer, large gins makes distribution based on past activity unreliable. In addition, if the estimates generated by the methodology above does not meet with State approval, the State may submit more accurate data for those counties and the apportioning methodology can be revised.

The March report, produced at the end of the crop year, contains the final totals (including revisions and updates) for the crop year. Data in the report may differ from earlier reports for the crop year in both total number of bales ginned and counties where ginning occurred. In fact, for crop year 1995, the January reports showed higher totals for some counties than did the final report. Subtracting the January totals from the March totals for these counties yielded a negative number. In these cases, the activity for the county for that time period was considered zero. For this methodology, in instances where counties are recorded in the March final report, but not in earlier (e.g., January) reports, the activity is assumed to

have occurred sometime before January. These counties were then added to the January listing as confidential counties, and distribution of ginning activity was then performed.

Kansas has only one small gin operating in the State, and this gin does not operate every year. Since the amount of cotton ginned at this facility is considered insignificant (less than 0.005 percent of the total cotton ginned in the United States in 1995), no emissions for Kansas were calculated.

4.3.7.4.2 Emission Factor —

AP-42[21] presents total PM and PM-10 emission factors (in lbs/bale) for gins with high-efficiency cyclones on all exhaust streams (i.e., full controls) and for gins with screened drums or cages on the lint cleaners and battery condenser and high-efficiency cyclones on all other exhaust streams (i.e., conventional controls). PM-2.5 emissions were assumed to be 1 percent of the total PM emissions, as given in Table B.2.2. in AP-42 for Grain Handling. Table 4.3-21 shows the AP-42 emission factors. Additional information obtained from EPA includes the estimated percent of cotton baled at gins using each type of control by State. These data were developed by the National Cotton Council and are shown in Table 4.3-22.[22] Emission factors are controlled emissions factors as indicated.

4.3.7.4.3 Sample Calculation —

Using the data for Alabama from the 03/25/96 *Cotton Ginnings* report:

- District 10 shows data for three counties, confidential data for two counties and a district total.

(1) Subtract District 10 county data from District 10 total.

144,250 - (35,200 + 59,300 + 25,750) = 24,000 bales

(2) Divide the remaining total by two (two counties claimed confidentiality) to estimate amount for each confidential county.

24,000/2 = 12,000 bales per confidential county

This procedure can also be used for District 40.

- Districts 50 and 60 show district totals only (i.e., all counties within these districts claim confidentiality). To estimate individual county totals, divide each district total by the number of counties within that district.

District 50	District 60
122,300/4 = 30,575 bales per county	153,650/6 = 25,608 bales per county

- Districts 20 and 30 claim county and district confidentiality. To estimate county totals,

(1) Subtract available district totals from State total.

491,150 - (144,250 + 34,650 + 122,300 + 153,650) = 36,300 bales

(2) Divide remainder by the number of counties claiming confidentiality in the two remaining districts.

36,300/8 = 4,538 bales per confidential county

Using the data in Table 4.3-23 and data from *Cotton Ginnings* reports, PM-10 emissions can be calculated for Madison County, Alabama, as shown in the following example.

(1) Determine total running bales ginned in Madison County in 1996

(a) For the period January 1, 1996 until the end of the crop season, subtract the running total as of January 1, 1996 from the 01/25/96 *Cotton Ginnings* report from the final crop season total from the 03/25/96 *Cotton Ginnings* report.

25,750 bales - 25,700 bales = 50 bales

(b) For the period from the beginning of the 1996 crop year until the end of calendar year 1996, use the running total as of January 1, 1997 from the 01/24/97 *Cotton Ginnings* report. Add this to the total from (a) above to get calendar year 1996 total.

50 bales + 40,500 bales = 40,550 bales ginned in calendar year 1996

(2) Determine the percent of crop ginned by emission control method using Table 4.3-23.

(3) Use the emission factors from AP-42 as shown in Table 4.3-21, the results of (1) and (2) above, and the general equation to estimate emissions.

$$E = [(P_c * B) * EF_c] + [(P_f * B) * EF_f] \qquad \text{(Eq. 4.3-9)}$$

where: P_c = 0.8
P_f = 0.2
B = 40,550 bales
EF_c = 1.2 lb/bale PM-10
EF_f = 0.82 lb/bale PM-10

Emissions = [(0.8 * 40,550 bales) * 1.2 lb/bale] + [(0.2 * 40,550 bales) * 0.82 lb/bale]
= 38,928 lbs + 6,650 lbs
= 45,578 lbs or 23 tons of PM-10

4.3.8 How Did EPA Develop the 1996 NET Inventory?

Initially, the 1996 emission inventory was developed by merging the 1995 AIRS/FS emissions with 1995 emissions grown from 1990 emissions for the States that did not submit 1995 emissions to AIRS/FS. No 1996 AIRS/FS data were available for use. The following three subsections describe the projected 1996 emissions. Subsequently, the merged data set was replaced with new emissions data submitted by State/local agencies. Section 4.3.8.4 explains how EPA incorporated State/local data into the 1996 NET.

4.3.8.1 Grown Estimates

The 1996 point and area source emissions were grown using the 1995 NET inventory as the basis. The algorithm for determining the estimates is detailed in section 4.3.3.4 and is described by the equation below. The 1990 through 1996 SEDS and BEA data are presented in Tables 4.3-15 and 4.3-16. The 1996 BEA and SEDS data were determined using linear interpretation of the 1988 through 1995 data. Rule effectiveness was updated to 100 percent as described in section 4.3.7.3 for the AIRS/FS sources that reported rule effectiveness of less than 100 percent in 1995.

The following equation describes the calculation used to estimate the 1996 emissions:

$$CER_{1996} = UC_{1995} \times \frac{GS_{1996}}{GS_{1995}} \times \left(1 - \left(\frac{REFF}{100}\right) \times \left(\frac{CEFF}{100}\right) \times \left(\frac{RP}{100}\right)\right) \qquad \text{(Eq. 4.3-10)}$$

where:
- CER_{1996} = controlled emissions incorporating rule effectiveness
- UC_{1995} = uncontrolled emissions
- GS = growth surrogate (either BEA or SEDS data)
- REFF = rule effectiveness (percent)
- CEFF = control efficiency (percent)
- RP = rule penetration (percent)

The rule effectiveness for 1996 was always assumed to be 100 percent. The control efficiencies and rule penetrations are detailed in the following subsections.

4.3.8.2 1996 VOC Controls

This section discusses VOC stationary source controls (except those for electric utilities). These controls were developed to represent the measures mandated by the CAAA and in place in 1996. Title I (specifically the ozone nonattainment provisions) affects VOC stationary sources. Title III hazardous air pollutant regulations will also affect VOC source categories. The discussion for each source category-specific control measure includes the regulatory authority, CAAA provisions relating to the control measure, and relevant EPA guidance.

Table 4.3-24 list the point source controls by pod. (A pod is a group of SCCs with similar emissions and process characteristics for which common control measures, i.e., cost and emission reductions, can be applied. It is used for control measure application/costing purposes.) Table 4.3-25 lists the POD to

SCC match. Table 4.3-26 lists the area source control efficiencies, and rule effectiveness and rule penetration if not 100 percent. A description of the controls is detailed below by measure.

4.3.8.2.1 Hazardous Waste Treatment, Storage, and Disposal Facilities —

Control assumptions for TSDF reflect application of Phase I and Phase II standards, as described below. Regulatory authority for these rules falls under the Resource Conservation and Recovery Act (RCRA). The Phase I rule for hazardous waste TSDFs restricts emissions from equipment leaks and process vents.[23] Process vent emissions must be below 3 lb/hr and 3.1 tons per year (tpy) or control devices must be installed. The control device must reduce emissions by 95 percent from uncontrolled levels or, if enclosed combustion devices are used, reduce the vent stream to 20 parts per million (ppm) by volume. The choice of control is not limited; condensers, absorbers, incinerators, and flares are demonstrated control techniques.

The equipment leak standards apply to emissions from valves, pumps, compressors, pressure relief devices, sampling connection systems, and open-ended valves or lines. Streams with organic concentrations equal to or greater than ten percent by weight are subject to the standards. Record keeping and monitoring are required for affected devices, in addition to the equipment standards, such as dual mechanical seals for compressors.

The Phase II rule will restrict emissions from tanks, containers, and surface impoundments.[24] The rule will affect an estimated 2,300 TSDFs. The proposed rule also requires generators with 90-day accumulation tanks (tanks holding waste for a period of 90 days or more) to install controls in order to retain RCRA permit exempt status. An estimated 7,200 generators will be affected. Controls specified for the Phase II rule are covers vented to a 95 percent destruction device, such as incinerators or carbon absorbers.

4.3.8.2.2 Municipal Solid Waste Landfills —

Emission reductions for landfills reflect the proposed rule and guidelines published in the *Federal Register*.[25] Regulatory authority for this control measure falls under RCRA. The proposed rule requires installation of gas collection systems and combustion (open flare) of the captured gases for all existing landfills emitting greater than 150 mg/year, or 167 tpy, of nonmethane organic compounds. A new source performance standard (NSPS) requires the same controls on all new facilities. The control device efficiency is estimated to be 82 percent. A rule effectiveness of 100 percent was applied. The penetration rate for existing facilities is estimated at 84 percent. A 100 percent penetration was applied to new sources.

4.3.8.2.3 New Control Technique Guidelines (CTGs) —

Section 183 of the CAAA mandated EPA to establish 11 new CTGs by November 1993. Controls following these guidelines must be implemented in moderate, serious, severe, and extreme nonattainment areas. The majority of these documents are in draft form or still in the analysis stages. Clean-up solvents will also be regulated through a negotiated rulemaking; however, implementation is not expected by 1996. Both of these control measures would apply nationwide. Control efficiency information was not available for many of the source categories, so default assumptions were made.

4.3.8.2.4 Existing CTGs —

EPA has issued three groups of CTG documents to be implemented in ozone nonattainment areas. These controls should already be included in areas designated as nonattainment prior to 1990. These controls, however, must also be implemented in newly designated nonattainment areas and over the entire OTR. Not all CTGs are included in Table 4.3-26 because of the difficulty, in some cases, of matching the document to the appropriate sources within the inventory. It is assumed that all existing CTGs are implemented by 1996.

4.3.8.2.5 Reasonably Available Control Technology —

The CAAA direct moderate and above ozone nonattainment areas to require reasonably available control technology (RACT)-level controls to VOC major stationary sources. The definition of major source varies, depending on the severity of the ozone nonattainment classification, as listed in Table 4.3-19.

Point source RACT control assumptions are based on EPA documents, including background documents for New Source Performance Standards (NSPSs) and National Emission Standards for Hazardous Air Pollutants (NESHAPs), Alternative Control Technology (ACT) documents, and other compilations of VOC control techniques.

Area source RACT control information was taken from similar sources. The complicating factor for area source RACT controls is the major stationary source size cutoff. A penetration factor was developed that accounts for the fraction of emissions within the area source category that are expected to be emitted from major stationary sources. The penetration rate varies according to the major stationary source size cutoff and, therefore, the ozone nonattainment classification.

4.3.8.2.6 Vehicle Refueling Controls-Stage II Vapor Recovery —

The CAAA and Title I General Preamble include the following specifications for Stage II vapor recovery programs.

- Stage II is required in serious and above nonattainment areas. Moderate areas must implement Stage II if onboard is not promulgated, and are also encouraged to implement Stage II (regardless of whether onboard is promulgated) in order to achieve early reductions. (Onboard controls require fleet turnover to become fully effective.)

- Stage II must be installed at facilities that sell more than 10,000 gallons of gasoline per month (the cutoff is 50,000 gallons per month for independent small business marketers). There is nothing to preclude States from adopting lower source size cutoffs.[26]

- A study must be conducted to analyze comparable measures in the OTR. Implementation plans for OTRs must be modified within 1 year after issuance of the comparability study to include Stage II or comparable measures.[27]

- States must prescribe the use of Stage II systems that are certified to achieve at least 95 percent control of VOC and that are properly installed and operated.[28]

EPA has issued two guidance documents related to Stage II:

- *Technical Guidance - Stage II Vapor Recovery Systems for Control of Vehicle Refueling Emissions at Gasoline Dispensing Facilities - Volume 1* (EPA-450/3-91-022, November 1991)[29]

- *Enforcement Guidance for Stage II Vehicle Refueling Programs* (December 1991)[30]

Table 4.3-27 list the areas with Stage II programs in place as of January 1996.

4.3.8.2.7 New Source Performance Standards —

For new sources subject to NSPS controls, these standards apply regardless of location. New sources in nonattainment areas are also subject to New Source Review (NSR)/offsets. A 100 percent rule effectiveness is assumed, consistent with that for other VOC stationary source controls.

4.3.8.2.8 Title III —

The source categories affected by Title III maximum achievable control technology (MACT) standards were identified by using EPA's timetable for regulation development under Title III. Applicability of the anticipated regulations in various projection years was also derived from this draft timetable.

Control technology efficiencies were estimated for the expected MACT standards based on available information. The information used depended on the status of specific standards in their development timetable. For standards that have already been proposed or promulgated, efficiencies were estimated using information presented in preambles to the appropriate regulations.

Rule effectiveness was estimated at 100 percent for all Title III standards, in accordance with current EPA guidelines for rule effectiveness. Rule penetration is not applicable for any of the MACT categories, since it is included in the average "control technology efficiency" parameter.

4.3.8.3 NO_x Controls

For the 1996 emissions, reductions were made in areas of the country that did not put RACT controls into place until January 1996. Area combustion sources were reduced in 1996 according to the control efficiencies and rule penetration values listed in Table 4.3-28.

4.3.8.4 How Did EPA Incorporate State/Local Emissions Inventory Data Into the 1996 NET?

The incorporation of the 1996 State/local emission inventory data is a five step process:

- Data Collection;
- Quality Control (QC);
- Data Augmentation (2 steps);
- Quality Assurance (QA); and
- Data Loading.

In the data collection step, EPA solicited point and area source PEI data and annual point source data from the State/local agencies. There were four acceptable formats State/local agencies could use to

submit their data: (1) the NET Input Format; (2) through AIRS/FS; (3) the Electronic Data Interchange X.12 format; and (4) the NET Overwrite Format.

In the QC step, EPA evaluated the data received to ensure that each State/local agency had correctly characterized, on the 1996 Emission Inventory Submittal Form, the data they submitted (e.g., geographic coverage, pollutants, SCCs, annual and daily emissions), that the data were formatted correctly, that mandatory data elements were included, and the priority SCCs needed to incorporate the data were present (e.g., non-utility point and stationary area source SCCs). Each data element was characterized as "mandatory submission" or "data can be augmented." As part of the QC step, all data received were checked to ensure that data elements classified as "mandatory submission" were included in the data supplied by the State/local agencies. Any problems found were followed-up by a phone call to the State/local agency for review and resolution, and the data set was updated with data provided by the State/local agency. If basic problems could not be resolved, the data were not included in the NET.

EPA needs a complete inventory containing annual and daily emissions for VOC, NO_x, CO, SO_2, PM-10, PM-2.5, and NH_3. Thus, in the first data augmentation step, EPA added annual emissions for each pollutant not included in the State/local agency's inventory. The procedures for augmenting inventories to add pollutants is explained in section 4.3.8.4.3.

In the QA step, data were checked for reasonableness. QA reports highlighting questionable data were developed and sent to the State/local agencies for review. Questionable data were either confirmed by the State/local agency as correct, corrected by the State/local agency, or in the case where the State/local agency did not respond, replaced using the data augmentation methods. The following QA reports were sent to the State/local agencies for review:

- Tier 2 summary;
- Top 20 plants for each pollutant with comparison to current data;
- NET plants not in the State/local agency data;
- Geographic coordinates falling outside State or NAA borders;
- Stack parameter exceptions;
- Large sources without emission controls; and
- Segments with emissions and control efficiency values of 100 percent or more.

For State/local agencies that submitted data in the NET input format, and had data tables with missing records (e.g., from the Emission Release Point table), QA reports were prepared to show the segments missing from some tables but not others.

After incorporating comments from the State/local agencies, EPA conducted a second data augmentation step to add or modify data in the State/local agency inventory because the data were missing or did not meet QA criteria. The augmentation step focused on the data required for regional scale modeling or the *Trends* report. For example, for point sources, data augmentation involved correcting stack, throughput, and operating time values that were missing or fell outside of typical ranges required for air quality modeling. The procedures for augmenting inventories to add or modify the required data elements is explained in section 4.3.8.4.3.

In the data loading step, EPA loaded State/local agency data that met the QA/QC criteria into the NET data base. This resulted in a fully revised 1996 point and area source file. For data incorporated

into Version 4.0 of the 1996 NET, EPA prepared a QA/QC plan defining the procedures for correcting missing or out-of-range values.[31] Computer programs were developed to apply the procedures to the entire point and area source files after incorporating State/local agency data. By doing this, the QA procedures have been applied consistently to all data included in the 1996 NET, as well as the 1997 through 1999 emissions prepared from the 1996 NET.

4.3.8.4.1 How Many States Submitted Data for 1996? —

Table 4.3-29 summarizes the sources of inventory data included in the 1996 NET point and area source inventories after incorporating inventories received in 1999 and 2000. For the State/local agencies that submitted point and area source inventories in 1999 and 2000, Tables 4.3-30 and 4.3-31 identify the pollutants for which data were submitted, the temporal basis of the emissions (i.e., annual or daily emissions), and the version of the NET in which the data were incorporated. Inventories submitted in 1999 were incorporated into Version 3.0 of the 1996 NET, and inventories submitted in 2000 were incorporated into Version 4.0 of the 1996 NET. For the majority of States, point source inventory submittals were made to AIRS/FS. Some States submitted data in alternative formats, primarily using the NET input format.

4.3.8.4.2 Were Any State-Supplied Data Rejected in the QC Phase? —

Yes. A few States' data were rejected either due to problems with data completeness, data format, or both. EPA is working to resolve these problems with the individual States and will include the data in the NET when the problems are resolved.

4.3.8.4.3 What Types of Data Were Augmented in the Data Augmentation Step? —

As mentioned above, the NET contains emission estimates for all criteria pollutants (except Pb). Thus, data elements and/or pollutant emissions missing from State/local agency data needed to be augmented. The following explains how the State/local agency emission inventories were augmented to add the data elements required for the NET.

Annual emissions for pollutants were added to State/local agency data sets, and then QA summary reports of the entire data set were prepared and submitted to each State/local agency for review and comment. EPA only added pollutants if the pollutants were completely missing from a State/local agency's data set. If a State/local agency's data set appeared to contain incomplete coverage of VOC, NO_x, CO, PM-10, or SO_2, EPA did not add any emissions for these pollutants to the data set. For example, if a data set contained SO_2 emissions for some but not all coal-fired external combustion sources, EPA did not add any SO_2 emissions to the data set. Note that for inventories submitted in 1999, no agency provided PM-2.5 or NH_3 emissions. For the inventories submitted in 2000, no agency provided PM-2.5, and three State agencies provided very limited NH_3 emissions. Thus, EPA added PM-2.5 and NH_3 emissions to the inventories.

State/local agency comments on the QA summary reports were incorporated into the data sets. For point sources, the revised data sets were incorporated into the 1996 NET by replacing the existing data in the NET by State and county. For area sources, the data sets were incorporated into the NET by State, county, and SCC.

4.3.8.4.3.1 Non-utility point sources. Table 4.3-32 lists the minimum set of the data elements EPA needs in order to add non-utility point source data into the NET. Each data element is coded "mandatory submission" (MS) or "data can be augmented" (DA). Data elements coded MS must be supplied by the

State/local agency for EPA to process the data. Data elements coded DA are elements that EPA adds to the State/local agency's data if they were not supplied by the State/local agency. Table 4.3-32 also includes a brief description of the method EPA uses to augment the necessary DA data elements.

PM-2.5 Augmentation: Inventory missing PM-2.5 emissions, but contains PM-10 emissions.

- Identify segment records with PM-10 emissions >0 but no PM-2.5, create PM-2.5 record and combine with PM-10 control code(s) from control file, and back calculate uncontrolled PM-10 annual emissions as follows where the control efficiency (CE) or rule effectiveness (RE) values must be >0:

  (PM-10 Annual Emissions)/(1-(CE (decimal) * (RE (decimal))

  For data supplied in NET input format, use CE value in "Total Capture Control Efficiency" field to calculate uncontrolled PM-10.

  If the record has PM-10 emissions >0 but PM-10 RE=0, assume State did not report PM-10 RE and set PM-10 RE=100. For area sources, use same procedure if rule penetration (RP)=0 and emissions are >0.

- Run uncontrolled PM-10 annual emissions through PM Calculator to get PM-2.5 annual emissions and control efficiency. Input fields needed for PM Calculator are:

  - Uncontrolled PM-10 annual emissions;
  - Primary and secondary control device codes;
  - SCC; and
  - Comments field for State/County/plant identification (ID) code/point ID/segment ID information to identify segment level records.

- To prepare inputs to PM Calculator, assume the following if control device code and associated CE data are incomplete:

  - If no PM-10 control device code(s) <u>and</u> no control efficiency value provided in State/local inventory, assume source is uncontrolled.

  - If have PM-10 control device code but no control efficiency value, run PM-10 emissions as uncontrolled through PM Calculator to estimate PM-2.5 emissions. Make control device record for PM-2.5 same as for PM-10 (i.e., include control code but no control efficiency).

  - If have PM-10 control efficiency value but no control device code, calculate uncontrolled PM-10, run PM-10 emissions through PM Calculator to estimate uncontrolled PM-2.5, and then apply PM-10 control efficiency to PM-2.5 to estimate controlled PM-2.5 emissions. Assume PM-10 and PM-2.5 control efficiency is the same.

  - For some PEI data supplied in the NET input format, incomplete CE data were provided. The following assumptions were applied to interpret the PM-10 control efficiency provided in the Control Equipment table for back calculating uncontrolled PM-10 emissions:

Primary PCT Control Efficiency (PPCE)	PCT Capture Efficiency (PCE)	Total Capture Control Efficiency (TCCE)	Assumption
Data	Data	No data	TCCE=PPCE x PCE
Data	No data	Data	Leave as is
No data	Data	Data	Leave as is
No data	Data	No data	Not enough information, assumed uncontrolled
No data	No data	Data	Leave as is
Data	No data	No data	TCCE=PPCE

- Review PM Calculator output and identify records with PM-2.5 annual emissions that exceed PM-10 annual emissions, and set PM-2.5 emissions equal to PM-10 emissions.

- Calculate PM-2.5 daily emissions as ratio of PM-10 daily to PM-10 annual times PM-2.5 annual emissions.

- Update data tables containing pollutant and control information, including PM-2.5 CE from PM Calculator. Set PM-2.5 control codes and RE equal to PM-10 control codes and RE.

PM-10 and PM-2.5 Augmentation: Inventory submittal missing PM-10 and PM-2.5 emissions, but contains total PM emissions.

Applied the procedures previously described but used uncontrolled total PM emissions as input to PM Calculator to calculate PM-10 and PM-2.5 emissions from total PM emissions. Then,

- Review PM Calculator output and identify records with PM-2.5 annual emissions that exceed PM-10 annual emissions, and set PM-2.5 emissions equal to PM-10 emissions.

- Calculate PM-10 and PM-2.5 daily emissions as ratio of total PM daily to total PM annual times PM-10 and PM-2.5 annual emissions.

- Update data tables containing pollutant and control information, including PM-10 and PM-2.5 CE from PM Calculator. Set PM-10 and PM-2.5 control codes and RE equal to total PM control codes and RE.

- Remove all records for total PM.

PM-10 and PM-2.5 Augmentation: Inventory submittal does not contain any PM emissions (i.e., total PM, PM-10, or PM-2.5).

The following steps were applied sequentially to estimate PM-10 and PM-2.5 emissions for State/local agency inventories that did not contain any PM emissions:

- Perform plant, point, and segment-level match of State/local agency inventory to current NET data. If a match, add PM-10 and PM-2.5 emissions from NET to segment in State/local inventory.

- If no segment match but is a match at plant and point, distribute point-level PM-10 and PM-2.5 emissions in NET to segments for same point in State/local agency inventory based on segment-level distribution of known pollutant (NO_x) in State/local inventory.

- If no point-level match but is a match at plant-level, distribute point-level PM-10 and PM-2.5 emissions in NET to segments for same plant in State/local inventory based on segment-level distribution of known pollutant (NO_x) in State/local inventory.

- If no plant-level match to current NET data, develop emissions using uncontrolled PM-10-to-NO_x emission factor ratio by SCC, and multiply ratio by uncontrolled NO_x emissions in State/local inventory, to calculate uncontrolled PM-10 emissions. NO_x was used to calculate the ratio because: (1) the types of sources likely to be important PM-10 emitters are likely to be similar to important NO_x sources, and (2) the generally high quality of the NO_x emissions data. After calculating PM-10 emissions, the PM Calculator was used to estimate uncontrolled PM-2.5 emissions.

SO_2 and CO Augmentation: Inventory does not contain any SO_2 or CO emissions.

The procedures previously described for State/local inventories that did not contain total PM, PM-10, or PM-2.5 emissions were used to add SO_2 and CO emissions to the inventories.

NH_3 Augmentation

In addition to criteria pollutants, the NET also houses estimates of NH_3 emissions. In 1999, none of the State/local agencies submitted NH_3 emissions. As a consequence, the NH_3 emissions from the 1996 NET were added. Two steps were taken to perform this augmentation. First, plant-level total NO_x emissions were calculated for the data submitted by State/local agencies. Then plant-level summaries of NH_3 from the NET were developed. Where a match could be made using the State FIPS code, county FIPS code, and plant ID code, segment-level emissions for NH_3 were calculated using the following equation:

$$NH_3\,seg = (NO_x\,seg/NO_x\,plant) * NH_3\,plant$$

where:

where:	NH_3seg	=	segment-level NH_3 emissions added to State/local inventory
	NO_xseg	=	segment-level NO_x emissions in State/local inventory
	NO_xplant	=	plant-level NO_x emissions in State/local inventory
	NH_3plant	=	plant-level NH_3 emissions in NET inventory

To maintain the NH_3 totals currently in the NET, NH_3-only plant/segment-level records were added for those facilities that did not match plants in the State/local inventory.

In 2000, Arkansas, New Mexico, and West Virginia submitted NH_3 emissions for some point sources. For these States, the procedures for adding NH_3 emissions in the NET to the State submitted data were applied to maintain the NH_3 totals currently in the NET, with the following exceptions:

- If a State provided NH_3 emissions for a plant that matched with a plant in the 1996 NET, the NH_3 emissions for the plant in the State/local inventory replaced the plant's NH_3 emissions in the 1996 NET.

- If a State provided NH_3 emissions for a plant that could not be matched to a plant in the NET, the NH_3 emissions for the plant in the State/local inventory were maintained. This procedure resulted in adding the emissions for the plant to the State's total NH_3 emissions currently in the NET.

Louisiana provided revisions to their NH_3 emissions in the NET. Therefore, the NH_3 emissions provided by Louisiana replaced the emissions in the NET.

Augment Temporal Emissions

If daily or annual emissions (whichever) is not known, EPA calculates the emissions using equations 4.3-11 and 4.3-12 with the Summer Throughput Percentage and the Days Per Week in Operation provided in the State/local inventory.

To calculate daily from annual -

$$EMIS_{ASD} = (EMIS_{ANN} * (SUMTHRU/100)) / (13 * DPW) \qquad \text{(Eq. 4.3-11)}$$

To calculate annual from daily -

$$EMIS_{ANN} = EMIS_{ASD} / ((SUMTHRU/100) * (1/(13 * DPW))) \qquad \text{(Eq. 4.3-12)}$$

where:

$EMIS_{ANN}$	=	Annual Emissions
$EMIS_{ASD}$	=	Typical Summer Day Emissions
SUMTHRU	=	Summer Throughput Percentage
DPW	=	Days Per Week in Operation
13	=	Number of Weeks in Summer

If the State/local inventory does not contain values for Summer Throughput Percentage or the Days Per Week in Operation, then the SCC in the State/local inventory is matched with a default profile in the TAFF. If there is no profile in the TAFF for an SCC, or the SCC is missing or invalid in the State/local inventory, then daily emissions are calculated by dividing annual emissions by the number of days in the year. If only daily emissions are provided, daily emissions are multiplied by the number of days in the year to estimate annual emissions.

4.3.8.4.3.2 Stationary area sources. Table 4.3-33 lists the minimum set of the data elements EPA needs in order to add area source data into the NET. Each data element is coded "mandatory

submission" (MS) or "data can be augmented" (DA). Data elements coded MS must be supplied by the State/local agency for EPA to process the data. Data elements coded DA are elements that EPA adds to the State/local agency's data if they were not supplied by the State/local agency. Table 4.3-33 also includes a brief description of the method EPA used to augment the necessary DA data elements.

- Perform State/county/SCC-level match to current NET data. If there is a match, use emissions from current NET.

- If there is no State/county/SCC match to current NET data, develop emissions using uncontrolled emission factor ratios to calculate uncontrolled emissions. This method applies SO_2 or PM-10 ratios to NO_x. NO_x was used to calculate the ratio because: (1) the types of sources likely to be important SO_2 and PM-10 emitters are likely to be similar to important NO_x sources, and (2) the generally high quality of the NO_x emissions data. Ratios of SO_2/NO_x and PM-10/NO_x based on uncontrolled emission factors were developed. These ratios were multiplied by uncontrolled NO_x emissions to determine either uncontrolled SO_2 or PM-10 emissions.

- PM-2.5 emission estimates were developed based on the PM-10 estimates using source-specific uncontrolled particle size distributions and particle size specific control efficiencies for sources with PM-10 controls. To estimate PM-2.5, uncontrolled PM-10 was first estimated by removing the impact of any PM-10 controls on sources in the inventory. Next, the uncontrolled PM-2.5 was calculated by multiplying the uncontrolled PM-10 emission estimates by the ratio of the PM-2.5 particle size multiplier to the PM-10 particle size multiplier. (These particle size multipliers represent the percentage to total particulates below the specified size.) Finally, controls were reapplied to sources with PM-10 controls by multiplying the uncontrolled PM-2.5 by source/control device particle size specific control efficiencies.

Augment Temporal Emissions

If daily or annual emissions (whichever) is not known, EPA calculates the emissions equations 4.3-13 and 4.3-14 and EPA's default TAFF. The TAFF contains national default temporal factors by SCC.

To calculate daily from annual -

$$EMIS_{ASD} = EMIS_{ANN} * (SUMFAC * WKDYFAC) \qquad \text{(Eq. 4.3-13)}$$

To calculate annual from daily -

$$EMIS_{ANN} = EMIS_{ASD} / (SUMFAC * WKDYFAC) \qquad \text{(Eq. 4.3-14)}$$

where:
$EMIS_{ANN}$ = Annual Emissions
$EMIS_{ASD}$ = Typical Summer Day Emissions
SUMFAC = Summer Season Factor from TAFF (by SCC)
WKDYFAC = Summer Weekday Factor from TAFF (by SCC)

4.3.8.4.4 What Quality Assurance Steps Were Taken to Ensure That State/Local Data Were Incorporated Correctly? —

Quality assurance was an essential element of the data incorporation process. Extensive internal review of the data was performed to ensure that the data were retrieved and formatted correctly and that the data augmentation process was performed correctly. EPA conducted QA review of stack parameters (height, diameter, velocity, flow, temperature), location information (latitude and longitude), operating schedule (hours per day, days per week, hours per year, seasonal throughput), and emission estimates for pollutants not included in the State submittals. On-going reviews were made of the data to ensure that there were not duplicate records, that emissions values were not "out of range," and that the values for stack parameters were within normal operational values.

The most important part of the QA program was State/local agency review of the retrieved and augmented data. EPA prepared a review package for each State/local agency that submitted data. The review package consisted of a number of reports and tables showing a variety of information about the preliminary data set.

In the past, QA of the NET inventory focused almost exclusively on the emission estimates. Due to the NET's change in focus to a modeling inventory, QA of the NET was expanded to cover additional data elements including stack parameters, geographic coordinates, emission control data, and operating schedule data.

To QA stack parameters, upper and lower limits were developed for each stack parameter carried in the NET. The upper and lower limits define the acceptable range for stack parameter inputs to air quality models. The Stack Exception Report in the QA package listed stacks in the NET where one or more of the parameters was above the upper bound or below the lower bound. High and low values not corrected by the States were replaced with the corresponding upper or lower bound value. The acceptable ranges for each stack parameter are listed below:

Height	<0 ft or >1,250 ft
Diameter	<0 ft or >50 ft
Temperature	<32°F or >2,250°F
Velocity	<0 ft/sec or >98.4 ft/sec
Flow Rate	<0 ft^3/sec or >16,666 ft^3/sec

To QA geographic coordinates, maps were generated for each State showing any facilities that were located outside of their State borders when plotted using the geographic coordinates supplied by the State. For NAA inventories, any facilities located outside of the county borders were identified by plotting coordinates. Coordinates not corrected by the State/local agencies were replaced with the coordinates for the county centroid based on the State and county FIPS codes provided by the State/local agency.

4.3.8.4.5 What Did EPA Do With Comments Received From the State/Local Agencies? —

In the early review of State/local data downloaded from AIRS/FS in 1999, several agencies indicated that the emissions for their ozone precursor pollutants were not correct. The original downloads from AIRS/FS were designed to retrieve the default emissions value. However, several States indicated that they typically stored emissions data in one of the alternative emission fields. As a consequence, EPA contacted the States that submitted data to determine which States submitted emissions data in something

other than the default emissions field. Data for those States was retrieved a second time and augmented as required. The emissions for those States were re-summarized and sent back to the States for a final review.

Once comments from all of the review packages were received, modifications to the emissions or process data were made based on the State/local agency comments. Modification to the AIRS/FS data were made to reflect either new data from the additional downloads, modifications based on the review packages sent out to the State/local agencies, or based on data that remained anomalous (e.g., stack flow rates).

The State review package included a table of plants that a State/local agency did not include in its inventory, but the plants were in the 1996 NET that EPA provided to the State/local agency as a starting point for its inventory. Several States provided comments on that table indicating that: (1) some or all of these facilities should be maintained, and (2) indicating that while they should be maintained, the emissions should be modified to reflect more accurate State-supplied values. The data for these plants were extracted from the NET and maintained in a separate file. Since the review packages only provided plant totals, ratios of old to new plant emissions were used to adjust the values of each segment's emissions and then the data were updated.

4.3.8.4.6 Were There Emissions From Any Sources Submitted by State/Local Agencies That Were Not Incorporated into the NET? —

A few source categories were not updated using State/local agency data. These source categories were not updated because EPA feels that the consistent methodology and the quality of the data involved in the calculation of emissions from these categories is at or above that provided by the States. For point and area sources, State-supplied utility emissions data for segments with SCCs beginning with 101 were not retained. Section 4.2 of this document explains the methodologies used to prepare point source utility emissions data for segments with SCCs beginning with 101. Area source SCCs beginning with 2101 for utilities were not retained to avoid double counting of emissions in the point source inventory. In addition, some States submitted aggregated emissions for portable sources under a general county code 777. The emissions associated with county code 777 were not retained because they cannot be allocated to actual counties for modeling purposes.

Some of the State/local inventories contain electric utilities with SCCs for industrial or commercial/ institutional fuel combustion (i.e., starting with 201/301, 202/302, and 203/303). In one case, this resulted in double counting of emissions when the PEI data were combined with the utility emissions that EPA prepared using the procedures in section 4.2. Thus, for the update of the 1996 NET (Version 4), EPA removed industrial and commercial/institutional fuel combustion SCCs for electric utilities identified with SIC code 4911. In addition, for plants having electric utility SCCs but an SIC code other than 4911, EPA excluded the electric utility SCCs (i.e., starting with 101, 102, and 103). EPA excluded these records from the NET to avoid double counting of emissions.

4.3.9 How Were Nonutility Point and Area Source Emissions Prepared for the 1997 through 1999 NET?

To develop 1997 through 1999 emission estimates, EPA compiled a set of emission growth and control factors for each year that was applied to the 1996 NET inventory. This section explains the methods applied to prepare the growth and control factors for Versions 2, 3, and 4 of the NET inventory.

4.3.9.1 Growth Factors

Version 2 of the NET Inventory

Emissions for 1997 were first included in Version 2 of the NET inventory. Growth factors were prepared for each year using either SEDS annual fuel consumption data or BEA national earnings by industry. The 1990 through 1996 SEDS and BEA data are presented in Tables 4.3-15 and 4.3-16. The algorithm for determining the estimates is detailed in section 4.3.3.4.

Versions 3 and 4 of the NET Inventory

Point and area source emissions for 1998 and 1999 are included in Versions 3 and 4, respectively. As a result of updates to the 1996 base year inventory to incorporate State/local agency emission inventories, Version 3 includes revisions to the 1997 inventory, and Version 4 includes revisions to the 1997 and 1998 inventories. For Versions 3 and 4, the growth factors for developing 1997 through 1999 estimates for the continental United States were developed using the inputs developed for EGAS 4.0. BEA data were used to prepare growth factors for Alaska and Hawaii.

As part of the EGAS 4.0 development effort, EPA obtained more recent data/models and updated some of the underlying files in the previous version (i.e., EGAS 3.0).[32] Two of the major changes are: (1) incorporating new economic models from Regional Economic Models, Inc. (REMI); and (2) revising the crosswalk that is used to assign REMI model-derived growth factors to SCCs. The REMI models, which included 72 modeling regions in EGAS 3.0, cover the continental United States. While many modeling regions cover an entire State, some States have separate models for ozone NAAs and rest-of-state areas. For this effort, updated REMI models were available that provide historical (through 1996) and forecast (through 2035) socioeconomic data for each of 75 modeling regions in the United States (three new modeling regions were added in North Carolina).[33] As part of the revisions to the EGAS 3.0 crosswalk, EPA reviewed each of the previous SCC assignments and incorporated new assignments for over 2,600 additional SCCs.

For point sources, REMI model-derived growth factors were assigned to each unique State, county, and SIC code combination whenever SIC code information was available in the inventory. These growth factors are based on REMI projections of socioeconomic activity. For most emission sectors, REMI constant dollar output (total sales) by economic sector are used as the surrogate growth indicator. Because REMI's models provide output for 172 economic sectors, which are roughly equivalent to 3-digit SIC codes, REMI output was first directly matched to the SIC code information available from the point source component of the 1996 NET inventory. For some point source records, SIC code information was missing, available at less than a 3-digit SIC code level, or invalid (did not represent a valid SIC code). For these point source records, EPA assigned REMI model-derived growth factors to SCCs using the revised EGAS crosswalk.

The 1996 area source inventory does not contain SIC code information. Thus, REMI model-derived growth factors were assigned to each unique State/county/SCC combination in the inventory using the revised EGAS crosswalk.

Because the REMI models do not include Alaska and Hawaii, a different source of projections data were used for these States. The BEA released a set of gross State product (GSP) projections in 1995.[34] These projections, which are generally available at a 2-digit SIC code level, were used to develop growth factors for Alaska and Hawaii. The BEA-derived growth factors were first matched with point sources in the inventory at the 2-digit SIC code level. For point sources with missing/invalid SIC code information, and for all area sources, EPA matched BEA data with emission sources using an updated EGAS crosswalk matching BEA sectors with SCCs.

EGAS includes several models that project energy consumption by sector and fuel type (e.g., residential natural gas consumption). The revisions to the energy consumption modules in EGAS were not completed when Versions 2, 3, and 4 of the NET inventory were prepared. Because the revisions incorporate the use of Department of Energy (DOE) energy projections data, EPA compiled the DOE's forecast data for use in adjusting the REMI/BEA data for projected changes in energy intensity.[35] Specifically, the EPA calculated the following national energy intensity factors for 1996, 1997, 1998, and 1999:

- Residential fuel combustion - projected delivered energy by fuel type divided by projected residential floor space;

- Commercial/institutional fuel combustion - projected delivered energy by fuel type divided by projected commercial floor space; and

- Industrial fuel combustion - projected delivered energy by fuel type for both specific industries (e.g., refining industry) and for total industrial fuel use divided by projected constant dollar industrial output (specific industry or total industrial output).

Next, EPA calculated the ratios of national 1996 energy intensity to the national 1997, 1998, and 1999 energy intensity for each sector/fuel type (each sector/fuel type combination has a different SCC in the point and area source inventories). The energy intensity ratios were then applied to the growth factors for each fuel combustion SCC. For industrial natural gas consumption, for example, EPA developed 1996:1997, 1996:1998, and 1996:1999 ratios of industrial natural gas consumption per constant dollar of industrial output. These ratios were then used to adjust the EGAS modeling region-specific REMI/BEA output-based industrial fuel consumption growth factors. Note that in the point source inventory, fuel combustion sources (e.g., industrial boilers) may burn more than one fuel type (identified by a different SCC for each fuel type) within a year. Although the same REMI-derived growth factor would be assigned to each SCC, the source may have different composite growth factors resulting from applying a different fuel-specific energy intensity factor to the growth factor for each SCC.

4.3.9.2 Control Factors

For VOC emissions, controls were applied for several maximum achievable control technology (MACT) sources. Table 4.3-32 presents the SCCs and the MACT control efficiencies applied for 1997, 1998, and 1999 for point and area sources. The control efficiencies were applied in Versions 2, 3, and 4 of the NET inventory. If a source category was subject to MACT in either 1997, 1998, or 1999, the 1996 control efficiency for that source was compared with the control efficiency that the MACT control would have on VOC. If the 1996 control efficiency was greater than or equal to the MACT control efficiency, then the data was maintained at the 1996 level. If the 1996 control efficiency was lower than the MACT control efficiency, then uncontrolled emissions were back-calculated using the 1996 control efficiency and then controlled emissions were calculated from the uncontrolled levels using the MACT control efficiency. The MACT control efficiency value was also inserted into the data base field for control efficiency. It was assumed that the MACT controls operated for the entire year, even if they were not scheduled to come on-line until the middle to latter part of the year.

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Table 4.3-1. Methods for Developing Annual Emission Estimates for Industrial Nonutility Point and Area Sources for the Years 1985-1999

For the years	For the pollutant(s)	EPA estimated emissions by
1985-1989	VOC, NO_x, CO, SO_2, PM-10	Backcasting 1990 Interim Inventory Emissions with historical Bureau of Economic Analysis (BEA) earnings data or fuel consumption data from the State Energy Data System (SEDS).
1990 (Interim Inventory)	VOC, NO_x, CO, SO_2, PM-10	Projecting 1985 National Acid Precipitation Assessment Program (NAPAP) emissions to 1990 and revising the 1990 emissions to: (1) update VOC emission factors for Stage I and II vehicle refueling; (2) revise point source emissions for hazardous waste treatment, storage, and disposal facilities and closing of a copper smelter; (3) revise petroleum refinery area source fugitive emissions; (4) apply VOC controls to Stage I and II vehicle refueling and gasoline bulk plants and terminals where required by State implementation plans; (5) update point source control efficiencies for VOC, NO_x, CO, and SO_2 where judged to be too high in NAPAP; (6) apply rule effectiveness assumptions to VOC, NO_x, and CO emissions; and (7) add PM-10 emissions calculated from total suspended particulate emissions.
1990 (NET)	VOC, NO_x, CO, SO_2, PM-10, PM-2.5, NH_3	Combining State/local agency data from the Ozone Transport Assessment Group (OTAG) emission inventory, the Grand Canyon Visibility Transport Commission (GCVTC) emission inventory, and Aerometric Information Retrieval System/Facility Subsystem (AIRS/FS). Filled data gaps with information from the 1990 Interim Inventory, and added PM-2.5 and NH_3 emissions.
1991-1996	VOC, NO_x, CO, SO_2, PM-10, PM-2.5, NH_3	Projecting 1990 NET emissions to the appropriate year using BEA or SEDS data, and replacing projected emissions with data from OTAG, GCVTC, or AIRS/FS, as directed by State/local agencies.
1996	VOC, NO_x, CO, SO_2, PM-10, PM-2.5, NH_3	Updating projected emissions with data received from State/local agencies or State/local agency data downloaded from AIRS/FS.
1997-1999	VOC, NO_x, CO, SO_2, PM-10, PM-2.5, NH_3	Projecting through 1999 based on the 1996 emissions using growth factors derived from the Economic Growth Analysis System (EGAS) and BEA growth factors, where applicable.

Table 4.3-2. SCCs With 100 Percent CO Rule Effectiveness

SCC	Process
30300801	Primary Metals Production - Iron Production - Blast Furnaces
30300913	Primary Metals Production -Steel Production - Basic Oxygen Furnace: Open Hood-Stack
30300914	Primary Metals Production -Steel Production - Basic Oxygen Furnace: Closed Hood-Stack
30500401	Mineral Products - Calcium Carbide - Electric Furnace (Hoods and Main Stack)
30600201	Petroleum Industry - Fluid Catalytic Cracking Units
31000205	Oil and Gas Production - Natural Gas Production - Flares
31000299	Oil and Gas Production - Natural Gas Production - Other Not Classified
39000689	In-Process Fuel Use - Natural Gas - General
39000797	In-Process Fuel Use - Process Gas - General

Table 4.3-3. July RVPs Used to Model Motor Vehicle Emission Factors

State	State Reid Vapor Pressure (psi)				
	1987	1988	1989	1990	1991
AL	10.8	10.9	8.9	8.5	8.5
AZ	8.6	8.3	8.2	8.1	8.2
AR	10.2	9.8	9.4	8.7	8.5
CA	8.6	8.5	8.4	8.1	8.2
CO	9.7	9.4	8.7	8.3	8.4
CT	10.9	11.0	8.6	8.3	8.3
DE	11.3	10.8	9.2	8.4	8.3
DC	11.0	10.8	9.1	8.2	8.1
FL	10.2	10.5	9.0	9.1	9.1
GA	10.5	10.7	8.6	8.5	8.3
ID	10.1	9.9	9.5	9.1	9.4
IL	11.1	10.6	9.5	8.6	8.8
IN	11.6	11.1	9.6	8.7	9.0
IA	10.5	10.3	9.7	9.6	9.8
KS	9.8	9.6	9.1	8.5	8.6
KY	11.3	10.9	9.5	8.7	8.8
LA	10.4	11.0	8.6	8.3	8.4
ME	10.8	11.0	8.6	8.3	8.3
MD	11.2	10.8	9.1	8.3	8.2
MA	10.8	11.0	8.6	8.3	8.3
MI	11.7	11.0	9.8	9.1	9.3
MN	10.5	10.3	9.7	9.6	9.8
MS	10.2	9.8	9.4	8.7	8.5
MO	10.0	9.7	9.3	8.6	8.6
MT	9.3	9.5	9.3	8.6	9.2
NE	10.2	9.9	9.4	9.1	9.2
NV	8.6	8.5	8.3	8.2	8.3
NH	10.8	11.0	8.6	8.3	8.3
NJ	11.3	10.9	9.0	8.4	8.3
NM	9.0	8.5	8.2	8.1	8.1
NY	11.2	11.0	8.7	8.3	8.4
NC	10.5	10.7	8.6	8.5	8.3
ND	10.5	10.3	9.7	9.6	9.8
OH	11.6	11.4	9.8	9.6	9.7
OK	9.9	9.7	8.7	8.2	8.4
OR	9.7	9.4	9.1	8.9	9.0
PA	11.4	10.9	9.3	8.6	8.5
RI	10.8	11.0	8.6	8.3	8.3
SC	10.5	10.7	8.6	8.5	8.3
SD	10.5	10.3	9.7	9.6	9.8
TN	10.4	10.5	8.8	8.5	8.3
TX	9.8	9.6	8.4	8.0	8.2
UT	9.7	9.4	8.7	8.3	8.4
VT	10.8	11.0	8.6	8.3	8.3
VA	10.9	10.8	9.0	8.3	8.1
WA	10.8	10.2	9.7	9.6	9.7
WV	11.4	11.2	9.6	9.1	9.1
WI	11.4	10.9	9.6	8.8	9.0
WY	9.5	9.4	9.0	8.4	8.8

Source: Developed from July MVMA Fuel Volatility Surveys

Table 4.3-4. 1990 Seasonal RVP (psi) by State

State	Winter	Spring	Summer	Fall
AL	12.8	10.3	9.1	9.7
AZ	10.1	8.5	8.1	8.3
AR	13.4	10.7	8.7	10.9
CA	12.3	10.1	8.1	8.7
CO	11.5	9.6	8.5	9.3
CT	13.2	10.2	8.3	10.2
DE	13.9	10.5	8.4	9.4
DC	12.2	9.1	8.2	9.1
FL	11.9	9.1	9.1	9.1
GA	12.5	10.2	9.1	9.6
ID	12.5	10.5	9.1	9.5
IL	13.7	10.5	8.6	9.6
IN	13.8	10.6	8.7	9.7
IA	13.4	11.2	10.0	11.2
KS	12.5	9.5	8.5	9.0
KY	12.9	9.6	8.7	9.6
LA	12.2	10.0	8.9	9.4
ME	13.1	10.1	8.3	10.1
MD	13.4	10.2	8.3	9.3
MA	13.1	10.1	8.3	10.1
MI	13.8	10.9	9.1	10.9
MN	13.4	11.0	9.6	10.3
MS	13.4	10.7	9.4	10.0
MO	12.4	10.7	8.6	10.2
MT	13.1	10.1	8.6	10.1
NE	13.0	10.5	9.1	9.5
NV	10.9	8.8	8.2	8.5
NH	13.1	10.1	8.3	10.1
NJ	13.8	10.5	8.4	10.5
NM	11.6	9.0	8.1	9.3
NY	13.4	10.2	8.3	10.2
NC	12.5	11.0	9.1	10.4
ND	13.4	11.8	9.6	10.9
OH	13.9	11.2	9.6	10.4
OK	13.1	9.6	8.2	8.9
OR	12.4	10.4	8.8	9.6
PA	13.9	10.6	8.6	10.6
RI	13.1	10.1	8.3	10.1
SC	12.5	11.0	9.1	10.4
SD	13.0	10.9	9.6	10.0
TN	12.7	11.1	9.1	10.5
TX	12.4	9.9	8.0	8.6
UT	11.5	10.0	8.5	9.3
VT	13.1	10.1	8.3	10.1
VA	12.1	9.1	8.2	9.1
WA	13.6	11.1	9.6	10.4
WV	13.5	10.8	9.1	9.9
WI	13.7	10.7	8.8	9.7
WY	12.2	9.8	8.4	8.8

Source: Based on RVPs from the January and July MVMA Fuel Volatility Surveys interpolated to spring and fall.

Table 4.3-5. Seasonal Maximum and Minimum Temperatures (°F) by State

	Winter		Spring		Summer		Fall	
State	Min	Max	Min	Max	Min	Max	Min	Max
AL	42	62	57	78	72	91	58	79
AK	20	31	32	46	46	63	36	47
AZ	41	67	54	83	76	103	59	86
AR	32	53	50	73	70	92	51	75
CA	45	61	50	67	59	78	54	73
CO	18	45	34	61	56	85	37	66
CT	19	36	38	59	60	83	42	63
DE	25	42	42	62	64	84	47	66
DC	29	45	47	66	68	86	51	69
FL	52	72	62	77	73	89	65	82
GA	34	54	50	72	68	87	52	73
HI	66	81	69	83	73	87	71	86
ID	25	40	37	61	56	86	39	64
IL	17	33	39	59	62	83	43	63
IN	21	37	41	62	63	84	44	65
IA	15	31	39	59	64	84	42	63
KS	23	44	44	67	68	91	47	69
KY	27	44	45	66	66	86	47	68
LA	44	64	59	78	73	90	60	79
ME	14	33	33	52	55	76	38	59
MD	26	43	43	64	65	85	47	68
MA	25	38	41	56	63	79	48	62
MI	14	30	33	53	55	77	39	57
MN	5	24	32	51	56	78	36	54
MS	36	59	53	77	70	92	53	78
MO	22	40	44	65	66	87	52	67
MT	14	33	31	54	52	80	35	58
NE	15	35	40	62	64	86	42	65
NV	21	47	31	64	45	87	31	69
NH	12	33	32	56	54	80	36	60
NJ	25	43	41	61	62	82	46	66
NM	24	49	40	70	62	91	43	71
NY	21	36	39	57	61	81	45	62
NC	32	54	48	72	67	88	51	73
ND	1	23	30	53	54	82	31	57
OH	22	38	40	61	61	82	44	64
OK	28	50	48	71	69	91	50	73
OR	35	47	42	61	55	77	45	64
PA	24	39	41	61	62	83	45	65
RI	22	38	38	57	61	80	44	63
SC	34	58	51	76	69	91	52	76
SD	7	27	34	56	59	84	36	60
TN	31	50	50	71	69	89	51	73
TX	37	61	54	78	71	95	55	79
UT	22	40	37	62	58	89	40	66
VT	11	28	33	52	56	78	39	57
VA	31	49	47	68	67	86	51	71
WA	30	42	39	57	53	76	41	59
WV	26	44	43	66	62	84	45	67
WI	15	29	35	53	59	78	41	59
WY	17	40	30	54	52	80	34	60

U.S. NOAA "Climatology of the United States", 1982[12].

Table 4.3-6. Average Annual Service Station Stage II VOC Emission Factors

Year	Emission Factor grams/gallon	Emission Factor lbs/1,000 gallons
1985	4.6	10.0
1986	4.6	10.0
1987	4.6	10.0
1988	4.6	10.0
1989	3.9	8.5
1990	3.6	8.0
1991	3.6	8.0
1992	3.6	8.0
1993	3.6	8.0

Table 4.3-7. TSDF Area Source Emissions Removed from the Inventory (1985-1996)

State		County		VOC Annual Emissions
48	Texas	071	Chambers	372,295
45	South Carolina	005	Allendale	364,227
54	West Virginia	073	Pleasants	252,128
22	Louisiana	047	Iberville	100,299
13	Georgia	051	Chatham	84,327
54	West Virginia	079	Putnum	60,568
48	Texas	039	Brazoria	59,951
01	Alabama	129	Washington	49,296

Table 4.3-8. Bureau of Economic Analysis's SA-5 National Changes in Earnings by Industry

Industry	SIC	Percent Growth from: 1985 to 1987	1987 to 1988	1988 to 1989	1989 to 1990
				14.58	-3.11
Farm	01, 02	14.67	-2.73		
Agricultural services, forestry, fisheries, and other	07, 08, 09	23.58	5.43	1.01	2.48
Coal mining	11, 12	-17.46	-6.37	-4.16	4.73
Metal mining	10	-3.03	18.01	8.94	4.56
Nonmetallic minerals, except fuels	14	2.33	3.74	-2.79	-0.45
Construction	15, 16, 17	7.27	4.81	-1.36	-3.80
Food and kindred products	20	1.67	1.34	-1.20	-0.24
Textile mill products	22	8.50	-0.64	-1.39	-4.97
Apparel and other textile products	23	-1.72	1.25	-1.62	-4.22
Paper and allied products	26	2.62	0.94	-0.14	-0.39
Printing and publishing	27	7.44	5.67	-0.81	0.43
Chemicals and allied products	28	1.75	6.94	0.32	1.61
Petroleum and coal products	29	-10.82	-3.22	-3.02	1.06
Tobacco manufactures	21	-1.97	2.43	-2.43	-5.01
Rubber and miscellaneous plastic products	30	5.27	5.51	0.68	-0.14
Leather and leather products	31	-9.39	-1.64	-3.58	-2.55
Lumber and wood products	24	10.03	5.15	-3.54	-3.71
Furniture and fixtures	25	6.82	2.35	-1.46	-2.98
Primary metal industries	33	-9.09	5.32	-0.34	-3.03
Fabricated metal products	34	-4.72	2.55	-0.86	-1.91
Machinery, except electrical	35	-5.72	6.02	-0.32	-1.92
Electric and electronic equipment	36	-3.17	-18.01	-1.91	-3.22
Transportation equipment, excluding motor vehicles	37	8.44	-1.57	0.55	-1.07
Motor vehicles and equipment	371	-6.45	2.20	-2.96	-5.43
Stone, clay, and glass products	32	-0.23	-1.61	-1.96	-3.19
Instruments and related products	38	-0.04	60.65	-0.82	-2.91
Miscellaneous manufacturing industries	39	1.84	6.92	-2.21	-2.54
Railroad transportation	40	-14.13	-2.53	-3.83	-6.03
Trucking and warehousing	42	5.63	3.26	-0.20	0.99
Water transportation	44	-8.92	0.07	-1.02	2.83
Local and interurban passenger transit	41	13.45	0.51	2.14	1.44
Transportation by air	45	12.01	4.63	4.94	4.36
Pipelines, except natural gas	46	-5.21	3.67	-4.93	3.53
Transportation services	47	15.92	8.52	4.60	4.97
Communication	48	1.94	0.68	-2.81	2.07
Electric, gas, and sanitary services	49	0.07	3.05	0.63	0.39

Table 4.3-9. Area Source Growth Indicators

NAPAP SCC	Category Description	Data Source	Growth Indicator
13	Industrial Fuel - Anthracite Coal	SEDS	Ind - Anthracite
14	Industrial Fuel - Bituminous Coal	SEDS	Ind - Bituminous
15	Industrial Fuel - Coke	BEA	Total Manufacturing
16	Industrial Fuel - Distillate Oil	SEDS	Ind - Distillate oil
17	Industrial Fuel - Residual Oil	SEDS	Ind - Residual oil
18	Industrial Fuel - Natural Gas	SEDS	Ind - Natural gas
19	Industrial Fuel - Wood	BEA	Total Manufacturing
20	Industrial Fuel - Process Gas	SEDS	Ind - LPG
21	On-Site Incineration - Residential	BEA	Population
22	On-Site Incineration - Industrial	BEA	Total Manufacturing
23	On-Site Incineration-Commercial/Institutional	BEA	Services
24	Open Burning - Residential	BEA	Population
25	Open Burning - Industrial	BEA	Total Manufacturing
26	Open Burning - Commercial/Institutional	BEA	Services
54	Gasoline Marketed	SEDS	Trans - Motor gasoline
63	Frost Control - Orchard Heaters	BEA	Farm
99	Minor Point Sources	BEA	Population
100	Publicly Owned Treatment Works	BEA	Electric, Gas, and Sanitary Services
102	Fugitive Emissions From Synthetic Organic Chemical Manufacturing	BEA	Mfg - Chemicals and Allied Products
103	Bulk Terminal and Bulk Plants	BEA	Trucking and Warehousing
104	Fugitive Emissions From Petroleum Refinery		Refinery operating cap
105	Process Emissions From Bakeries	BEA	Mfg - Food and Kindred Products
106	Process Emissions From Pharmaceutical Manufacturing	BEA	Mfg - Chemicals and Allied Products
107	Process Emissions From Synthetic Fiber Manufacturing	BEA	Mfg - Textile Mill Products
108	Crude Oil and Natural Gas Production Fields	BEA	Oil and Gas Extraction
109	Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDFs)	BEA	Total Manufacturing

Table 4.3-10. SEDS National Fuel Consumption

Category	1985	1986	1987	1988	1989	1990
Anthracite Coal (thousand short tons)						
Industrial	575	470	437	434	392	387
Bituminous Coal (thousand short tons)						
Industrial	115,854	111,119	111,695	117,729	117,112	118,322
Distillate Fuel (thousand barrels)						
Industrial	203,659	206,108	210,699	209,553	197,035	205,856
Liquefied Petroleum Gases (thousand barrels)						
Industrial	437,964	411,451	447,120	453,599	441,784	457,013
Motor Gasoline (thousand barrels)						
Transportation	2,433,592	2,507,936	2,570,047	2,627,331	2,617,450	2,703,666
All Sectors	2,493,361	2,567,436	2,630,089	2,685,145	2,674,669	2,760,414
Natural Gas (million cubic feet)						
Industrial	6,867	6,502	7,103	7,479	7,887	8,120
Residual Fuel (thousand barrels)						
Industrial	120,002	132,249	107,116	105,448	95,646	118,122

Table 4.3-11. AMS to NAPAP Source Category Correspondence

AMS		NAPAP	
SCC	**Category**	**SCC**	**Category**
Stationary Source Fuel Combustion			
2102001000	Industrial - Anthracite Coal (Total: All Boiler Types)	13	Industrial Fuel - Anthracite Coal
2102002000	Industrial - Bituminous/Subbituminous Coal (Total: All Boiler Types)	14	Industrial Fuel - Bituminous Coal
2102004000	Industrial - Distillate Oil (Total: Boilers & IC Engines)	16	Industrial Fuel - Distillate Oil
2102005000	Industrial - Residual Oil (Total: All Boiler Types)	17	Industrial Fuel - Residual Oil
2102006000	Industrial - Natural Gas (Total: Boilers & IC Engines)	18	Industrial Fuel - Natural Gas
2102008000	Industrial - Wood (Total: All Boiler Types)	19	Industrial Fuel - Wood
2102009000	Industrial - Coke (Total: All Boiler Types)	15	Industrial Fuel - Coke
2102010000	Industrial - Process Gas (Total: All Boiler Types)	20	Industrial Fuel - Process Gas
Industrial Processes			
2301020000	Process Emissions from Pharmaceuticals (PECHAN)	106	Process Emissions from Pharmaceutical Manufacturing
2301030000	Process Emissions from Synthetic Fiber (PECHAN)	107	Process Emissions from Synthetic Fibers Manufacturing
2301040000	SOCMI Fugitives (PECHAN)	102	Fugitive Emissions From Synthetic Organic Chemical Manufacturing
2302050000	Food & Kindred Products: SIC 20 - Bakery Products (Total)	105	Process Emissions From Bakeries
2306000000	Petroleum Refining: SIC 29 - All Processes (Total)	104	Fugitive Emissions From Petroleum Refinery Operations
2310000000	Oil & Gas Production: SIC 13 - All Processes (Total)	108	Crude Oil and Natural Gas Production Fields
2399000000	Industrial Processes: NEC	99	Minor point sources
Storage & Transport			
2501050120	Petroleum & Petroleum Product Storage - Bulk Stations/Terminals: Breathing Loss (Gasoline)	103	Bulk Terminal and Bulk Plants
2501060050	Petroleum & Petroleum Product Storage - Gasoline Service Stations (Stage I: Total)	54	Gasoline Marketed (Stage I)
2501060100	Petroleum & Petroleum Product Storage - Gasoline Service Stations (Stage II: Total)	54	Gasoline Marketed (Stage II)
2501060201	Petroleum & Petroleum Product Storage - Gasoline Service Stations (Underground Tank: Breathing & Emptying)	54	Gasoline Marketed (Breathing & Emptying) (continued)

Table 4.3-11 (continued)

AMS		NAPAP	
SCC	**Category**	**SCC**	**Category**
Waste Disposal, Treatment, & Recovery			
2601010000	On-Site Incineration - Industrial (Total)	22	On-Site Incineration - Industrial
2601020000	On-Site Incineration - Commercial/Institutional (Total)	23	On-Site Incineration - Commercial/Institutional
2601030000	On-Site Incineration - Residential (Total)	21	On-Site Incineration - Residential
2610010000	Open Burning - Industrial (Total)	25	Open Burning - Industrial
2610020000	Open Burning - Commercial/Institutional (Total)	26	Open Burning - Commercial/Institutional
2610030000	Open Burning - Residential (Total)	24	Open Burning - Residential
2630020000	Wastewater Treatment - Public Owned (Total)	100	Publicly-Owned Treatment Works (POTWs)
2640000000	TSDFs - All TSDF Types (Total: All Processes)	109	Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)

Table 4.3-12. Point Source Data Submitted by OTAG States

State	Data Source/Format	Temporal Resolution	Year of Data	Adjustments to Data
Alabama	AIRS/FS - Ad hoc retrievals	Annual	1994	Backcast to 1990 using BEA. Average Summer Day estimated using methodology described above.
Arkansas	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using default temporal factors.
Connecticut	State - EPS Workfile	Daily	1990	None
Delaware	State - EPS Workfile	Daily	1990	None
District of Columbia	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Florida	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Georgia - Atlanta Urban Airshed (47 counties) domain	State - State format	Daily	1990	None
Georgia - Rest of State	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using default temporal factors.
Illinois	State - EPS Workfiles	Daily	1990	None
Indiana	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Kansas	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Kentucky - Jefferson County	Jefferson County - EPS Workfile	Daily	1990	None
Kentucky - Rest of State	State - EPS Workfile	Daily	1990	None
Louisiana	State - State Format	Annual	1990	Average Summer Day estimated using methodology described above.
Maine	State - EPS Workfile	Daily	1990	None
Maryland	State - EPS Workfile	Daily	1990	None
Massachusetts	State - EPS Workfile	Daily	1990	None
Michigan	State - State Format	Annual	1990	Average Summer Day estimated using methodology described above.
Minnesota	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Missouri	AIRS/FS - Ad hoc retrievals	Annual	1993	Backcast to 1990 using BEA. Average Summer Day estimated using methodology described above.
Nebraska	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
New Hampshire	State - EPS Workfile	Daily	1990	None
New Jersey	State - EPS Workfile	Daily	1990	None
New York	State - EPS Workfile	Daily	1990	None
North Carolina	State - EPS Workfiles	Daily	1990	None
North Dakota	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Ohio	State - State Format	Annual	1990	Average Summer Day estimated using methodology described above.
Oklahoma	State - State Format	Annual	1994	Backcast to 1990 using BEA. Average Summer Day estimated using methodology described above.
Pennsylvania - Allegheny County	Allegheny County - County Format	Daily	1990	None
Pennsylvania - Philadelphia County	Philadelphia County - County Format	Daily	1990	None
Pennsylvania - Rest of State	State - EPS Workfile	Daily	1990	None
Rhode Island	State - EPS Workfile	Daily	1990	None
South Carolina	AIRS/FS - Ad hoc retrievals	Annual	1991	Average Summer Day estimated using default temporal factors.
South Dakota	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.

Table 4.3-12 (continued)

State	Data Source/Format	Temporal Resolution	Year of Data	Adjustments to Data
Tennessee	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using default temporal factors.
Texas	State - State Format	Daily	1992	Backcast to 1990 using BEA.
Vermont	State - EPS Workfile	Daily	1990	None
Virginia	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
West Virginia	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Wisconsin	State - State Format	Daily	1990	None

Table 4.3-13. Area Source Data Submitted by OTAG States

State	Data Source/Format[1]	Temporal Resolution	Geographic Coverage	Adjustments to Data
Connecticut	State - EPS Workfile	Daily	Entire State	None
Delaware	State - EPS Workfile	Daily	Entire State	None
District of Columbia	State - Hard copy	Daily	Entire State	None
Florida	AIRS/AMS - Ad hoc retrievals	Daily	Jacksonville, Miami/ Ft. Lauderdale, Tampa	Added Non-road emission estimates from Int. Inventory to Jacksonville (Duval County)
Georgia	State - State format	Daily	Atlanta Urban Airshed (47 Counties)	None
Illinois	State - State format	Daily	Entire State	None
Indiana	State - State format	Daily	Entire State	Non-road emissions submitted were county totals. Non-road emissions distributed to specific SCCs based on Int. Inventory
Kentucky	State - State Format	Daily	Kentucky Ozone Nonattainment Areas	None
Louisiana	State - State Format	Daily	Baton Rouge Nonattainment Area (20 Parishes)	None
Maine	State - EPS Workfile	Daily	Entire State	None
Maryland	State - EPS Workfile	Daily	Entire State	None
Michigan	State - State Format	Daily	49 Southern Michigan Counties	None
Missouri	AIRS/AMS- Ad hoc retrievals	Daily	St. Louis area (25 counties)	Only area source combustion data was provided. All other area source data came from Int. Inventory
New Hampshire	State - EPS Workfile	Daily	Entire State	None
New Jersey	State - EPS Workfile	Daily	Entire State	None
New York	State - EPS Workfile	Daily	Entire State	None
North Carolina	State - EPS Workfiles	Annual	Entire State	Average Summer Day estimated using default temporal factors.
Ohio	State - Hard copy	Daily	Canton, Cleveland Columbus, Dayton, Toledo, and Youngstown	Assigned SCCs and converted from kgs to tons. NO_x and CO from Int. Inventory added to Canton, Dayton, and Toledo counties.
Pennsylvania	State - EPS Workfile	Daily	Entire State	Non-road emissions submitted were county totals. Non-road emissions distributed to specific SCCs based on Int. Inventory
Rhode Island	State - EPS Workfile	Daily	Entire State	None
Tennessee	State - State format	Daily	42 Counties in Middle Tennessee	No non-road data submitted. Non-road emissions added from Int. Inventory
Texas	State - State Format	Annual	Entire State	Average Summer Day estimated using default temporal factors.
Vermont	State - EPS Workfile	Daily	Entire State	None
Virginia	State - EPS Workfile	Daily	Entire State	None
West Virginia	AIRS/AMS - Ad hoc retrievals	Daily	Charleston, Huntington/Ashland, and Parkersburg (5 counties total)	None
Wisconsin	State - State Format	Daily	Entire State	None

[1] AIRS/AMS = AIRS Area and Mobile Subsystem.

Table 4.3-14. Ad Hoc Report

Criteria		Plant Output		Point Output		Stack Output		Segment Output General		Segment Output Pollutant	
Regn	GT 0	YINV	YEAR OF INVENTORY	STTE	STATE FIPS CODE	STTE	STATE FIPS CODE	STTE	STATE FIPS CODE	STTE	STATE FIPS CODE
PLL4	CE VOC	STTE	STATE FIPS CODE	CNTY	COUNTY FIPS CODE	CNTY	COUNTY FIPS CODE	CNTY	COUNTY FIPS CODE	CNTY	COUNTY FIPS CODE
PLL4	CE CO	CNTY	COUNTY FIPS CODE	PNED	NEDS POINT ID	PNED	NEDS POINT ID	PNED	NEDS POINT ID	PNED	NEDS POINT ID
PLL4	CE SO2	CYCD	CITY CODE	PNUM	POINT NUMBER	STNB	STACK NUMBER	STNB	STACK NUMBER	STNB	STACK NUMBER
PLL4	CE NO2	ZIPC	ZIP CODE	CAPC	DESIGN CAPACITY	LAT2	LATITUDE STACK	PNUM	POINT NUMBER	PNUM	POINT NUMBER
PLL4	CE PM-10	PNED	NEDS POINT ID	CAPU	DESIGN CAPACITY UNITS	LON2	LONGITUDE STACK	SEGN	SEGMENT NUMBER	SEGN	SEGMENT NUMBER
PLL4	CE PT	PNME	PLANT NAME	PAT1	WINTER THROUGHPUT	STHT	STACK HEIGHT	SCC8	SCC	SCC8	SCC
DES4	GE 0	LAT1	LATITUDE PLANT	PAT2	SPRING THROUGHPUT	STDM	STACK DIAMETER	HEAT	HEAT CONTENT	PLL4	POLLUTANT CODE
DUE4	ME TY	LON1	LONGITUDE PLANT	PAT3	SUMMER THROUGHPUT	STET	STACK EXIT TEMPERATURE	FPRT	ANNUAL FUEL THROUGHPUT	D034	OSD EMISSIONS
YINV	ME 90	SIC1	STANDARD INDUSTRIAL CODE	PAT4	FALL THROUGHPUT	STEV	STACK EXIT VELOCITY	SULF	SULFUR CONTENT	DU04	OSD EMISSION UNITS
		OPST	OPERATING STATUS	NOHD	NUMBER HOURS/DAY	STFR	STACK FLOW RATE	ASHC	ASH CONTENT	DES4	DEFAULT ESTIMATED EMISSIONS
		STRS	STATE REGISTRATION NUMBER	NODW	NUMBER DAYS/WEEK	PLHT	PLUME HEIGHT	PODP	PEAK OZONE SEASON DAILY PROCESS RATE	DUE4	DEFAULT ESTIMATED EMISSIONS UNITS
				NOHY	NUMBER HOURS/YEAR					CLEE	CONTROL EFFICIENCY
										CLT1	PRIMARY CONTROL DEVICE CODE
										CTL2	SECONDARY CONTROL DEVICE CODE
										REP4	RULE EFFECTIVENESS
										DME4	METHOD CODE
										Emfa	Emission factor

Table 4.3-15. SEDS National Fuel Consumption, 1990-1996 (trillion Btu)

Fuel Type	End-User	Code	1990	1991	1992	1993	1994	1995	1996
Anthracite Coal									
	Commercial	ACCCB	12	11	11	11	11	11	11
	Electric utility	ACEUB	17	16	17	16	15	15	15
	Industrial	ACICB	10	8	7	11	10	10	10
	Residential	ACRCB	19	17	17	16	16	16	16
Bituminous Coal									
	Commercial	BCCCB	80	72	75	72	70	69	68
	Electric utility	BCEUB	16,071	15,997	16,175	16,825	16,995	17,164	17,333
	Industrial	BCICB	2,744	2,592	2,505	2,489	2,434	2,379	2,333
	Residential	BCRCB	43	39	40	40	40	39	39
Distillate Fuel									
	Commercial	DFCCB	487	482	464	464	450	435	422
	Industrial	DFICB	1,181	1,139	1,144	1,100	1,090	1,080	1,071
	Residential	DFRCB	837	832	865	913	887	862	836
	Total	DFTCB	6,422	6,210	6,351	6,466	6,417	6,368	6,319
Distillate Fuel including Kerosene jet fuel									
	Electric utility	DKEUB	86	80	67	77	64	58	54
Kerosene									
	Commercial	KSCCB	12	12	11	14	13	12	11
	Industrial	KSICB	12	11	10	13	10	9	9
	Residential	KSRCB	64	72	65	76	67	59	51
	Total	KSTCB	88	96	86	103	89	76	65
Liquid Petroleum Gas									
	Commercial	LGCCB	64	69	67	70	70	70	70
	Industrial	LGICB	1,608	1,749	1,860	1,794	1,804	1,813	1,823
	Residential	LGRCB	365	389	382	399	398	397	397
	Total	LGTCB	2,059	2,227	2,328	2,282	2,290	2,298	2,306
Natural Gas									
	Commercial	NGCCB	2,698	2,808	2,884	2,996	3,035	3,074	3,114
	Electric utility	NGEUB	2,861	2,854	2,829	2,744	2,720	2,698	2,675
	Industrial	NGICB	8,520	8,637	8,996	9,387	9,635	9,883	10,131
	Residential	NGRCB	4,519	4,685	4,821	5,097	5,132	5,166	5,201
	Total	NGTCB	19,280	19,605	20,139	20,868	21,164	21,461	21,757
Residual Fuel									
	Commercial	RFCCB	233	213	191	175	170	168	167
	Electric utility	RFEUB	1,139	1,076	854	939	823	726	650
	Industrial	RFICB	417	336	391	452	459	469	481
	Total	RFTCB	2,820	2,657	2,518	2,479	2,346	2,213	2,080
Population									
		TPOPP	248,709	252,131	255,025	257,785	259,693	261,602	263,510

Table 4.3-16. BEA SA-5 National Earnings by Industry, 1990-1996 (million $)

Industry	LNUM	SIC	1990	1991	1992	1993	1994	1995	1996
Total population as of July 1 (thousands)	020	999	0	0	0	0	0	0	0
Total population as of July 1 (thousands)	030	999	1	1	1	1	1	1	1
Total population as of July 1 (thousands)	040	999	3,634	3,593	3,732	3,785	3,891	4,011	4,086
Total population as of July 1 (thousands)	041	999	238	242	248	253	265	273	280
Total population as of July 1 (thousands)	045	999	3,395	3,350	3,483	3,531	3,626	3,737	3,805
Total population as of July 1 (thousands)	046	999	971	947	907	914	934	980	981
Total population as of July 1 (thousands)	047	999	735	791	858	888	912	951	994
Total population as of July 1 (thousands)	050	999	2,932	2,891	2,975	3,003	3,082	3,182	3,231
Total population as of July 1 (thousands)	060	999	321	331	351	371	383	394	408
Total population as of July 1 (thousands)	070	999	381	370	405	410	426	436	447
Total population as of July 1 (thousands)	071	999	34	28	34	32	29	18	16
Total population as of July 1 (thousands)	072	999	347	342	372	378	396	418	432
Farm	081	1, 2	48	41	46	45	42	31	29
Farm	082	1, 2	3,586	3,552	3,686	3,740	3,849	3,980	4,058
Farm	090	1, 2	3,001	2,957	3,079	3,126	3,228	3,353	3,423
Agricultural services, forestry, fisheries, and other	100	7-9	24	24	24	24	26	27	27
Agricultural services, forestry, fisheries, and other	110	7-9	20	20	21	22	23	24	25
Agricultural services, forestry, fisheries, and other	120	7-9	4	3	3	3	3	3	3
Agricultural services, forestry, fisheries, and other	121	7-9	1	1	1	0	1	1	1
Agricultural services, forestry, fisheries, and other	122	7-9	2	2	2	2	2	2	1
Agricultural services, forestry, fisheries, and other	123	7-9	1	1	1	1	1	1	1
Agricultural services, forestry, fisheries, and other	200	7-9	36	37	36	34	35	35	35
Metal mining	210	10	2	3	3	2	2	2	3
Coal mining	220	11, 12	8	8	8	6	6	6	6
Oil and gas extraction	230	13	20	22	21	21	21	21	21
Nonmetallic minerals, except fuels	240	14	4	4	4	4	4	4	4
Construction	300	15-17	218	197	195	199	216	219	219
Construction	310	15-17	54	47	46	47	51	51	50
Construction	320	15-17	29	28	28	27	29	29	29
Construction	330	15-17	135	123	121	125	136	138	139
Manufacturing	400	998	710	690	705	705	725	740	747
Durable goods	410	996	437	418	423	424	440	452	456
Lumber and wood products	413	24	22	21	22	22	24	25	25
Furniture and fixtures	417	25	13	12	13	13	14	14	14
Stone, clay, and glass products	420	32	20	18	19	19	20	20	20
Primary metal industries	423	33	33	30	31	30	32	33	32
Fabricated metal products	426	34	51	48	49	49	51	53	53
Machinery, except electrical	429	35	86	83	83	84	86	90	91
Electric and electronic equipment	432	36	63	62	62	63	65	68	69
Motor vehicles and equipment	435	371	41	38	42	46	53	56	60
Transportation equipment, excluding motor vehicles	438	37	54	52	50	45	43	42	39
Instruments and related products	441	38	43	42	42	40	40	40	39
Miscellaneous manufacturing industries	444	39	11	11	11	12	12	12	12
Nondurable goods	450	997	273	272	281	282	285	288	291
Food and kindred products	453	20	51	51	52	52	53	53	54
Tobacco manufactures	456	21	3	3	3	2	2	3	3
Textile mill products	459	22	16	16	17	17	17	17	17
Apparel and other textile products	462	23	20	20	20	19	19	19	19
Paper and allied products	465	26	28	27	28	28	29	29	29
Printing and publishing	468	27	54	54	55	56	57	58	59
Chemicals and allied products	471	28	61	63	66	65	65	67	68
Petroleum and coal products	474	29	9	9	10	9	10	9	9
Rubber and miscellaneous plastic products	477	30	27	26	28	29	30	31	31
Leather and leather products	480	31	3	3	2	3	3	2	2

Table 4.3-16 (continued)

Industry	LNUM	SIC	1990	1991	1992	1993	1994	1995	1996
Leather and leather products	500	31	243	245	251	260	269	277	283
Railroad transportation	510	40	12	12	13	12	12	12	12
Trucking and warehousing	520	42	59	58	60	62	66	69	71
Water transportation	530	44	7	7	7	6	6	6	6
Water transportation	540	44	48	49	50	51	50	52	53
Local and interurban passenger transit	541	41	8	8	9	9	9	10	10
Transportation by air	542	45	30	30	31	31	31	31	31
Pipelines, except natural gas	543	46	1	1	1	1	1	1	1
Transportation services	544	47	12	13	14	14	15	16	17
Communication	560	48	63	63	64	67	71	75	78
Electric, gas, and sanitary services	570	49	49	52	53	56	56	56	57
Wholesale trade	610	50, 51	236	231	238	235	242	255	258
Retail trade	620	52-59	342	335	342	347	359	372	378
Retail trade	621	52-59	18	18	18	19	20	21	21
Retail trade	622	52-59	40	38	39	39	40	41	41
Retail trade	623	52-59	56	56	57	56	57	58	58
Retail trade	624	52-59	55	54	54	56	60	62	64
Retail trade	625	52-59	18	18	18	18	18	18	18
Retail trade	626	52-59	22	20	19	19	21	22	22
Retail trade	627	52-59	76	78	80	82	85	88	90
Retail trade	628	52-59	57	54	57	57	59	62	63
Retail trade	700	52-59	246	247	280	290	291	302	313
Banking and credit agencies	710	60, 61	82	81	86	89	89	90	91
Banking and credit agencies	730	60, 61	163	166	194	201	202	212	221
Banking and credit agencies	731	60, 61	38	40	50	53	51	55	58
Insurance	732	63, 64	56	59	61	62	63	63	65
Insurance	733	63, 64	34	33	33	34	36	37	38
Real estate	734	65, 66	28	25	36	43	44	47	51
Holding companies and investment services	736	62, 67	8	10	14	10	9	10	10
Services	800	995	946	951	1,008	1,032	1,066	1,128	1,164
Hotels and other lodging places	805	70	31	31	32	33	33	35	36
Personal services	810	72	33	32	33	36	36	36	37
Private households	815	88	10	9	10	10	10	11	11
Business and miscellaneous repair services	820	76	170	162	175	180	191	213	221
Auto repair, services, and garages	825	75	29	28	28	30	31	33	34
Auto repair, services, and garages	830	75	15	13	13	14	14	15	15
Amusement and recreation services	835	78, 79	29	30	34	33	35	37	39
Amusement and recreation services	840	78, 79	16	16	16	17	18	20	20
Health services	845	80	290	304	325	330	341	355	368
Legal services	850	81	80	80	85	84	84	85	86
Educational services	855	82	39	41	42	44	45	46	48
Social services and membership organizations	860	83, 86	29	31	34	35	38	40	42
Social services and membership organizations	865	83, 86	1	1	1	1	2	2	2
Social services and membership organizations	870	83, 86	35	36	36	38	40	41	42
Social services and membership organizations	875	83, 86	125	121	127	130	132	141	145
Miscellaneous professional services	880	84, 87, 89	14	14	15	15	17	18	19
Government and government enterprises	900	995	585	594	607	613	621	626	635
Federal, civilian	910	43, 91, 97	118	120	123	124	125	123	124
Federal, military	920	992	50	50	51	48	45	44	43
State and local	930	92-96	417	425	433	441	451	459	468
State and local	931	92-96	125	128	128	130	134	136	138
State and local	932	92-96	292	297	305	311	317	323	330

Table 4.3-17. Area Source Listing by SCC and Growth Basis

SCC	FILE	CODE *	SCC	FILE	CODE	SCC	FILE	CODE	SCC	FILE	CODE	SCC	FILE	CODE
2101002000	SEDS	ACEUB	2199005000	SEDS	RFTCB	2260008010	BEA	542	2265004035	SEDS	TPOPP	2270002015	BEA	300
2101004001	SEDS	DKEUB	2199006000	SEDS	NGTCB	2265000000	SEDS	TPOPP	2265004040	SEDS	TPOPP	2270002018	BEA	300
2101004002	SEDS	DKEUB	2199007000	SEDS	LGTCB	2265001000	SEDS	TPOPP	2265004045	SEDS	TPOPP	2270002021	BEA	300
2101006001	SEDS	NGEUB	2199011000	SEDS	KSTCB	2265001010	SEDS	TPOPP	2265004050	SEDS	TPOPP	2270002027	BEA	300
2101006002	SEDS	NGEUB	2260000000	SEDS	TPOPP	2265001030	SEDS	TPOPP	2265004055	SEDS	TPOPP	2270002030	BEA	300
2102001000	SEDS	ACICB	2260001000	SEDS	TPOPP	2265001040	SEDS	TPOPP	2265004060	SEDS	TPOPP	2270002033	BEA	300
2102002000	SEDS	BCICB	2260001010	SEDS	TPOPP	2265001050	SEDS	TPOPP	2265004065	SEDS	TPOPP	2270002036	BEA	300
2102004000	SEDS	DFICB	2260001020	SEDS	TPOPP	2265001060	SEDS	TPOPP	2265004070	SEDS	TPOPP	2270002039	BEA	300
2102005000	SEDS	RFICB	2260001030	SEDS	TPOPP	2265002000	BEA	300	2265004075	SEDS	TPOPP	2270002042	BEA	300
2102006000	SEDS	NGICB	2260001050	SEDS	TPOPP	2265002003	BEA	300	2265005000	BEA	81	2270002045	BEA	300
2102006001	SEDS	NGICB	2260001060	SEDS	TPOPP	2265002006	BEA	300	2265005010	BEA	81	2270002048	BEA	300
2102006002	SEDS	NGICB	2260002000	BEA	300	2265002009	BEA	300	2265005015	BEA	81	2270002051	BEA	300
2102007000	SEDS	LGICB	2260002006	BEA	300	2265002015	BEA	300	2265005020	BEA	81	2270002054	BEA	300
2102008000	BEA	400	2260002009	BEA	300	2265002021	BEA	300	2265005030	BEA	81	2270002057	BEA	300
2102010000	SEDS	LGICB	2260002021	BEA	300	2265002024	BEA	300	2265005035	BEA	81	2270002060	BEA	300
2102011000	SEDS	KSICB	2260002033	BEA	300	2265002027	BEA	300	2265005040	BEA	81	2270002063	BEA	300
2103001000	SEDS	ACCCB	2260003000	BEA	400	2265002030	BEA	300	2265005045	BEA	81	2270002066	BEA	300
2103002000	SEDS	BCCCB	2260003010	BEA	400	2265002033	BEA	300	2265005050	BEA	81	2270002069	BEA	300
2103004000	SEDS	DFCCB	2260003020	BEA	400	2265002039	BEA	300	2265005055	BEA	81	2270002072	BEA	300
2103005000	SEDS	RFCCB	2260003030	BEA	400	2265002042	BEA	300	2265006000	BEA	400	2270002075	BEA	300
2103006000	SEDS	NGCCB	2260003040	BEA	400	2265002045	BEA	300	2265006005	BEA	400	2270002078	BEA	300
2103007000	SEDS	LGCCB	2260004000	SEDS	TPOPP	2265002054	BEA	300	2265006010	BEA	400	2270002081	BEA	300
2103008000	BEA	400	2260004010	SEDS	TPOPP	2265002057	BEA	300	2265006015	BEA	400	2270003000	BEA	400
2103011000	SEDS	KSCCB	2260004015	SEDS	TPOPP	2265002060	BEA	300	2265006025	BEA	400	2270003010	BEA	400
2104001000	SEDS	ACRCB	2260004020	SEDS	TPOPP	2265002066	BEA	300	2265006030	BEA	400	2270003020	BEA	400
2104002000	SEDS	BCRCB	2260004025	SEDS	TPOPP	2265002072	BEA	300	2265007000	BEA	100	2270003030	BEA	400
2104004000	SEDS	DFRCB	2260004030	SEDS	TPOPP	2265002078	BEA	300	2265007010	BEA	100	2270003040	BEA	400
2104005000	NG		2260004035	SEDS	TPOPP	2265002081	BEA	300	2265008000	BEA	542	2270003050	BEA	400
2104006000	SEDS	NGRCB	2260004050	SEDS	TPOPP	2265003000	BEA	400	2265008005	BEA	542	2270004000	SEDS	TPOPP
2104007000	SEDS	LGRCB	2260004075	SEDS	TPOPP	2265003010	BEA	400	2265008010	BEA	542	2270004010	SEDS	TPOPP
2104008000	SEDS	TPOPP	2260005000	BEA	81	2265003020	BEA	400	2270000000	SEDS	TPOPP	2270004040	SEDS	TPOPP
2104008001	SEDS	TPOPP	2260006000	BEA	400	2265003030	BEA	400	2270001000	SEDS	TPOPP	2270004055	SEDS	TPOPP
2104008010	SEDS	TPOPP	2260006005	BEA	400	2265003040	BEA	400	2270001010	SEDS	TPOPP	2270004060	SEDS	TPOPP
2104008030	SEDS	TPOPP	2260006010	BEA	400	2265003050	BEA	400	2270001050	SEDS	TPOPP	2270004065	SEDS	TPOPP
2104008050	SEDS	TPOPP	2260006015	BEA	400	2265004000	SEDS	TPOPP	2270001060	SEDS	TPOPP	2270004070	SEDS	TPOPP
2104008051	SEDS	TPOPP	2260006020	BEA	400	2265004010	SEDS	TPOPP	2270002000	BEA	300	2270004075	SEDS	TPOPP
2104011000	SEDS	KSRCB	2260007000	BEA	100	2265004015	SEDS	TPOPP	2270002003	BEA	300	2270005000	BEA	81
2110030000	NG		2260007005	BEA	100	2265004025	SEDS	TPOPP	2270002009	BEA	300	2270005015	BEA	81

Table 4.3-17 (continued)

SCC	FILE	CODE *	SCC	FILE	CODE	SCC	FILE	CODE	SCC	FILE	CODE	SCC	FILE	CODE
2199004000	SEDS	DFTCB	2260008000	BEA	542	2265004030	SEDS	TPOPP	2270002012	BEA	300	2270005020	BEA	81
2270005025	BEA	81	2282005000	SEDS	TPOPP	2306010000	BEA	474	2401990000	BEA	400	2420010055	SEDS	TPOPP
2270005035	BEA	81	2282005010	SEDS	TPOPP	2308000000	BEA	477	2415000000	BEA	400	2420010370	SEDS	TPOPP
2270005045	BEA	81	2282005015	SEDS	TPOPP	2309000000	BEA	426	2415000385	BEA	400	2420010999	SEDS	TPOPP
2270005050	BEA	81	2282005025	SEDS	TPOPP	2309100230	BEA	426	2415000999	BEA	400	2420020000	SEDS	TPOPP
2270005055	BEA	81	2282010000	SEDS	TPOPP	2310000000	BEA	230	2415035000	BEA	438	2420020055	SEDS	TPOPP
2270006000	BEA	400	2282010005	SEDS	TPOPP	2310010000	BEA	230	2415045000	BEA	444	2425000000	BEA	820
2270006005	BEA	400	2282010010	SEDS	TPOPP	2310020000	BEA	230	2415065000	BEA	413	2425000999	BEA	820
2270006010	BEA	400	2282010015	SEDS	TPOPP	2312000000	BEA	429	2415100000	BEA	400	2425010000	BEA	820
2270006015	BEA	400	2282010020	SEDS	TPOPP	2325030000	BEA	210	2415105000	BEA	417	2425030000	BEA	820
2270006025	BEA	400	2282010025	SEDS	TPOPP	2390004000	BEA	400	2415110000	BEA	423	2425040000	BEA	820
2270006030	BEA	400	2282020000	SEDS	TPOPP	2390005000	BEA	400	2415120000	BEA	426	2430000000	BEA	477
2270007000	BEA	100	2282020005	SEDS	TPOPP	2390006000	BEA	400	2415125000	BEA	429	2440000000	BEA	444
2270007015	BEA	100	2282020010	SEDS	TPOPP	2390007000	BEA	400	2415130000	BEA	432	2440000999	BEA	444
2270007020	BEA	100	2282020020	SEDS	TPOPP	2390010000	BEA	400	2415135000	BEA	438	2440020000	BEA	444
2270008000	BEA	542	2282020025	SEDS	TPOPP	2399000000	BEA	400	2415140000	BEA	441	2460000000	SEDS	TPOPP
2270008005	BEA	542	2283002000	BEA	920	2401000000	SEDS	TPOPP	2415145000	BEA	444	2460000385	SEDS	TPOPP
2270008010	BEA	542	2285000000	BEA	510	2401001000	SEDS	TPOPP	2415200000	BEA	438	2461000000	BEA	300
2275000000	BEA	542	2285002000	BEA	510	2401002000	NG		2415230000	BEA	432	2461020000	BEA	300
2275001000	BEA	920	2285002005	BEA	510	2401005000	BEA	825	2415245000	BEA	444	2461021000	BEA	300
2275020000	BEA	542	2285002010	BEA	510	2401008000	SEDS	TPOPP	2415260000	BEA	825	2461022000	BEA	300
2275020021	BEA	542	2301000000	BEA	471	2401015000	BEA	413	2415300000	BEA	438	2461023000	BEA	300
2275050000	BEA	542	2301010000	BEA	471	2401020000	BEA	417	2415305000	BEA	417	2461050000	BEA	300
2275060000	BEA	542	2301020000	BEA	471	2401025000	BEA	417	2415310000	BEA	423	2461160000	BEA	300
2275070000	BEA	542	2301030000	BEA	471	2401030000	BEA	465	2415315000	BEA	423	2461600000	BEA	300
2275900000	BEA	542	2301040000	BEA	471	2401035000	BEA	477	2415320000	BEA	426	2461800000	BEA	300
2275900101	BEA	542	2302000000	BEA	453	2401040000	BEA	426	2415325000	BEA	429	2461850000	BEA	300
2275900102	BEA	542	2302002000	BEA	453	2401045000	BEA	426	2415330000	BEA	432	2465000000	SEDS	TPOPP
2280000000	BEA	530	2302010000	BEA	453	2401045999	BEA	426	2415335000	BEA	438	2465100000	SEDS	TPOPP
2280001000	BEA	530	2302050000	BEA	453	2401050000	BEA	426	2415340000	BEA	441	2465200000	SEDS	TPOPP
2280002000	BEA	530	2302070000	BEA	453	2401055000	BEA	429	2415345000	BEA	444	2465400000	SEDS	TPOPP
2280002010	BEA	530	2302070001	BEA	453	2401060000	BEA	432	2415350000	BEA	510	2465600000	SEDS	TPOPP
2280002020	BEA	530	2302070005	BEA	453	2401065000	BEA	432	2415355000	BEA	620	2465800000	SEDS	TPOPP
2280002040	BEA	530	2302070010	BEA	453	2401070000	BEA	435	2415360000	BEA	825	2465900000	SEDS	TPOPP
2280003000	BEA	530	2303020000	BEA	423	2401075000	BEA	438	2415365000	BEA	820	2500000000	NG	
2280003010	BEA	530	2304000000	BEA	423	2401080000	BEA	438	2420000000	SEDS	TPOPP	2501000000	BEA	230
2280003020	BEA	530	2304050000	BEA	423	2401085000	BEA	438	2420000055	SEDS	TPOPP	2501000030	BEA	230
2280003030	BEA	530	2305000000	BEA	240	2401090000	BEA	444	2420000370	SEDS	TPOPP	2501000090	BEA	230
2280004020	BEA	530	2305070000	BEA	240	2401100000	BEA	400	2420000999	SEDS	TPOPP	2501000150	BEA	230
2282000000	SEDS	TPOPP	2306000000	BEA	474	2401200000	BEA	400	2420010000	SEDS	TPOPP	2501010000	BEA	230
2501050000	BEA	610	2501995000	BEA	230	2601020000	BEA	570	2810015000	SEDS	TPOPP	2495000000	SEDS	TPOPP

Table 4.3-17 (continued)

SCC	FILE	CODE *	SCC	FILE	CODE	SCC	FILE	CODE	SCC	FILE	CODE	SCC	FILE	CODE
2501050030	BEA	610	2501995030	BEA	230	2601030000	BEA	570	2810025000	SEDS	TPOPP	2505010000	BEA	474
2501050060	BEA	610	2501995060	BEA	230	2610000000	BEA	570	2810030000	SEDS	TPOPP	2710020030	BEA	81
2501050090	BEA	610	2501995090	BEA	230	2610010000	BEA	570	2810035000	SEDS	TPOPP	2730050000	NG	
2501050120	BEA	610	2501995120	BEA	230	2610020000	BEA	570	2810050000	SEDS	TPOPP	2730100000	NG	
2501050150	BEA	610	2501995150	BEA	230	2610030000	SEDS	TPOPP	2810060000	SEDS	TPOPP	2801000003	BEA	81
2501050180	BEA	610	2501995180	BEA	230	2620000000	BEA	570	2830000000	NG		2801520000	BEA	81
2501060000	BEA	620	2505000000	BEA	474	2620030000	BEA	570	2830001000	NG		2801700001	BEA	81
2501060050	BEA	620	2505000120	BEA	474	2630000000	BEA	570	2850000010	NG		2801700002	BEA	81
2501060051	BEA	620	2505010120	BEA	474	2630010000	BEA	570	2102009000	BEA	400	2801700003	BEA	81
2501060052	BEA	620	2505020000	BEA	474	2630020000	BEA	570	2275085000	BEA	542	2801700004	BEA	81
2501060053	BEA	620	2505020030	BEA	474	2630030000	BEA	570	2280004000	BEA	530	2801700005	BEA	81
2501060100	BEA	620	2505020060	BEA	474	2640000000	BEA	570	2294000000	NG		2801700006	BEA	81
2501060101	BEA	620	2505020090	BEA	474	2640000001	BEA	570	2296000000	NG		2801700007	BEA	81
2501060102	BEA	620	2505020120	BEA	474	2640000004	BEA	570	2302080000	BEA	453	2801700008	BEA	81
2501060103	BEA	620	2505020150	BEA	474	2640010001	BEA	570	2307060000	BEA	413	2801700009	BEA	81
2501060200	BEA	620	2505020180	BEA	474	2640010004	BEA	570	2309100010	BEA	426	2801700010	BEA	81
2501060201	BEA	620	2505020900	BEA	474	2660000000	BEA	570	2310030000	BEA	230	2805000000	BEA	81
2501070000	BEA	620	2505030000	BEA	474	2801000005	BEA	100	2311000100	NG		2805001000	BEA	81
2501070051	BEA	620	2505030120	BEA	474	2801500000	BEA	100	2325000000	NG		2805020000	BEA	81
2501070052	BEA	620	2510000000	BEA	471	2810001000	NG		2401010000	BEA	459	2805025000	BEA	81
2501070101	BEA	620	2510995000	BEA	471	2810003000	SEDS	TPOPP	2415045999	BEA	400	2805030000	BEA	81
2501070103	BEA	620	2601000000	BEA	570	2810005000	BEA	100	2415060000	BEA	400	2805040000	BEA	81
2501070201	BEA	620	2601010000	BEA	570	2810010000	BEA	100	2461800999	SEDS	TPOPP	2805045001	BEA	81

NOTE(S): * BEA Code is equal to LNUM on previous table.

Table 4.3-18. Emission Estimates Available from AIRS/FS by State, Year, and Pollutant

State	1990						1991						1992						1993						1994						1995					
	C	N	S	P	T	V	C	N	S	P	T	V	C	N	S	P	T	V	C	N	S	P	T	V	C	N	S	P	T	V	C	N	S	P	T	V
Alabama	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Alaska	✓	✓	✓		✓	✓													✓	✓	✓		✓	✓	✓	✓	✓		✓	✓						
Arizona	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
California	✓	✓	✓	✓	✓	✓													✓						✓	✓		✓	✓	✓						
Colorado	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Connecticut	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓
Hawaii	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Illinois	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Louisiana	✓	✓	✓		✓	✓													✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓						
Michigan	✓	✓	✓	✓	✓	✓													✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓
Minnesota	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Montana	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Nebraska	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
Nevada	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
New Hampshire	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
New Mexico	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
North Dakota	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓
Oregon	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pennsylvania	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
South Carolina																			✓	✓	✓		✓	✓												
South Dakota		✓	✓	✓	✓	✓		✓	✓	✓		✓		✓	✓	✓		✓		✓	✓	✓		✓		✓	✓	✓		✓		✓	✓	✓		✓
Texas	✓	✓	✓	✓	✓	✓													✓	✓	✓	✓	✓	✓							✓	✓	✓	✓		✓
Utah	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓		✓	✓		✓	✓		✓	✓		✓
Vermont	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Virginia	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Washington	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Wisconsin	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
Wyoming	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes: C = CO N = NO_2 S = SO_2 P = PM-10 T = TSP V = VOC

Pennsylvania only includes Allegheny County (State 42, County 003); New Mexico only includes Albuquerque (State 35, County 001); Washington only includes Puget Sound (State 53, County 033, 053, or 061); Nebraska includes all except Omaha City (State 31, County 055); the CO emissions in NET were maintained for South Dakota (State 46).

Table 4.3-19. NO_x and VOC Major Stationary Source Definition

Ozone Nonattainment Status	Major Stationary Source (tons)
Marginal/Moderate	100
Serious	50
Severe	25
Extreme	10
Ozone Transport Region	50

Table 4.3-20. Summary of Revised NO_x Control Efficiencies

Pod ID	Pod Name	Estimated Efficiency	Control	Reference
55	Industrial Process Heat	74	ULNB	ACT (EPA,1993d)
58	Commercial/Institutional - Coal	50	LNB	ACT (EPA,1993e)
59	Commercial/Institutional - Oil	50	LNB	ACT (EPA,1993e)
60	Commercial/Institutional - Gas	50	LNB	ACT (EPA,1993e)
70	Industrial Oil Fired Turbines	70	WI	ACT (EPA,1993f)
71	Industrial Oil Fired Reciprocating Engines	25	IR	ACT (EPA,1993g)
72	Industrial Gas Fired Turbines	84	LNB	ACT (EPA,1993f)
73	Industrial Gas Fired Reciprocating Engines	30	AF + IR	ACT (EPA,1993g)
74	Utility Oil Fired Turbines	70	WI	ACT (EPA,1993f)
75	Utility Oil Fired Reciprocating Engines	25	IR	ACT (EPA,1993g)
76	Utility Gas Fired Turbines	84	LNB	ACT (EPA,1993f)
77	Utility Gas Fired Reciprocating Engines	30	AF + IR	ACT (EPA,1993g)
84	Industrial External Combustion - Coal	50	LNB	ACT (EPA,1993e)
85	Industrial External Combustion - Oil - < 100 MMBtu/hr	50	LNB	ACT (EPA,1993e)
86	Industrial External Combustion - Oil -Cogeneration	50	LNB	ACT (EPA,1993e)
87	Industrial External Combustion - Oil -General	50	LNB	ACT (EPA,1993e)
88	Industrial External Combustion - Gas - < 100 MMBtu/hr	50	LNB	ACT (EPA,1993e)
89	Industrial External Combustion - Gas - Cogeneration	50	LNB	ACT (EPA,1993e)
90	Industrial External Combustion - Gas - General	50	LNB	ACT (EPA,1993e)

Controls:
AF - Air/Fuel Adjustment
IR - Ignition Time Retardation
LNB - Low NO_x Burner
ULNB - Ultra-low NO_x Burner
WI - Water Injection

Table 4.3-21. Cotton Ginning Emission Factors[22]

Control Type	Total PM (lb/bale)	PM-10 (lb/bale)	PM-2.5 (lb/bale)
Full controls (high-efficiency cyclone)	2.4	0.82	0.024
Conventional controls (screened drums or cages)	3.1	1.2	0.031

Table 4.3-22. Estimated Percentage of Crop By Emission Control Method (By State and U.S. Average)[29]

State	Percent Crop - Full Controls	Percent Crop - Conventional Controls
Alabama	20	80
Arizona	50	50
Arkansas	30	70
California	72	28
Florida	20	80
Georgia	30	70
Louisiana	20	80
Mississippi	20	80
Missouri	20	80
New Mexico	20	80
North Carolina	30	70
Oklahoma	20	80
South Carolina	20	80
Tennessee	20	80
Texas	30	70
Virginia	20	80
U.S. Average[a]	**35**	**65**

[a]Average is based on the average crop (average total bales ginned per year) from 1991 to 1995 for these States.

Table 4.3-23. Cotton Ginnings: Running Bales Ginned By County, District, State, and United States[a]

State/County/ District	Running Bales Ginned	State/County/ District	Running Bales Ginned
UNITED STATES	17,498,800		
Alabama		Alabama (Cont'd)	
Colbert 1/	*12,000*	Baldwin 1/	*30,575*
Lauderdale 1/	*12,000*	Escambia1/	*30,575*
Lawrence	35,200	Mobile 1/	*30,575*
Limestone	59,300	Monroe 1/	*30,575*
Madison	25,750		
		District 50	122,300
District 10	144,250		
		Covington 1/	*25,608*
Blount 1/	*4,538*	Crenshaw 1/	*25,608*
Cherokee 1/	*4,538*	Geneva 1/	*25,608*
		Henry 1/	*25,608*
District 20		Houston 1/	*25,608*
		Russell 1/	*25,608*
Chilton 1/	*4,538*		
Fayette 1/	*4,538*	District 60	153,650
Pickens 1/	*4,538*		
Shelby 1/	*4,538*	AL Total	491,150
Tallapoosa 1/	*4,538*		
Tuscaloosa 1/	*4,538*		
		Arizona	
District 30 2/			
		Mohave 1/	
Autauga 1/	*4,079*		
Dallas 1/	*4,079*	District 20 2/	
Elmore	6,100		
Greene 1/	*4,079*	Maricopa	354,050
Hale 1/	*4,079*	Pinal	266,900
Lowndes 1/	*4,079*		
Macon 1/	*4,079*	District 50	620,950
Marengo 1/	*4,079*		
		La Paz 1/	
District 40	34,650	Yuma	74,100

[a]The data in and format of this table were taken from the 03/25/96 *Cotton Ginnings* report.
1/ Withheld to avoid disclosing individual gins.
2/ Withheld to avoid disclosing individual gins, but included in State total.
3/ Excludes some gins' data to avoid disclosing individual gins, but included in State total.
4/ Withheld to avoid disclosing individual gins, but included in U.S. total.

Table 4.3-24. Point Source Controls by Pod and Measure

POD	PODNAME	MEASNAME	SOURCE	PTFYCE
4	Fixed roof petroleum product tanks	CTG	Fixed roof petroleum tanks	98
5	Fixed roof gasoline tanks	CTG	Fixed roof gasoline tanks	96
6	EFR petroleum product tanks	CTG	EFR petroleum tanks	90
7	EFR gasoline tanks	CTG	EFR gasoline tanks	95
15	Ethylene oxide manufacture	SOCMI HON	Ethylene oxide manufacture	79
16	Phenol manufacture	SOCMI HON	Phenol manufacture	79
17	Terephthalic acid manufacture	Incineration (RACT)	Terephthalic acid manufacture	98
	Acrylonitrile manufacture	SOCMI HON	Acrylonitrile manufacture	79
	Cellulose acetate manufacture	Carbon adsorber (RACT)	Cellulose acetate manufacture	54
23	Polypropylene manufacture	Flare (RACT)	Polypropylene manufacture	98
24	Polyethylene manufacture	Flare (RACT)	Polyethylene manufacture	98
25	Ethylene manufacture	Flare (RACT)	Ethylene manufacture	98
26	Petroleum refinery wastewater treatment	Benzene NESHAP/CTG	Petroleum ref wastewater treatment	95
27	Petroleum refinery vacuum distillation	CTG	Petroleum ref vacuum distillation	100
28	Vegetable oil manufacture	Stripper and equipment (RACT)	Vegetable oil manufacture	42
29	Paint and varnish manufacture	RACT	Paint and varnish manufacture	70
32	Carbon black manufacture	Flare (RACT)	Carbon black manufacture	90
42	Surface coating - thinning solvents	RACT	Surface coating - thinning solvents	90
47	Ferrosilicon production	RACT	Ferrosilicon production	88
48	By-product coke manufacture - other	NESHAP	By-product coke manufacture - other	94
49	By-product coke manufacture - oven charging	NESHAP	By-product coke mfg - oven charging	94
50	Coke ovens - door and topside leaks	NESHAP	Coke ovens - door and topside leaks	94
51	Coke oven by-product plants	NESHAP	Coke oven by-product plants	94
53	Whiskey fermentation - aging	Carbon adsorption (RACT)	Whiskey fermentation - aging	85
54	Charcoal manufacturing	Incineration (RACT)	Charcoal manufacturing	80
56	SOCMI reactor	New CTG	SOCMI reactor	98
57	SOCMI distillation	New CTG	SOCMI distillation	98
61	Open top degreasing	MACT	Open top degreasing	63
62	In-line degreasing	MACT	In-line degreasing	63
63	Cold cleaning	MACT	Cold cleaning	63
65	Open top degreasing - halogenated	MACT	Open top degreasing - halogenated	63
66	In-line degreasing - halogenated	MACT	In-line degreasing - halogenated	63

Table 4.3-24 (continued)

POD	PODNAME	MEASNAME	SOURCE	PTFYCE
68	SOCMI fugitives	HON - Equipment Leak and Detection	SOCMI fugitives	79
69	SOCMI wastewater	SOCMI HON	SOCMI wastewater	79
71	SOCMI processes - pharmaceutical	SOCMI HON/Pharmaceuticals	SOCMI processes - pharmaceutical	79
73	SOCMI processes - gum and wood	SOCMI reactor CTG	SOCMI processes - gum and wood	98
74	SOCMI processes - cyclic crudes	SOCMI HON	SOCMI processes - cyclic crudes	79
75	SOCMI processes - industrial chemicals	SOCMI HON	SOCMI processes - industrial chem	79
77	SOCMI processes - crudes & agricultural	SOCMI reactor CTG	SOCMI processes - crudes & agricul	98
80	SOCMI fugitives - cyclic crudes	SOCMI HON	SOCMI fugitives - cyclic crudes	79
81	SOCMI fugitives - industrial organics	SOCMI HON	SOCMI fugitives - ind organics	79
82	SOCMI - process vents	SOCMI HON	SOCMI - process vents	79
84	VOL storage	SOCMI HON	VOL storage	79
85	Misc organic solvent evaporation	SOCMI HON	Misc organic solvent evaporation	79
86	Single chamber incinerators	RACT	Single chamber incinerators	90
91	Dry cleaning - perchloroethylene	MACT	Dry cleaning - perchloroethylene	44
93	Dry cleaning - other	MACT	Dry cleaning - other	44
95	Bakeries	Incineration (RACT)	Bakeries	95
96	Urea resins - general	RACT	Urea resins - general	90
97	Organic acids manufacture	RACT	Organic acids manufacture	90
98	Leather products	RACT	Leather products	90
114	Petroleum refineries - Blowdown w/o control	RACT/CTG	Petroleum ref - blowdown	98
199	Miscellaneous non-combustion	RACT	Miscellaneous non-combustion	90
401	By-product coke mfg	Benzene NESHAP	By-product coke mfg	85
402	By-product coke - flushing-liquor circulation tank	Benzene NESHAP	By-prod coke - flush-liq circ tank	95
403	By-product coke - excess-ammonia liquor tank	Benzene NESHAP	By-prod coke - ex nh3 liquor tank	98
404	By-product coke mfg - tar storage	Benzene NESHAP	By-product coke mfg - tar storage	98
405	By-product coke mfg - light oil sump	Benzene NESHAP	By-product coke - light oil sum	98
406	By-product coke mfg - light oil dec/cond vents	Benzene NESHAP	By-prod coke - oil dec/cond vents	98
407	By-product coke mfg - tar bottom final cooler	Benzene NESHAP	By-prod coke - tar bottom cooler	81
408	By-product coke mfg - naphthalene processing	Benzene NESHAP	By-prod coke - naphtha processing	100
409	By-product coke mfg - equipment leaks	Benzene NESHAP	By-product coke - equipment leaks	83

NOTE: A pod is a group of SCCs with similar emissions and process characteristics for which common control measures (i.e., cost and emission reductions) can be applied.

Table 4.3-25. Point Source SCC to Pod Match-up

SCC	POD	SCC	POD	SCC	POD	SCC	POD	SCC	POD	SCC	POD	SCC	POD
30100101	75	30101842	70	30102630	22	30112021	56	30116780	81	30125003	82	30181001	77
30100103	17	30101847	136	30102699	22	30112099	75	30116799	75	30125004	81	30182001	69
30100104	56	30101849	143	30103101	134	30112199	56	30116901	74	30125005	56	30182002	69
30100180	81	30101852	70	30103102	134	30112480	81	30116906	74	30125010	56	30182003	69
30100199	75	30101860	24	30103103	134	30112501	75	30116980	80	30125015	56	30182004	69
30100504	32	30101861	24	30103104	134	30112502	75	30117401	15	30125020	56	30182005	69
30100509	68	30101863	24	30103105	134	30112509	81	30117421	15	30125099	56	30182006	69
30100601	54	30101864	24	30103199	134	30112510	75	30117480	15	30125101	75	30182007	69
30100603	54	30101865	24	30103301	76	30112512	82	30117617	75	30125180	81	30182008	69
30100604	54	30101866	24	30103311	76	30112514	75	30117680	75	30125201	56	30182009	69
30100699	73	30101870	136	30103312	76	30112520	75	30118101	74	30125301	75	30182010	69
30101012	116	30101872	136	30103399	78	30112524	81	30118102	74	30125302	82	30182011	69
30101013	116	30101880	136	30103402	75	30112525	75	30118103	74	30125306	82	30183001	68
30101021	116	30101881	136	30103405	82	30112526	82	30118110	74	30125315	75	30184001	57
30101022	116	30101882	136	30103406	82	30112533	75	30118180	80	30125325	75	30188801	68
30101030	116	30101885	136	30103410	75	30112534	81	30119001	74	30125326	82	30188802	68
30101099	116	30101890	104	30103412	75	30112535	75	30119013	74	30125380	81	30188803	68
30101401	29	30101891	104	30103420	75	30112540	75	30119014	74	30125401	75	30188804	68
30101402	29	30101892	104	30103425	75	30112541	75	30119080	80	30125405	18	30188805	68
30101403	29	30101893	104	30103499	75	30112547	75	30119501	75	30125406	75	30190001	88
30101404	29	30101894	104	30104204	75	30112550	81	30119580	81	30125409	81	30190002	88
30101499	29	30101899	104	30106001	71	30112599	75	30119701	25	30125413	75	30190003	88
30101501	29	30101901	74	30106002	71	30112699	75	30119705	25	30125415	75	30190004	88
30101502	29	30101902	74	30106003	71	30112701	75	30119707	75	30125420	81	30201003	53
30101503	29	30101904	74	30106004	71	30112702	75	30119708	75	30125499	56	30201401	94
30101505	29	30101907	57	30106005	71	30112730	75	30119709	75	30125801	75	30201902	28
30101599	29	30102001	29	30106006	71	30112780	81	30119710	75	30125802	75	30201903	28
30101603	145	30102002	29	30106007	71	30113201	75	30119741	75	30125803	57	30201906	28
30101801	140	30102003	29	30106008	71	30113210	75	30119742	75	30125805	75	30201907	28
30101802	23	30102004	29	30106009	71	30113221	75	30119743	75	30125807	57	30201908	28
30101803	23	30102005	29	30106010	71	30113227	75	30119744	75	30125810	75	30201911	28

Table 4.3-25 (continued)

SCC	POD	SCC	POD	SCC	POD	SCC	POD	SCC	POD	SCC	POD	SCC	POD
30101805	137	30102099	29	30106011	71	30113299	97	30119745	75	30125815	75	30201912	28
30101807	24	30102401	142	30106012	71	30113301	75	30119749	75	30125880	75	30201914	28
30101808	24	30102402	104	30106099	79	30113302	75	30119799	25	30125899	75	30201915	28
30101809	24	30102410	141	30109101	75	30113701	75	30120201	16	30130101	74	30201916	28
30101810	24	30102416	21	30109105	75	30113710	75	30120202	16	30130102	74	30201917	28
30101811	24	30102423	21	30109151	75	30113799	75	30120204	82	30130103	74	30201918	28
30101812	24	30102424	21	30109152	75	30114001	75	30120205	16	30130104	74	30201919	28
30101813	24	30102426	21	30109153	57	30114005	56	30120206	16	30130105	74	30201999	28
30101814	24	30102427	21	30109154	57	30115201	75	30120280	81	30130106	82	30203201	95
30101815	136	30102499	21	30109180	81	30115301	75	30120501	75	30130107	74	30203202	95
30101816	136	30102501	139	30109199	75	30115311	82	30120502	75	30130108	74	30203299	95
30101817	138	30102505	21	30110002	75	30115380	81	30120521	82	30130180	80	30300302	49
30101818	136	30102601	22	30110003	82	30115601	74	30120530	82	30130301	75	30300303	48
30101819	136	30102602	22	30110080	81	30115604	74	30120545	82	30130380	81	30300304	48
30101820	136	30102608	22	30110099	75	30115701	74	30120580	81	30130402	75	30300306	48
30101821	136	30102609	22	30112001	75	30115704	74	30120601	74	30130480	81	30300308	50
30101822	138	30102612	22	30112002	75	30115780	80	30120603	74	30130501	75	30300313	48
30101827	136	30102613	22	30112005	82	30115802	75	30120680	80	30130502	75	30300314	50
30101832	96	30102614	22	30112006	82	30115803	75	30121001	75	30130580	81	30300315	51
30101837	144	30102615	22	30112007	81	30115822	57	30121002	82	30180001	68	30300331	401
30101838	143	30102616	22	30112011	75	30116701	75	30121101	75	30180002	68	30300332	402
30101839	143	30102617	22	30112013	82	30116703	82	30125001	75	30180003	68	30300333	403
30101840	143	30102625	22	30112014	82	30116704	75	30125002	75	30180006	68	30300334	402
30300335	402	30600811	20	30700703	117	31000205	112	40100101	91	40188898	63	40201505	37
30300336	404	30600812	20	30700704	117	31000206	112	40100102	92	40199999	63	40201531	37
30300341	405	30600813	20	30700705	117	31000207	112	40100103	91	40200101	33	40201599	37
30300342	406	30600814	20	30700706	117	31000299	112	40100104	92	40200110	33	40201601	33
30300343	406	30600815	20	30700707	117	31000401	88	40100105	93	40200301	34	40201602	33
30300344	406	30600816	20	30700708	117	31000403	88	40100198	93	40200310	34	40201603	33
30300351	401	30600817	20	30700709	117	31000404	88	40100201	61	40200401	33	40201604	33
30300353	408	30600818	20	30700711	117	31000405	88	40100202	65	40200410	40	40201605	33
30300361	409	30600819	20	30700713	117	31088801	112	40100203	65	40200501	33	40201606	33
30300813	46	30600821	20	30700715	117	31088802	112	40100204	65	40200510	33	40201607	33

Table 4.3-25 (continued)

SCC	POD	SCC	POD	SCC	POD	SCC	POD	SCC	POD	SCC	POD	SCC	POD
30300825	46	30600903	110	30700798	117	31088803	112	40100205	65	40200601	33	40201608	33
30390003	88	30600904	110	30700799	117	31088804	112	40100206	61	40200610	33	40201609	33
30390004	88	30600905	110	30701199	36	31088805	112	40100207	65	40200701	36	40201619	33
30490001	88	30600999	110	30790001	88	32099997	98	40100221	62	40200706	36	40201620	33
30490003	88	30601001	110	30790002	88	32099998	98	40100222	66	40200707	36	40201621	33
30490004	88	30601101	110	30790003	88	32099999	98	40100223	66	40200710	36	40201622	33
30490031	88	30601201	110	30800101	30	39000201	87	40100224	66	40200801	35	40201623	33
30490033	88	30601401	110	30800102	30	39000203	87	40100225	66	40200802	35	40201625	33
30490034	88	30609902	110	30800103	30	39000289	87	40100235	62	40200803	35	40201626	33
30600101	88	30609903	110	30800104	30	39000299	87	40100236	62	40200810	35	40201627	33
30600102	88	30609904	110	30800105	30	39000402	87	40100251	61	40200898	35	40201628	33
30600103	88	30610001	110	30800106	31	39000403	87	40100252	65	40200998	33	40201629	33
30600104	88	30688801	20	30800107	30	39000489	87	40100253	65	40201001	88	40201631	33
30600105	88	30688802	20	30800108	30	39000499	87	40100254	65	40201002	88	40201632	33
30600106	88	30688803	20	30800109	30	39000501	87	40100255	65	40201003	88	40201699	33
30600107	88	30688804	20	30800120	30	39000502	87	40100256	61	40201004	88	40201702	34
30600111	88	30688805	20	30800121	30	39000503	87	40100257	65	40201101	41	40201703	34
30600201	109	30700101	60	30800122	30	39000589	87	40100258	61	40201103	41	40201704	34
30600202	109	30700102	60	30800123	31	39000598	87	40100259	61	40201105	41	40201705	34
30600204	109	30700103	60	30800197	30	39000599	87	40100275	61	40201112	41	40201721	34
30600301	109	30700104	60	30800198	30	39000602	87	40100295	62	40201113	41	40201722	34
30600401	113	30700105	60	30800199	30	39000603	87	40100296	62	40201114	41	40201723	34
30600402	114	30700106	60	30800501	30	39000605	87	40100297	61	40201115	41	40201724	34
30600503	26	30700107	60	30800699	123	39000689	87	40100298	62	40201116	41	40201725	34
30600504	26	30700108	60	30800701	123	39000699	87	40100299	61	40201199	41	40201726	34
30600505	26	30700109	60	30800702	123	39000701	87	40100301	63	40201201	41	40201727	34
30600506	26	30700110	60	30800703	123	39000702	87	40100302	63	40201210	41	40201728	34
30600508	26	30700199	60	30800704	123	39000789	87	40100303	63	40201301	36	40201731	34
30600514	26	30700203	60	30800705	123	39000797	87	40100304	63	40201303	36	40201732	34
30600516	26	30700214	60	30800720	123	39000799	87	40100305	63	40201304	36	40201734	34
30600517	26	30700215	60	30800721	123	39000801	87	40100306	61	40201305	36	40201735	34
30600519	26	30700221	60	30800722	123	39000889	87	40100307	63	40201399	36	40201799	34
30600520	26	30700222	60	30800723	123	39000899	87	40100308	63	40201401	37	40201801	37

Table 4.3-25 (continued)

SCC	POD	SCC	POD	SCC	POD	SCC	POD	SCC	POD	SCC	POD	SCC	POD
30600602	27	30700223	60	30800724	123	39000989	87	40100309	63	40201404	37	40201803	37
30600603	27	30700234	60	30800799	123	39000999	87	40100310	63	40201405	37	40201805	37
30600701	111	30700299	60	30800901	123	39001089	87	40100335	63	40201406	37	40201806	37
30600702	111	30700301	60	30901601	108	39001099	87	40100336	63	40201431	37	40201899	37
30600801	20	30700303	60	31000104	112	39001299	98	40100398	63	40201432	37	40201901	39
30600802	20	30700401	60	31000105	112	39001389	87	40100399	63	40201433	37	40201903	39
30600803	20	30700402	60	31000199	112	39001399	87	40100499	63	40201435	37	40201904	39
30600804	20	30700501	115	31000201	112	39990001	88	40100550	63	40201499	37	40201999	39
30600805	20	30700597	115	31000202	112	39990002	88	40188801	63	40201501	37	40202001	37
30600806	20	30700599	115	31000203	112	39990003	88	40188802	63	40201502	37	40202002	37
30600807	20	30700701	117	31000204	112	39990004	88	40188805	63	40201503	37	40202005	37
40202031	37	40300106	4	40301068	4	40388802	110	40400240	173	40500510	186	40600243	55
40202033	37	40300107	4	40301078	4	40388803	110	40400241	173	40500511	183	40600244	55
40202099	37	40300108	4	40301097	4	40388804	110	40400250	155	40500512	183	40600245	55
40202101	40	40300109	4	40301098	4	40388805	110	40400251	155	40500513	183	40600246	55
40202103	40	40300111	4	40301099	4	40399999	110	40400254	155	40500514	183	40600248	55
40202104	40	40300112	4	40301101	7	40400101	150	40400260	174	40500598	183	40600249	55
40202105	40	40300115	4	40301102	7	40400102	150	40400261	174	40500599	183	40600250	55
40202106	40	40300116	4	40301103	7	40400103	150	40400271	174	40500601	184	40600251	55
40202107	40	40300150	4	40301104	7	40400104	150	40400301	156	40500701	187	40600253	55
40202108	40	40300151	4	40301105	7	40400105	150	40400302	157	40500801	188	40600257	55
40202109	40	40300152	4	40301106	7	40400106	150	40400303	158	40500811	188	40600259	55
40202131	40	40300153	4	40301107	7	40400107	151	40400304	158	40500812	188	40600298	55
40202132	40	40300154	4	40301108	7	40400108	151	40400305	158	40588801	188	40600299	55
40202133	40	40300156	4	40301109	6	40400109	151	40400401	159	40588802	188	40600301	168
40202199	40	40300157	4	40301110	6	40400110	152	40400402	160	40588803	188	40600302	169
40202201	38	40300159	4	40301111	6	40400111	152	40400403	159	40588804	188	40600306	170
40202202	38	40300160	4	40301112	6	40400112	152	40400404	160	40588805	188	40600307	171
40202203	38	40300161	4	40301113	6	40400113	152	40400406	160	40600101	161	40600399	170
40202205	38	40300198	4	40301114	6	40400114	152	40400408	160	40600126	163	40700401	84
40202299	38	40300199	4	40301115	6	40400115	152	40400410	160	40600130	166	40700402	84
40202301	132	40300201	7	40301116	6	40400116	153	40400412	160	40600131	163	40700497	84
40202302	132	40300202	7	40301117	6	40400117	153	40400413	159	40600132	166	40700498	84

Table 4.3-25 (continued)

SCC	POD	SCC	POD	SCC	POD	SCC	POD	SCC	POD	SCC	POD	SCC	POD
40202305	132	40300203	6	40301118	6	40400118	154	40400414	160	40600133	166	40700801	84
40202306	132	40300204	6	40301119	6	40400119	154	40400497	159	40600134	166	40700802	84
40202399	132	40300205	6	40301120	6	40400120	154	40400498	160	40600135	166	40700803	84
40202401	52	40300207	6	40301130	6	40400130	173	40500101	189	40600136	161	40700805	84
40202402	52	40300208	6	40301131	7	40400131	173	40500199	189	40600137	164	40700806	84
40202403	52	40300209	6	40301132	6	40400140	173	40500201	180	40600138	164	40700807	84
40202405	52	40300210	6	40301133	6	40400141	173	40500202	186	40600139	164	40700808	84
40202406	52	40300212	6	40301134	6	40400150	155	40500203	186	40600140	164	40700809	84
40202499	52	40300216	6	40301135	6	40400151	155	40500211	180	40600141	162	40700810	84
40202501	37	40300299	6	40301140	8	40400152	155	40500212	180	40600143	165	40700811	84
40202502	37	40300302	6	40301141	9	40400153	155	40500299	180	40600144	165	40700812	84
40202503	37	40301001	5	40301142	8	40400154	155	40500301	181	40600145	165	40700813	84
40202504	37	40301002	5	40301143	8	40400160	174	40500303	186	40600146	165	40700814	84
40202505	37	40301003	5	40301144	8	40400161	174	40500304	186	40600147	163	40700815	84
40202531	37	40301004	5	40301145	8	40400170	174	40500305	186	40600148	166	40700816	84
40202532	37	40301005	5	40301150	8	40400171	174	40500306	186	40600149	166	40700817	84
40202533	37	40301006	5	40301151	9	40400178	174	40500307	186	40600161	166	40700818	84
40202534	37	40301007	5	40301152	8	40400199	155	40500311	181	40600162	167	40700897	84
40202537	37	40301008	5	40301153	8	40400201	150	40500312	181	40600163	167	40700898	84
40202598	37	40301009	5	40301154	8	40400202	150	40500314	181	40600197	172	40701605	84
40202599	37	40301010	4	40301155	8	40400203	150	40500401	182	40600198	172	40701606	84
40202601	37	40301011	4	40301197	6	40400204	151	40500411	182	40600199	172	40701608	84
40202605	37	40301012	4	40301198	6	40400205	151	40500412	182	40600231	55	40701611	84
40202606	37	40301013	4	40301199	6	40400206	151	40500413	182	40600232	55	40701612	84
40202607	37	40301014	4	40301201	7	40400207	152	40500414	182	40600233	55	40701613	84
40202699	37	40301015	4	40301202	7	40400208	152	40500416	182	40600234	55	40701614	84
40290013	88	40301016	4	40301203	7	40400209	152	40500418	182	40600235	55	40701697	84
40300101	5	40301017	4	40301204	6	40400210	154	40500501	183	40600236	55	40701698	84
40300102	4	40301018	4	40301205	6	40400211	154	40500502	183	40600237	55	40702003	84
40300103	5	40301019	4	40301206	6	40400212	154	40500503	186	40600238	55	40702097	84
40300104	4	40301020	4	40301299	6	40400230	173	40500506	186	40600239	55	40702098	84
40300105	4	40301021	4	40388801	110	40400231	173	40500507	186	40600240	55	40703201	84
40703202	84	40704498	84	40707698	84	40787201	84	50200301	89				

Table 4.3-25 (continued)

SCC	POD	SCC	POD	SCC	POD	SCC	POD	SCC	POD	SCC	POD	SCC	POD
40703203	84	40704801	84	40708097	84	40787299	84	50200302	89				
40703204	84	40704802	84	40708098	84	40799997	84	50200505	89				
40703205	84	40704897	84	40708401	84	40799998	84	50200506	89				
40703206	84	40704898	84	40708403	84	40899995	85	50200601	128				
40703297	84	40705203	84	40708404	84	40899997	55	50200602	128				
40703298	84	40705208	84	40708497	84	40899999	85	50290005	88				
40703601	84	40705210	84	40708498	84	49000101	85	50290006	88				
40703602	84	40705211	84	40715809	84	49000103	85	50290099	88				
40703603	84	40705213	84	40717205	84	49000105	85	50300101	89				
40703605	84	40705216	84	40717206	84	49000199	85	50300102	89				
40703606	84	40705297	84	40717207	84	49000201	85	50300103	89				
40703608	84	40705298	84	40717208	84	49000202	85	50300104	89				
40703609	84	40705603	84	40717209	84	49000203	85	50300105	89				
40703610	84	40705604	84	40717211	84	49000204	85	50300106	89				
40703613	84	40705605	84	40717297	84	49000205	85	50300201	89				
40703614	84	40705606	84	40717298	84	49000206	85	50300202	89				
40703615	84	40705607	84	40717601	84	49000299	85	50300204	89				
40703616	84	40705609	84	40717602	84	49000399	85	50300501	89				
40703617	84	40705610	84	40717603	84	49000401	85	50300506	89				
40703618	84	40705697	84	40717604	84	49000499	85	50300599	89				
40703619	84	40705698	84	40717697	84	49000501	85	50300601	128				
40703620	84	40706005	84	40717698	84	49000599	85	50300602	128				
40703622	84	40706006	84	40718097	84	49090013	85	50300603	128				
40703623	84	40706007	84	40720801	84	49090023	85	50300701	89				
40703624	84	40706008	84	40720897	84	49099998	85	50300801	129				
40703697	84	40706009	84	40720898	84	49099999	85	50300810	129				
40703698	84	40706010	84	40722001	84	50100101	89	50300820	129				
40704001	84	40706011	84	40722003	84	50100103	89	50300830	129				
40704002	84	40706012	84	40722005	84	50100201	89	50300899	129				
40704003	84	40706013	84	40722009	84	50100401	89	50390005	89				
40704004	84	40706015	84	40722010	84	50100505	89	50390006	89				
40704008	84	40706017	84	40722097	84	50100506	89	50390010	89				
40704009	84	40706018	84	40722098	84	50100507	89	62540010	138				

Table 4.3-25 (continued)

SCC	POD	SCC	POD	SCC	POD	SCC	POD	SCC	POD	SCC	POD	SCC	POD
40704097	84	40706019	84	40722801	84	50100510	89	62540020	138				
40704098	84	40706020	84	40722802	84	50100515	89	62540022	138				
40704401	84	40706021	84	40722803	84	50100516	89	64630016	138				
40704402	84	40706022	84	40722804	84	50100601	88	64630040	138				
40704403	84	40706023	84	40722805	84	50100603	89						
40704404	84	40706024	84	40722806	84	50100701	127						
40704405	84	40706097	84	40722897	84	50100702	127						
40704406	84	40706098	84	40722898	84	50100703	127						
40704407	84	40706401	84	40781602	84	50100704	127						
40704408	84	40706402	84	40781605	84	50190005	87						
40704411	84	40706403	84	40781699	84	50190006	87						
40704412	84	40706497	84	40782001	84	50200101	89						
40704414	84	40706801	84	40782003	84	50200103	89						
40704416	84	40706802	84	40782006	84	50200104	89						
40704418	84	40706814	84	40782009	84	50200105	89						
40704419	84	40706897	84	40782099	84	50200106	89						
40704420	84	40706898	84	40783203	84	50200116	89						
40704421	84	40707601	84	40784899	84	50200117	89						
40704422	84	40707602	84	40786004	84	50200201	89						
40704497	84	40707697	84	40786099	84	50200202	89						

NOTE: A pod is a group of SCCs with similar emissions and process characteristics for which common control measures (i.e., cost and emission reductions) can be applied.

Table 4.3-26. Area Source VOC Controls by SCC and Pod

POD	SCC	SOURCE	MEASURE	PCTRD96
211	2420010055	Dry Cleaning - perchloroethylene	MACT	44.0
211	2420000055	Dry Cleaning - perchloroethylene	MACT	44.0
217	2501050120	Bulk Terminals	RACT	51.0
217	2501050000	Bulk Terminals	RACT	51.0
217	2501995000	Bulk Terminals	RACT	51.0
241	2415305000	Cold cleaning	MACT	35.0
241	2415310000	Cold cleaning	MACT	35.0
241	2415320000	Cold cleaning	MACT	35.0
241	2415325000	Cold cleaning	MACT	35.0
241	2415330000	Cold cleaning	MACT	35.0
241	2415335000	Cold cleaning	MACT	35.0
241	2415340000	Cold cleaning	MACT	35.0
241	2415345000	Cold cleaning	MACT	35.0
241	2415355000	Cold cleaning	MACT	35.0
241	2415360000	Cold cleaning	MACT	35.0
241	2415365000	Cold cleaning	MACT	35.0
250	2401075000	Aircraft surface coating	MACT	0.0
251	2401080000	marine surface coating	MACT	0.0
259	2301040001	SOCMI batch reactor processes	New CTG	78.0
270	2640000000	TSDFs	Phase I & II rules	94.0
270	2640000004	TSDFs	Phase I & II rules	94.0
272	2461021000	Cutback Asphalt	Switch to emulsified (CTG)	100.0
272	2461020000	Cutback Asphalt	Switch to emulsified (CTG)	100.0
274	2301040000	SOCMI fugitives	RACT	37.0
276	2306000000	Petroleum refinery fugitives	RACT	43.0
277	2301030000	Pharmaceutical manufacture	RACT	37.0
278	2301020000	Synthetic fiber manufacture	RACT (adsorber)	54.0
279	2310000000	Oil & natural gas fields	RACT (equipment/maintenance)	37.0
279	2310010000	Oil & natural gas fields	RACT (equipment/maintenance)	37.0
279	2310020000	Oil & natural gas fields	RACT (equipment/maintenance)	37.0
279	2310030000	Oil & natural gas fields	RACT (equipment/maintenance)	37.0
280	2501060050	Service stations - stage I	Vapor balance (CTG)	95.0
281	2501060101	Service stations - stage II	Vapor balance (stage II)	70.0
281	2501060103	Service stations - stage II	Vapor balance (stage II)	70.0
283	2501060201	Service stations - underground tank	Vapor balance (stage II)	84.0
283	2501060201	Service stations - underground tank	Vapor balance (stage II)	86.0
284	2620000000	Municipal solid waste landfills	RCRA standards	82.0
284	2620030000	Municipal solid waste landfills	RCRA standards	82.0

POD_VOC	PODNAME	APPLICABLE
211	Dry Cleaning - perchloroethylene	National
217	Bulk Terminals	National
241	Cold cleaning	National
250	Aircraft surface coating	National
251	marine surface coating	National
259	SOCMI batch reactor processes	Moderate+
270	Treatment, storage and disposal facilities	National
272	Cutback Asphalt	Marginal+
274	SOCMI fugitives	National
276	Petroleum refinery fugitives	National
277	Pharmaceutical manufacture	National
278	Synthetic fiber manufacture	National
279	Oil and natural gas production fields	Moderate+
280	Service stations - stage I-truck unloading	National
284	Municipal solid waste landfills	National

NOTE: A pod is a group of SCCs with similar emissions and process characteristics for which common control measures (i.e., cost and emission reductions) can be applied.

Table 4.3-27. Counties in the United States with Stage II Programs that use Reformulated Gasoline

State		County		State		County		State		County	
6	California	19	Fresno Co	24	Maryland	510	Baltimore	42	Pennsylvania	91	Montgomery Co
6	California	29	Kern Co	25	Massachusetts	1	Barnstable Co	42	Pennsylvania	101	Philadelphia Co
6	California	37	Los Angeles Co	25	Massachusetts	3	Berkshire Co	44	Rhode Island	1	Bristol Co
6	California	55	Napa Co	25	Massachusetts	5	Bristol Co	44	Rhode Island	3	Kent Co
6	California	67	Sacramento Co	25	Massachusetts	7	Dukes Co	44	Rhode Island	5	Newport Co
6	California	73	San Diego Co	25	Massachusetts	9	Essex Co	44	Rhode Island	7	Providence Co
6	California	75	San Francisco Co	25	Massachusetts	11	Franklin Co	44	Rhode Island	9	Washington Co
9	Connecticut	1	Fairfield Co	25	Massachusetts	13	Hampden Co	48	Texas	39	Brazoria Co
9	Connecticut	3	Hartford Co	25	Massachusetts	15	Hampshire Co	48	Texas	71	Chambers Co
9	Connecticut	5	Litchfield Co	25	Massachusetts	17	Middlesex Co	48	Texas	85	Collin Co
9	Connecticut	7	Middlesex Co	25	Massachusetts	19	Nantucket Co	48	Texas	113	Dallas Co
9	Connecticut	9	New Haven Co	25	Massachusetts	21	Norfolk Co	48	Texas	121	Denton Co
9	Connecticut	11	New London Co	25	Massachusetts	23	Plymouth Co	48	Texas	157	Fort Bend Co
9	Connecticut	13	Tolland Co	25	Massachusetts	25	Suffolk Co	48	Texas	167	Galveston Co
9	Connecticut	15	Windham Co	25	Massachusetts	27	Worcester Co	48	Texas	201	Harris Co
10	Delaware	1	Kent Co	33	New Hampshire	11	Hillsborough Co	48	Texas	291	Liberty Co
10	Delaware	3	New Castle Co	33	New Hampshire	13	Merrimack Co	48	Texas	339	Montgomery Co
10	Delaware	5	Sussex Co	33	New Hampshire	15	Rockingham Co	48	Texas	439	Tarrant Co
11	Dist. Columbia	1	Washington	33	New Hampshire	17	Strafford Co	48	Texas	473	Waller Co
17	Illinois	31	Cook Co	34	New Jersey	1	Atlantic Co	51	Virginia	13	Arlington Co
17	Illinois	43	Du Page Co	34	New Jersey	3	Bergen Co	51	Virginia	36	Charles City Co
17	Illinois	63	Grundy Co	34	New Jersey	5	Burlington Co	51	Virginia	41	Chesterfield Co
17	Illinois	89	Kane Co	34	New Jersey	7	Camden Co	51	Virginia	85	Hanover Co
17	Illinois	93	Kendall Co	34	New Jersey	9	Cape May Co	51	Virginia	87	Henrico Co
17	Illinois	97	Lake Co	34	New Jersey	11	Cumberland Co	51	Virginia	95	James City Co
17	Illinois	111	McHenry Co	34	New Jersey	13	Essex Co	51	Virginia	107	Loudoun Co
17	Illinois	197	Will Co	34	New Jersey	15	Gloucester Co	51	Virginia	153	Prince William Co
18	Indiana	89	Lake Co	34	New Jersey	17	Hudson Co	51	Virginia	159	Richmond Co
18	Indiana	127	Porter Co	34	New Jersey	19	Hunterdon Co	51	Virginia	179	Stafford Co
21	Kentucky	15	Boone Co	34	New Jersey	21	Mercer Co	51	Virginia	199	York Co
21	Kentucky	29	Bullitt Co	34	New Jersey	23	Middlesex Co	51	Virginia	510	Alexandria
21	Kentucky	37	Campbell Co	34	New Jersey	25	Monmouth Co	51	Virginia	550	Chesapeake
21	Kentucky	111	Jefferson Co	34	New Jersey	27	Morris Co	51	Virginia	570	Colonial Heights
21	Kentucky	117	Kenton Co	34	New Jersey	29	Ocean Co	51	Virginia	600	Fairfax
21	Kentucky	185	Oldham Co	34	New Jersey	31	Passaic Co	51	Virginia	610	Falls Church
23	Maine	1	Androscoggin Co	34	New Jersey	33	Salem Co	51	Virginia	650	Hampton
23	Maine	5	Cumberland Co	34	New Jersey	35	Somerset Co	51	Virginia	670	Hopewell
23	Maine	11	Kennebec Co	34	New Jersey	37	Sussex Co	51	Virginia	683	Manassas
23	Maine	13	KNO_x Co	34	New Jersey	39	Union Co	51	Virginia	685	Manassas Park
23	Maine	15	Lincoln Co	34	New Jersey	41	Warren Co	51	Virginia	700	Newport News
23	Maine	23	Sagadahoc Co	36	New York	5	Bronx Co	51	Virginia	710	Norfolk
23	Maine	31	York Co	36	New York	27	Dutchess Co	51	Virginia	735	Poquoson
24	Maryland	3	Anne Arundel Co	36	New York	47	Kings Co	51	Virginia	740	Portsmouth
24	Maryland	5	Baltimore Co	36	New York	59	Nassau Co	51	Virginia	760	Richmond
24	Maryland	9	Calvert Co	36	New York	61	New York Co	51	Virginia	800	Suffolk
24	Maryland	13	Carroll Co	36	New York	71	Orange Co	51	Virginia	810	Virginia Beach
24	Maryland	15	Cecil Co	36	New York	79	Putnam Co	51	Virginia	830	Williamsburg
24	Maryland	17	Charles Co	36	New York	81	Queens Co	55	Wisconsin	59	Kenosha Co
24	Maryland	21	Frederick Co	36	New York	85	Richmond Co	55	Wisconsin	79	Milwaukee Co
24	Maryland	25	Harford Co	36	New York	87	Rockland Co	55	Wisconsin	89	Ozaukee Co
24	Maryland	27	Howard Co	36	New York	103	Suffolk Co	55	Wisconsin	101	Racine Co
24	Maryland	29	Kent Co	36	New York	119	Westchester Co	55	Wisconsin	131	Washington Co
24	Maryland	31	Montgomery Co	42	Pennsylvania	17	Bucks Co	55	Wisconsin	133	Waukesha Co
24	Maryland	33	Prince George's Co	42	Pennsylvania	29	Chester Co				
24	Maryland	35	Queen Annes Co	42	Pennsylvania	45	Delaware Co				

Table 4.3-28. NO_x Area Source RACT

SCC	POD	PODNAME	ATTAINMENT	RULPEN96	CONEFF96
2102001000	22	Industrial Bituminous Coal Combustion	Moderate	23	21
2102001000	22	Industrial Bituminous Coal Combustion	Serious	45	21
2102001000	22	Industrial Bituminous Coal Combustion	Severe	45	21
2102001000	22	Industrial Bituminous Coal Combustion	Extreme	45	21
2102002000	22	Industrial Anthracite Coal Combustion	Moderate	23	21
2102002000	22	Industrial Anthracite Coal Combustion	Serious	45	21
2102002000	22	Industrial Anthracite Coal Combustion	Severe	45	21
2102002000	22	Industrial Anthracite Coal Combustion	Extreme	45	21
2102004000	23	Industrial Distillate Oil Combustion	Moderate	8	36
2102004000	23	Industrial Distillate Oil Combustion	Serious	16	36
2102004000	23	Industrial Distillate Oil Combustion	Severe	16	36
2102004000	23	Industrial Distillate Oil Combustion	Extreme	16	36
2102005000	23	Industrial Residual Oil Combustion	Moderate	8	42
2102005000	23	Industrial Residual Oil Combustion	Serious	16	42
2102005000	23	Industrial Residual Oil Combustion	Severe	16	42
2102005000	23	Industrial Residual Oil Combustion	Extreme	16	42
2102006000	24	Industrial Natural Gas Combustion	Moderate	11	31
2102006000	24	Industrial Natural Gas Combustion	Serious	22	31
2102006000	24	Industrial Natural Gas Combustion	Severe	22	31
2102006000	24	Industrial Natural Gas Combustion	Extreme	22	31

Table 4.3-29. Sources of Point and Area Source Emissions Data for the 1996 NET Inventory After Incorporating State/Local Agency Data Received in 1999 and 2000

	Point Sources		Area Sources[1]	
State	**Source[2]**	**Comments**	**Source[2]**	**Comments**
Alabama	BY96		BY96	Birmingham NAA Only
Alabama			NAPAP	Rest of State
Alaska	AIRS/FS 1994	Emissions grown to 1996		
Arizona	AIRS/FS 1995		NAPAP	
Arkansas	BY96		NAPAP	
California	BY96		BY96	
Colorado	BY96		NAPAP	
Connecticut	BY96		BY96	
District of Columbia	BY96		OTAG	
Delaware	BY96		BY96	
Florida	BY96		OTAG	
Georgia	BY96	Only Atlanta not statewide	BY96	Only Atlanta not statewide
Georgia	OTAG	Average summer day emissions estimated using default temporal factors	OTAG	
Hawaii	BY96			No emissions data available for industrial category
Idaho	NAPAP	Statewide data submitted in 1999 but not incorporated into NET inventory	NAPAP	Statewide data submitted in 1999 but not incorporated into NET inventory
Illinois	BY96		OTAG	
Indiana	BY96		BY96	
Iowa	NAPAP		NAPAP	
Kansas	BY96		NAPAP	
Kentucky	BY96		OTAG	
Louisiana	BY96		BY96	
Maine	BY96		OTAG	
Maryland	BY96		BY96	
Massachusetts	BY96		NAPAP	
Michigan	BY96		OTAG/ BY96	Includes average summer day emissions for VOC, NO_x, and CO
Minnesota	AIRS/FS 1995		NAPAP	
Mississippi	BY96		NAPAP	
Missouri	BY96	Only partial state.	BY96	St. Louis NAA Only
Missouri	OTAG	Backcast to 1990 using BEA. Average summer day emissions estimated using methodology described	OTAG	Rest of State grown from 1990 Interim Inventory data
Montana	BY96		NAPAP	

Table 4.3-29 (continued)

State	Point Sources		Area Sources[1]	
	Source[2]	Comments	Source[2]	Comments
Nebraska	BY96	Statewide data submitted in 1999 but not incorporated into NET inventory	NAPAP	
Nevada	BY96	Washoe County only		
Nevada	AIRS/FS 1995	Rest of State	NAPAP	Statewide
New Hampshire	BY96		OTAG	
New Jersey	OTAG		OTAG	
New Mexico	BY96		NAPAP	
New York	BY96		OTAG	
North Carolina	BY96		OTAG	Average summer day emissions estimated using default temporal factors.
North Dakota	BY96		NAPAP	
Ohio	OTAG	Average summer day emissions estimated using methodology described	OTAG	Assigned SCCs and converted from kgs to tons. NO_x and CO from 1990 Interim Inventory added to Canton, Dayton and Toledo.
Oklahoma	BY96		BY96	
Oregon	AIRS/FS 1995		GCVTC	
Pennsylvania	BY96	Allegheny and Philadelphia Counties only incorporated in 1999	BY96	Allegheny and Philadelphia Counties only incorporated in 1999
Pennsylvania	BY96	Statewide incorporated in 2000	OTAG	
Rhode Island	OTAG		OTAG	
South Carolina	BY96		NAPAP	
South Dakota	BY96		NAPAP	
Tennessee	OTAG	Average summer day emissions estimated using default temporal factors	OTAG	
Texas	BY96		BY96	NAAs Only (Houston, Beaumont, Dallas, El Paso)
Texas			OTAG	Rest of State. Average summer day emissions estimated using default temporal factors.
Utah	BY96		NAPAP	
Vermont	BY96		OTAG	
Virginia	BY96		BY96	
Washington	BY96		BY96	
West Virginia	BY96		OTAG	
Wisconsin	BY96		OTAG	
Wyoming	AIRS/FS 1995		NAPAP	

[1] EPA has developed 1996 emissions for many area source categories. These estimates are prepared for all States and counties.
[2] BY96= State/local agencies that submitted 1996 base year inventories in calendar years 1999 or 2000 that are incorporated into the 1996 NET. Year of Inventory is 1990 for OTAG and 1985 for NAPAP. AIRS/FS identifies State/local agency inventories downloaded from AIRS/FS in the year specified.

Table 4.3-30. State/Local Point Source Inventories Used to Update the 1996 NET Inventory

State	Geographic Coverage	Pollutants	Annual/Daily Emissions	Included in 1996 NET Version?
AL	Statewide	VOC, NO_x, CO, SO_2	Annual	3 and 4
AR	Statewide	VOC, NO_x, CO, SO_2, PM_{10}, NH_3	Annual	4
AZ	Maricopa County Nonattainment Area (NAA)	VOC, NO_x, CO, SO_2, PM_{10}, NH_3	Annual	3 and 4
CO	Statewide	VOC, NO_x, CO, SO_2, PM_{10}	Annual	3 and 4
CT	Statewide	VOC, NO_x, CO, SO_2, PM_{10}	Both	3 and 4
DC	Statewide	VOC, NO_x, CO, SO_2	Annual	4
DE	Statewide	VOC, NO_x, CO, SO_2, PM_{10}	Both	3 and 4
FL	Statewide	VOC, NO_x, CO, SO_2, PM_{10}	Annual	3 and 4
GA	Atlanta Ozone NAA (34 counties)	VOC, NO_x, CO	Both	4
HI	Statewide	VOC, NO_x, CO, SO_2, PM_{10}	Annual	4
ID	Statewide, but did not meet EPA QA critieria for incorporating data into NEI			
IL	Statewide	VOC, NO_x, CO, PM, PM_{10}	Annual	3 and 4
IN	Statewide	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$, NH_3	Both	3 and 4
KY	Statewide	VOC, NO_x, CO, SO_2, PM_{10}	Annual	3 and 4
LA	Statewide	VOC, NO_x, CO, SO_2, PM_{10}	Both	3 and 4
MA	Statewide	VOC, NO_x, CO, SO_2, PM_{10}	Annual	3 and 4
MD	Statewide	VOC, NO_x, CO, SO_2, PM_{10}	Annual	3 and 4
MI	Statewide	VOC, NO_x, CO, SO_2, PM_{10}	Both	4
MO	Statewide	VOC, NO_x, CO, SO_2, PM_{10}	Annual	3 and 4
MS	Statewide	VOC, NO_x, CO, SO_2, PM_{10}	Annual	4
MT	Statewide	VOC, NO_x, CO, SO_2, PM_{10}	Annual	3 and 4
NC	Statewide	VOC, NO_x, CO, SO_2, PM_{10}, NH_3	Annual	3 and 4
ND	Statewide	VOC, NO_x, CO, SO_2, PM_{10}	Annual	3 and 4
NE	Statewide Except for Lancaster County and City of Omaha	VOC, NO_x, CO, SO_2, PM_{10}	Annual	3 and 4
NH	Statewide	VOC, NO_x, CO	Annual	3 and 4
NM	Statewide	VOC, NO_x, CO, SO_2, PM_{10}	Both	4
NV	Washoe County	VOC, NO_x, CO, SO_2, PM_{10}	Both	4
NY	Statewide	VOC, NO_x, CO, SO_2	Annual	4
OK	Statewide	VOC, NO_x, CO, SO_2, PM_{10}, NH_3	Annual	3 and 4
PA	Statewide	VOC, NO_x	Both	4
SC	Statewide	VOC, NO_x, CO, SO_2, PM_{10}	Annual	3 and 4
SD	Statewide	VOC, NO_x, SO_2, PM_{10}	Annual	3 and 4
TX	Statewide	VOC, NO_x, CO, SO_2, PM_{10}	Both	3 and 4
UT	Statewide	VOC, NO_x, CO, SO_2, PM_{10}	Annual	4
VA	Statewide	VOC, NO_x, CO, SO_2, PM_{10}	Both	3 and 4
VT	Statewide	VOC, NO_x, CO, SO_2, PM_{10}	Both	3 and 4
WA	Statewide except for counties under the jurisdiction of Puget Sound Air Pollution Control Agency (APCA)	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Annual	3 and 4
WA	Puget Sound APCA	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Annual	3 and 4
WI	Statewide	VOC, NO_x, CO, SO_2, PM_{10}	Both	3 and 4
WY	Statewide	VOC, NO_x, CO, SO_2, PM_{10}, NH_3	Annual	3 and 4
WV	Statewide	VOC, NO_x, CO, SO_2; and PM_{10} and NH_3 for some sources	Both	4

Table 4.3-31. State/Local Area Source Inventories Used to Update the 1996 NET Inventory

State	Geographic Coverage?	Pollutant(s):	Annual/Daily Emissions	Included in 1996 NET Version?
AL	Birmingham Ozone Nonattainment Area (NAA) only (2 counties)	VOC, NO_x, CO	Both	3 and 4
CA	Statewide	VOC, NO_x, CO, SO_2, PM_{10}	Annual	3 and 4
CO	Statewide for Residential Woodburning only	VOC, NO_x, CO, SO_2, PM_{10}	Annual	3 and 4
CT	Statewide	VOC, NO_x, CO	Both	3 and 4
DE	Statewide	VOC, NO_x, CO	Both	4
GA	Atlanta Ozone NAA only (13 counties)	VOC, NO_x, CO	Both	4
IN	Statewide	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$, NH_3	Both	3 and 4
KS	Statewide for Wildfires only	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Both	3 and 4
LA	Statewide	VOC, NO_x, CO, SO_2, PM_{10}	Both	3 and 4
MD	Statewide	VOC, NO_x, CO	Both	3 and 4
MO	St. Louis NAA only (6 counties)	VOC, NO_x, CO, SO_2, PM_{10}	Both	3 and 4
OK	Statewide	VOC, NO_x, CO, SO_2, PM_{10}, NH_3	Both	3 and 4
TX	16 counties	VOC, NO_x, CO	Both	3 and 4
VA	Statewide	VOC, NO_x, CO	Both	3 and 4
WA	Consumer solvents and prescribed burning for all counties except those under the jurisdiction of Puget Sound Air Pollution Control Agency (APCA)	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$, NH_3	Annual	3 and 4
WA	Puget Sound APCA	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$, NH_3	Annual	3 and 4

Table 4.3-32. Non-Utility Point Source Data Augmentation Methods

Data Element	Element Type*	Augmentation Method
State FIPS	MS	
County FIPS	MS	
Plant ID	MS	
Plant Name	MS	
SIC	DA	If SIC code is a 1977 or 1972 code, update to 1987 code Else Contact State/local agency for SIC code Else Match to current NET plant Else Leave blank in NET, but assign code based on processes identified by SCCs and/or plant name for purposes of assigning growth factor to prepare future year inventories. Note that this augmentation will be fully implemented in future versions of the NET to correct invalid and outdated SIC codes.
Point ID	DA	Number sequentially within plant - start with "X" (e.g., X1, X2, ...)
Stack ID	DA	Number sequentially within plant - start with "Y" (e.g., Y1, Y2, ...)
Stack Height	DA	If value is <0 ft or >1,250 ft, set value to 0 or 1,250 ft.
Stack Diameter	DA	If value is <0 ft or >50 ft, set value to 0 or 50 ft.
Stack Temperature	DA	If value is <32°F or >2,250°F, set value to 32°F or 2,250°F.
Stack Flow Rate	DA	If value is <0 ft^3/sec or >16,666 ft^3/sec, set value to 0 or 16,666 ft3/sec.
Stack Exit Gas Velocity	DA	If value is <0 ft/sec or >98.4 ft/sec, set value to 0 or 98.4 ft/sec.
Stack Coordinates (Latitude/Longitude or UTM)	DA	Match to current NET Else County centroid
Segment ID	DA	Number sequentially within point - start with "Z" (e.g., Z1, Z2, ...)
SCC	MS	
Winter Throughput PCT	DA	Temporal Allocation Factor File (TAFF) by SCC
Spring Throughput PCT	DA	TAFF by SCC
Summer Throughput PCT	DA	TAFF by SCC
Fall Throughput PCT	DA	TAFF by SCC
Days Per Week	DA	Default to 7
Hours Per Day	DA	Default to 24
Start Date Time	DA	19960101
End Date Time	DA	19961231
Emissions	DA**	See text, section 4.3.8.4.3.1

* MS - States must submit these data elements. Confirmation of submission of these fields will be performed in QC Step.
DA - Data can be augmented if not submitted by the States.

** States must submit annual or daily emissions for at least 1 pollutant.

Table 4.3-33. Stationary Area Source Data Augmentation Methods

Data Element	Element Type*	Augmentation Method
State FIPS	MS	
County FIPS	MS	
SCC	MS	
Emissions	DA**	See text, section 4.3.8.4.3.2

* MS - States must submit these data elements. Confirmation of submission of these fields will be performed in QC Step.
DA - Data can be augmented if not submitted by the States.

** States must submit annual or daily emissions for at least 1 pollutant.

Table 4.3-34. MACT Control Efficiencies Applied to 1996 VOC Emissions for Point and Area Industrial Sources

SCC	POD	MACT Control Efficiency (%)[1] 1997	1998	1999	SCC1_DESC	SCC3_DESC	SCC6_DESC	SCC8_DESC
Point Sources								
30101815	136	0	0	78	Industrial Processes	Chemical Manufacturing	Plastics Production	Pellet Silo
30101816	136	0	0	78	Industrial Processes	Chemical Manufacturing	Plastics Production	Transferring/Handling/Loading/Packing
30101817	138	47	47	47	Industrial Processes	Chemical Manufacturing	Plastics Production	General
30101818	136	0	0	78	Industrial Processes	Chemical Manufacturing	Plastics Production	Reactor
30101819	136	0	0	78	Industrial Processes	Chemical Manufacturing	Plastics Production	Solvent Recovery
30101820	136	0	0	78	Industrial Processes	Chemical Manufacturing	Plastics Production	Polymer Drying
30101821	136	0	0	78	Industrial Processes	Chemical Manufacturing	Plastics Production	Extruding/Pelletizing/Conveying/Storage
30101822	138	47	47	47	Industrial Processes	Chemical Manufacturing	Plastics Production	Acrylic Resins
30101827	136	0	0	78	Industrial Processes	Chemical Manufacturing	Plastics Production	Polyamide Resins
30101847	136	0	0	78	Industrial Processes	Chemical Manufacturing	Plastics Production	Epoxy Resins
30101870	136	0	0	78	Industrial Processes	Chemical Manufacturing	Plastics Production	Reactor (Polyether Resins)
30101871	136	0	0	78	Industrial Processes	Chemical Manufacturing	Plastics Production	Blowing Agent: Freon (Polyether Resins)
30101872	136	0	0	78	Industrial Processes	Chemical Manufacturing	Plastics Production	Miscellaneous (Polyether Resins)
30101880	136	0	0	78	Industrial Processes	Chemical Manufacturing	Plastics Production	Reactor (Polyurethane)
30101881	136	0	0	78	Industrial Processes	Chemical Manufacturing	Plastics Production	Blowing Agent: Freon (Polyurethane)
30101882	136	0	0	78	Industrial Processes	Chemical Manufacturing	Plastics Production	Blowing Agent: Methylene Chloride (Polyurethane)
30101885	136	0	0	78	Industrial Processes	Chemical Manufacturing	Plastics Production	Other Not Classified (Polyurethane)
30102601	22	48	48	48	Industrial Processes	Chemical Manufacturing	Synthetic Rubber (Manufacturing Only)	General
30102602	22	48	48	48	Industrial Processes	Chemical Manufacturing	Synthetic Rubber (Manufacturing Only)	Butyl (Isobutylene)
30102608	22	48	48	48	Industrial Processes	Chemical Manufacturing	Synthetic Rubber (Manufacturing Only)	Acrylonitrile
30102609	22	48	48	48	Industrial Processes	Chemical Manufacturing	Synthetic Rubber (Manufacturing Only)	Dryers
30102611	22	48	48	48	Industrial Processes	Chemical Manufacturing	Synthetic Rubber (Manufacturing Only)	Steam Stripper
30102612	22	48	48	48	Industrial Processes	Chemical Manufacturing	Synthetic Rubber (Manufacturing Only)	Pre-storage Tank
30102613	22	48	48	48	Industrial Processes	Chemical Manufacturing	Synthetic Rubber (Manufacturing Only)	Monomer Recovery: Absorber Vent
30102614	22	48	48	48	Industrial Processes	Chemical Manufacturing	Synthetic Rubber (Manufacturing Only)	Blending Tanks
30102615	22	48	48	48	Industrial Processes	Chemical Manufacturing	Synthetic Rubber (Manufacturing Only)	Isoprene
30102616	22	48	48	48	Industrial Processes	Chemical Manufacturing	Synthetic Rubber (Manufacturing Only)	Latex: Monomer Removal
30102617	22	48	48	48	Industrial Processes	Chemical Manufacturing	Synthetic Rubber (Manufacturing Only)	Latex: Blending Tank
30102625	22	48	48	48	Industrial Processes	Chemical Manufacturing	Synthetic Rubber (Manufacturing Only)	Chloroprene
30102630	22	48	48	48	Industrial Processes	Chemical Manufacturing	Synthetic Rubber (Manufacturing Only)	Silicone Rubber
30102699	22	48	48	48	Industrial Processes	Chemical Manufacturing	Synthetic Rubber (Manufacturing Only)	Other Not Classified
30600402	114	0	0	78	Industrial Processes	Petroleum Industry	Blowdown Systems	Blowdown System w/o Controls
30600801	20	0	0	72	Industrial Processes	Petroleum Industry	Fugitive Emissions	Pipeline Valves and Flanges
30600802	20	0	0	72	Industrial Processes	Petroleum Industry	Fugitive Emissions	Vessel Relief Valves
30600803	20	0	0	72	Industrial Processes	Petroleum Industry	Fugitive Emissions	Pump Seals w/o Controls
30600804	20	0	0	72	Industrial Processes	Petroleum Industry	Fugitive Emissions	Compressor Seals
30600805	20	0	0	72	Industrial Processes	Petroleum Industry	Fugitive Emissions	Miscellaneous: Sampling/Non-Asphalt Blowing/Purging/etc.
30600806	20	0	0	72	Industrial Processes	Petroleum Industry	Fugitive Emissions	Pump Seals with Controls
30600807	20	0	0	72	Industrial Processes	Petroleum Industry	Fugitive Emissions	Blind Changing
30600811	20	0	0	72	Industrial Processes	Petroleum Industry	Fugitive Emissions	Pipeline Valves: Gas Streams

Table 4.3-34 (continued)

SCC	POD	MACT Control Efficiency (%)[1] 1997	1998	1999	SCC1_DESC	SCC3_DESC	SCC6_DESC	SCC8_DESC
Point Sources								
30600812	20	0	0	72	Industrial Processes	Petroleum Industry	Fugitive Emissions	Pipeline Valves: Light Liquid/Gas Streams
30600813	20	0	0	72	Industrial Processes	Petroleum Industry	Fugitive Emissions	Pipeline Valves: Heavy Liquid Streams
30600814	20	0	0	72	Industrial Processes	Petroleum Industry	Fugitive Emissions	Pipeline Valves: Hydrogen Streams
30600815	20	0	0	72	Industrial Processes	Petroleum Industry	Fugitive Emissions	Open-ended Valves: All Streams
30600816	20	0	0	72	Industrial Processes	Petroleum Industry	Fugitive Emissions	Flanges: All Streams
30600817	20	0	0	72	Industrial Processes	Petroleum Industry	Fugitive Emissions	Pump Seals: Light Liquid/Gas Streams
30600818	20	0	0	72	Industrial Processes	Petroleum Industry	Fugitive Emissions	Pump Seals: Heavy Liquid Streams
30600819	20	0	0	72	Industrial Processes	Petroleum Industry	Fugitive Emissions	Compressor Seals: Gas Streams
30600821	20	0	0	72	Industrial Processes	Petroleum Industry	Fugitive Emissions	Drains: All Streams
30600822	20	0	0	72	Industrial Processes	Petroleum Industry	Fugitive Emissions	Vessel Relief Valves: All Streams
30688801	20	0	0	72	Industrial Processes	Petroleum Industry	Fugitive Emissions	Specify in Comments Field
30688802	20	0	0	72	Industrial Processes	Petroleum Industry	Fugitive Emissions	Specify in Comments Field
30688803	20	0	0	72	Industrial Processes	Petroleum Industry	Fugitive Emissions	Specify in Comments Field
30688804	20	0	0	72	Industrial Processes	Petroleum Industry	Fugitive Emissions	Specify in Comments Field
30688805	20	0	0	72	Industrial Processes	Petroleum Industry	Fugitive Emissions	Specify in Comments Field
40100550	63	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Solvent Storage	General Processes: Drum Storage - Pure Organic Chemicals
40201904	39	0	60	60	Petroleum and Solvent Evaporation	Surface Coating Operations	Wood Furniture Surface Coating	Coating Storage
40202404	52	0	0	60	Petroleum and Solvent Evaporation	Surface Coating Operations	Large Aircraft	Coating Storage
40300101	5	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Gasoline **
40300102	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Crude **
40300103	5	0	0	96	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Gasoline **
40300104	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Crude **
40300105	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Jet Fuel **
40300106	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Kerosene **
40300107	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Dist Fuel **
40300108	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Benzene **
40300109	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Cyclohexane **
40300111	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Heptane **
40300112	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Hexane **
40300115	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Pentane **
40300116	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Toluene **
40300150	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Jet Fuel **
40300151	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Kerosene **
40300152	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Dist Fuel **
40300153	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Benzene **
40300154	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Cyclohexane **
40300156	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Heptane **
40300157	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Hexane **
40300158	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Isooctane **
40300159	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Isopentane **
40300160	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Pentane **
40300161	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	Toluene **
40300197	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries		
40300198	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	See Comment **

Table 4.3-34 (continued)

SCC	POD	MACT Control Efficiency (%)[1] 1997	1998	1999	SCC1_DESC	SCC3_DESC	SCC6_DESC	SCC8_DESC
Point Sources								
40300199	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-010 and 4-07)	See Com ment **
40300201	7	0	0	95	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-011 and 4-07)	Gaso line **
40300202	7	0	0	95	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-011 and 4-07)	Product **
40300203	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-011 and 4-07)	Crude **
40300204	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-011 and 4-07)	Crude **
40300205	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-011 and 4-07)	Jet Fuel **
40300207	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-011 and 4-07)	Dist Fue l **
40300208	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-011 and 4-07)	Benzene **
40300209	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-011 and 4-07)	Cyclohexane **
40300210	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-011 and 4-07)	Cyclopentan e **
40300212	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-011 and 4-07)	Hexane **
40300216	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-011 and 4-07)	Toluen e **
40300299	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-011 and 4-07)	Specify Liquid **
40300302	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Deleted - Do Not Use (See 4-03-011 and 4-07)	Gaso line **
40301001	5	0	0	96	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Gaso line RVP 1 3: Breathing Lo ss (6700 0 Bbl. Tank Size)
40301002	5	0	0	96	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Gaso line RVP 1 0: Breathing Lo ss (6700 0 Bbl. Tank Size)
40301003	5	0	0	96	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Gaso line RVP 7 : Breathing Los s (67000 B bl. Tank Size)
40301004	5	0	0	96	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Gasoline RVP 13: Breathing Loss (250000 Bbl. Tank Size)
40301005	5	0	0	96	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Gasoline RVP 10: Breathing Loss (250000 Bbl. Tank Size)
40301006	5	0	0	96	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Gaso line RVP 7 : Breathing Los s (250000 Bbl. Tank Size)
40301007	5	0	0	96	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Gasoline RVP 13: Working Loss (Tank Diam eter Indepe ndent)
40301008	5	0	0	96	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Gasoline RVP 10: Working Loss (Tank Diam eter Indepe ndent)
40301009	5	0	0	96	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Gasoline RVP 7: Working Loss (Tank Diam eter Indepe ndent)
40301010	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Crude O il RVP 5: Brea thing Loss (67000 Bb l. Tank Size)
40301011	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Crude Oil RVP 5: Breathing Loss (250000 Bbl. Tank Size)
40301012	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Crude Oil RVP 5: Working Loss (Tank Diam eter Indepe ndent)
40301013	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Jet Naphtha (JP-4): Breathing Loss (67000 Bbl. Tank Size)
40301014	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Jet Naphtha (JP-4): Breathing Loss (250000 Bbl. Tank Size)
40301015	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Jet Naphtha (JP-4): Working Loss (Tank Diam eter Indepe ndent)
40301016	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Jet Kerose ne: Breathing L oss (670 00 Bbl. Tank Size)
40301017	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Jet Kerose ne: Breathing L oss (250 000 Bbl. Tank Size)

Table 4.3-34 (continued)

SCC	POD	MACT Control Efficiency (%)[1] 1997	1998	1999	SCC1_DESC	SCC3_DESC	SCC6_DESC	SCC8_DESC
Point Sources								
40301018	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Jet Kerosene: Working Loss (Tank Diameter Independent)
40301019	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Distillate Fuel #2: Breathing Loss (67000 Bbl. Tank Size)
40301020	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Distillate Fuel #2: Breathing Loss (250000 Bbl. Tank Size)
40301021	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Distillate Fuel #2: Working Loss (Tank Diameter Independent)
40301068	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Grade 2 Fuel Oil: Breathing Loss (250000 Bbl. Tank Size)
40301078	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Grade 2 Fuel Oil: Working Loss (Independent Tank Diameter)
40301097	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Specify Liquid: Breathing Loss (67000 Bbl. Tank Size)
40301098	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Specify Liquid: Breathing Loss (250000 Bbl. Tank Size)
40301099	4	0	0	98	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Fixed Roof Tanks (Varying Sizes)	Specify Liquid: Working Loss (Tank Diameter Independent)
40301101	7	0	0	95	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Gasoline RVP 13: Standing Loss (67000 Bbl. Tank Size)
40301102	7	0	0	95	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Gasoline RVP 10: Standing Loss (67000 Bbl. Tank Size)
40301103	7	0	0	95	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Gasoline RVP 7: Standing Loss (67000 Bbl. Tank Size)
40301104	7	0	0	95	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Gasoline RVP 13: Standing Loss (250000 Bbl. Tank Size)
40301105	7	0	0	95	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Gasoline RVP 10: Standing Loss (250000 Bbl. Tank Size)
40301106	7	0	0	95	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Gasoline RVP 7: Standing Loss (250000 Bbl. Tank Size)
40301107	7	0	0	95	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Gasoline RVP 13/10/7: Withdrawal Loss (67000 Bbl. Tank Size)
40301108	7	0	0	95	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Gasoline RVP 13/10/7: Withdrawal Loss (250000 Bbl.Tank Size)
40301109	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Crude Oil RVP 5: Standing Loss (67000 Bbl. Tank Size)
40301110	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Crude Oil RVP 5: Standing Loss (250000 Bbl. Tank Size)
40301111	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Jet Naphtha (JP-4): Standing Loss (67000 Bbl. Tank Size)
40301112	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Jet Naphtha (JP-4): Standing Loss (250000 Bbl. Tank Size)
40301113	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Jet Kerosene: Standing Loss (67000 Bbl. Tank Size)
40301114	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Jet Kerosene: Standing Loss (250000 Bbl. Tank Size)
40301115	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Distillate Fuel #2: Standing Loss (67000 Bbl. Tank Size)
40301116	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Distillate Fuel #2: Standing Loss (250000 Bbl. Tank Size)

Table 4.3-34 (continued)

SCC	POD	MACT Control Efficiency (%)[1] 1997	1998	1999	SCC1_DESC	SCC3_DESC	SCC6_DESC	SCC8_DESC
Point Sources								
40301117	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Crude Oil RVP 5: Withdrawal Loss
40301118	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Jet Naphtha (JP-4): Withdrawal Loss
40301119	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Jet Kerosene: Withdrawal Loss
40301120	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Distillate Fuel #2: Withdrawal Loss
40301130	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Specify Liquid: Standing Loss - External - Primary Seal
40301131	7	0	0	95	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Gasoline: Standing Loss - External - Primary Seal
40301132	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Crude Oil: Standing Loss - External - Primary Seal
40301133	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Jet Naphtha (JP-4): Standing Loss - External - Primary Seal
40301134	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Jet Kerosene: Standing Loss - External - Primary Seal
40301135	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Distillate Fuel #2: Standing Loss - External - Primary Seal
40301197	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Specify Liquid: Withdrawal Loss
40301198	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Specify Liquid: Standing Loss (67000 Bbl. Tank Size)
40301199	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Floating Roof Tanks (Varying Sizes)	Specify Liquid: Standing Loss (250000 Bbl. Tank Size)
40301201	7	0	0	95	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Variable Vapor Space	Gasoline RVP 13: Filling Loss
40301202	7	0	0	95	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Variable Vapor Space	Gasoline RVP 10: Filling Loss
40301203	7	0	0	95	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Variable Vapor Space	Gasoline RVP 7: Filling Loss
40301204	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Variable Vapor Space	Jet Naphtha (JP-4): Filling Loss
40301205	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Variable Vapor Space	Jet Kerosene: Filling Loss
40301206	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Variable Vapor Space	Distillate Fuel #2: Filling Loss
40301299	6	0	0	90	Petroleum and Solvent Evaporation	Petroleum Product Storage at Refineries	Variable Vapor Space	Specify Liquid: Filling Loss
40400101	150	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Breathing Loss (67000 Bbl Capacity) - Fixed Roof Tank
40400102	150	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Breathing Loss (67000 Bbl Capacity) - Fixed Roof Tank
40400103	150	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Breathing Loss (67000 Bbl. Capacity) - Fixed Roof Tank
40400104	150	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Breathing Loss (250000 Bbl Capacity)-Fixed Roof Tank
40400105	150	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Breathing Loss (250000 Bbl Capacity)-Fixed Roof Tank
40400106	150	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Breathing Loss (250000 Bbl Capacity) - Fixed Roof Tank
40400107	151	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Working Loss (Diam. Independent) - Fixed Roof Tank
40400108	151	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Working Loss (Diameter Independent) - Fixed Roof Tank
40400109	151	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Working Loss (Diameter Independent) - Fixed Roof Tank
40400110	152	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Standing Loss (67000 Bbl Capacity)-Floating Roof Tank

Table 4.3-34 (continued)

SCC	POD	MACT Control Efficiency (%)[1] 1997	1998	1999	SCC1_DESC	SCC3_DESC	SCC6_DESC	SCC8_DESC
Point Sources								
40400111	152	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Standing Loss (67000 Bbl Capacity)-Floating Roof Tank
40400112	152	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Standing Loss (67000 Bbl Capacity)- Floating Roof Tank
40400113	152	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Standing Loss (250000 Bbl Cap.) - Floating Roof Tank
40400114	152	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Standing Loss (250000 Bbl Cap.) - Floating Roof Tank
40400115	152	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Standing Loss (250000 Bbl Cap.) - Floating Roof Tank
40400116	153	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13/10/7: Withdrawal Loss (67000 Bbl Cap.) - Float Rf Tnk
40400117	153	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13/10/7: Withdrawal Loss (250000 Bbl Cap.)- Float Rf Tnk
40400118	154	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Filling Loss (10500 Bbl Cap.) - Variable Vapor Space
40400119	154	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Filling Loss (10500 Bbl Cap.) - Variable Vapor Space
40400120	154	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Filling Loss (10500 Bbl Cap.) - Variable Vapor Space
40400130	173	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Specify Liquid: Standing Loss - External Floating Roof w/ Primary Seal
40400131	173	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Standing Loss - Ext. Floating Roof w/ Primary Seal
40400140	173	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Specify Liquid: Standing Loss - Ext. Float Roof Tank w/ Second'y Seal
40400141	173	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Standing Loss - Ext. Floating Roof w/ Secondary Seal
40400150	155	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Miscellaneous Losses/Leaks: Loading Racks
40400151	155	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Valves, Flanges, and Pumps
40400152	155	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Vapor Collection Losses
40400153	155	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Vapor Control Unit Losses
40400154	155	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Tank Truck Vapor Leaks
40400160	174	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Specify Liquid: Standing Loss - Internal Floating Roof w/ Primary Seal
40400161	174	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Standing Loss - Int. Floating Roof w/ Primary Seal
40400170	174	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Specify Liquid: Standing Loss - Int. Floating Roof w/ Secondary Seal
40400171	174	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Standing Loss - Int. Floating Roof w/ Secondary Seal
40400178	174	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13/10/7: Withdrawal Loss - Int. Float Roof (Pri/Sec Seal)
40400199	155	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	See Comment **

Table 4.3-34 (continued)

SCC	POD	MACT Control Efficiency (%)[1] 1997	1998	1999	SCC1_DESC	SCC3_DESC	SCC6_DESC	SCC8_DESC
Point Sources								
40400201	150	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Breathing Loss (67000 Bbl Capacity) - Fixed Roof Tank
40400202	150	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10: Breathing Loss (67000 Bbl Capacity) - Fixed Roof Tank
40400203	150	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 7: Breathing Loss (67000 Bbl. Capacity) - Fixed Roof Tank
40400204	151	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Working Loss (67000 Bbl. Capacity) - Fixed Roof Tank
40400205	151	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10: Working Loss (67000 Bbl. Capacity) - Fixed Roof Tank
40400206	151	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 7: Working Loss (67000 Bbl. Capacity) - Fixed Roof Tank
40400207	152	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Standing Loss (67000 Bbl Cap.) - Floating Roof Tank
40400208	152	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10: Standing Loss (67000 Bbl Cap.) - Floating Roof Tank
40400209	152	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 7: Standing Loss (67000 Bbl Cap.) - Floating Roof Tank
40400210	154	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13/10/7: Withdrawal Loss (67000 Bbl Cap.) - Float Rf Tnk
40400211	154	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Filling Loss (10500 Bbl Cap.) - Variable Vapor Space
40400212	154	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10: Filling Loss (10500 Bbl Cap.) - Variable Vapor Space
40400230	173	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Specify Liquid: Standing Loss - External Floating Roof w/ Primary Seal
40400231	173	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Standing Loss - Ext. Floating Roof w/ Primary Seal
40400240	173	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Specify Liquid: Standing Loss - Ext. Floating Roof w/ Secondary Seal
40400241	173	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Standing Loss - Ext. Floating Roof w/ Secondary Seal
40400250	155	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Loading Racks
40400251	155	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Valves, Flanges, and Pumps
40400254	155	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Tank Truck Vapor Losses
40400260	174	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Specify Liquid: Standing Loss - Internal Floating Roof w/ Primary Seal
40400261	174	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Standing Loss - Int. Floating Roof w/ Primary Seal
40400271	174	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Standing Loss - Int. Floating Roof w/ Secondary Seal
40400301	156	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Oil and Gas Field Storage and Working Tanks	Fixed Roof Tank: Breathing Loss
40400302	157	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Oil and Gas Field Storage and Working Tanks	Fixed Roof Tank: Working Loss
40400303	158	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Oil and Gas Field Storage and Working Tanks	External Floating Roof Tank with Primary Seals: Standing Loss

Table 4.3-34 (continued)

SCC	POD	MACT Control Efficiency (%)[1] 1997	1998	1999	SCC1_DESC	SCC3_DESC	SCC6_DESC	SCC8_DESC
Point Sources								
40400304	158	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Oil and Gas Field Storage and Working Tanks	External Floating Roof Tank with Secondary Seals: Standing Loss
40400305	158	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Oil and Gas Field Storage and Working Tanks	Internal Floating Roof Tank: Standing Loss
40400401	159	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Gasoline RVP 13: Breathing Loss
40400402	160	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Gasoline RVP 13: Working Loss
40400403	159	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Gasoline RVP 10: Breathing Loss
40400404	160	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Gasoline RVP 10: Working Loss
40400405	159	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Gasoline RVP 7: Breathing Loss
40400406	160	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Gasoline RVP 7: Working Loss
40400407	159	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Crude Oil RVP 5: Breathing Loss
40400408	160	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Crude Oil RVP 5: Working Loss
40400409	159	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Jet Naphtha (JP-4): Breathing Loss
40400410	160	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Jet Naphtha (JP-4): Working Loss
40400411	159	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Jet Kerosene: Breathing Loss
40400412	160	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Jet Kerosene: Working Loss
40400413	159	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Distillate Fuel #2: Breathing Loss
40400414	160	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Distillate Fuel #2: Working Loss
40400497	159	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Specify Liquid: Breathing Loss
40400498	160	0	5	5	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Specify Liquid: Working Loss
40600101	161	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Splash Loading **
40600126	163	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Submerged Loading **
40600131	163	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Submerged Loading (Normal Service)
40600136	161	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Splash Loading (Normal Service)
40600137	164	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Crude Oil: Splash Loading (Normal Service)
40600138	164	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Jet Naphtha: Splash Loading (Normal Service)
40600139	164	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Kerosene: Splash Loading (Normal Service)

Table 4.3-34 (continued)

SCC	POD	MACT Control Efficiency (%)[1] 1997	1998	1999	SCC1_DESC	SCC3_DESC	SCC6_DESC	SCC8_DESC
Point Sources								
40600140	164	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Distillate Oil: Splash Loading (Normal Service)
40600141	162	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Submerged Loading (Balanced Service)
40600142	165	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Crude Oil: Submerged Loading (Balanced Service)
40600143	165	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Jet Naphtha: Submerged Loading (Balanced Service)
40600144	162	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Splash Loading (Balanced Service)
40600145	165	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Crude Oil: Splash Loading (Balanced Service)
40600146	165	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Jet Naphtha: Splash Loading (Balanced Service)
40600147	163	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Submerged Loading (Clean Tanks)
40600162	167	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Loaded with Fuel (Transit Losses)
40600163	167	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Return with Vapor (Transit Losses)
40600197	172	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Not Classified **
40600198	172	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Not Classified **
40600199	172	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Not Classified **
40600301	168	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Gasoline Retail Operations - Stage I	Splash Filling
40600302	169	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Gasoline Retail Operations - Stage I	Submerged Filling w/o Controls
40600305	170	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Gasoline Retail Operations - Stage I	Unloading **
40600306	170	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Gasoline Retail Operations - Stage I	Balanced Submerged Filling
40600307	171	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Gasoline Retail Operations - Stage I	Underground Tank Breathing and Emptying
40600399	170	0	5	5	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Gasoline Retail Operations - Stage I	Not Classified **
50300801	129	0	0	96	Waste Disposal	Solid Waste Disposal - Industrial	Treatment, Storage, Disposal/TSDF	Surface Impoundment: Fugitive Emissions
50300810	129	0	0	96	Waste Disposal	Solid Waste Disposal - Industrial	Treatment, Storage, Disposal/TSDF	Waste Piles: Fugitive Emissions
50300820	129	0	0	96	Waste Disposal	Solid Waste Disposal - Industrial	Treatment, Storage, Disposal/TSDF	Land Treatment: Fugitive Emissions
50300830	129	0	0	96	Waste Disposal	Solid Waste Disposal - Industrial	Treatment, Storage, Disposal/TSDF	Containers: Fugitive Emissions
50300899	129	0	0	96	Waste Disposal	Solid Waste Disposal - Industrial	Treatment, Storage, Disposal/TSDF	General: Fugitive Emissions
62540010	138	47	47	47	MACT Source Categories	Food and Agricultural Processes	Cellulose Food Casing Manufacture	Cellulose Xanthate Formation: Barattees
62540020	138	47	47	47	MACT Source Categories	Food and Agricultural Processes	Cellulose Food Casing Manufacture	Viscose Processing
62540022	138	47	47	47	MACT Source Categories	Food and Agricultural Processes	Cellulose Food Casing Manufacture	Viscose Processing: Extrusion and Coagulation
64630016	138	47	47	47	MACT Source Categories	Vinyl-based Resins	Polyvinyl Chloride and Copolymers Production - Suspension Process	Process Vents, Reactor: Safety Valve Vents

Table 4.3-34 (continued)

SCC	POD	MACT Control Efficiency (%)[1] 1997	1998	1999	SCC1_DESC	SCC3_DESC	SCC6_DESC	SCC8_DESC
Point Sources								
64630040	138	47	47	47	MACT Source Categories	Vinyl-based Resins	Polyvinyl Chloride and Copolymers Production - Suspension Process	Process Vents: Rotary Dryer
Area Sources								
2501000000	217	0	0	51	Storage and Transport	Petroleum and Petroleum Product Storage	All Storage Types: Breathing Loss	Total: All Products
2501010000	217	0	0	51	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial/Industrial: Breathing Loss	Total: All Products
2501050000	217	0	0	51	Storage and Transport	Petroleum and Petroleum Product Storage	Bulk Stations/Terminals: Breathing Loss	Total: All Products
2501050120	217	0	0	51	Storage and Transport	Petroleum and Petroleum Product Storage	Bulk Stations/Terminals: Breathing Loss	Gasoline
2501995000	217	0	0	51	Storage and Transport	Petroleum and Petroleum Product Storage	All Storage Types: Working Loss	Total: All Products
2501995120	217	0	0	51	Storage and Transport	Petroleum and Petroleum Product Storage	All Storage Types: Working Loss	Gasoline

[1] Percent reduction from uncontrolled emissions in 1996 NET inventory.

Figure 4.3-1. OTAG Inventory Data Source - Area Sources

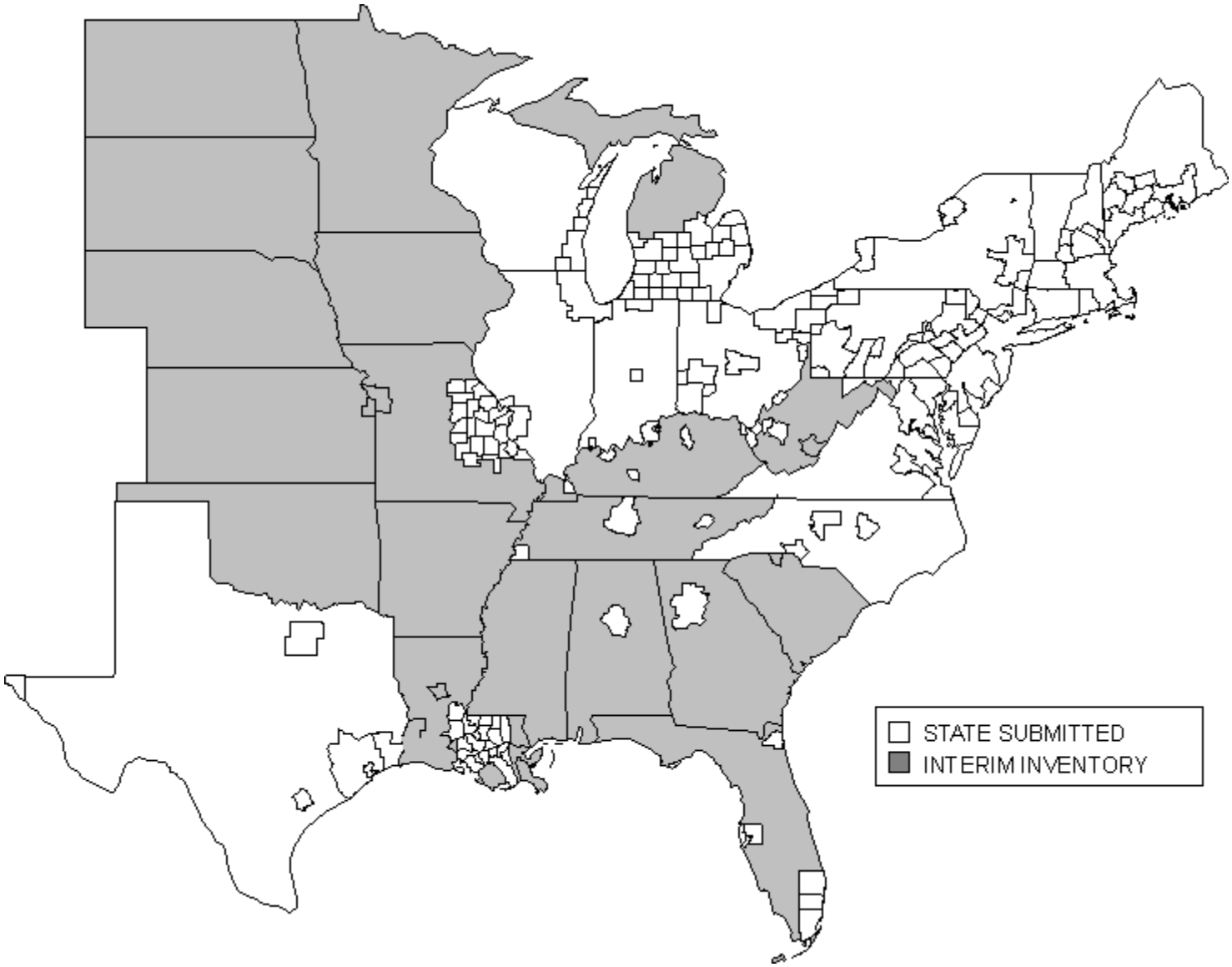
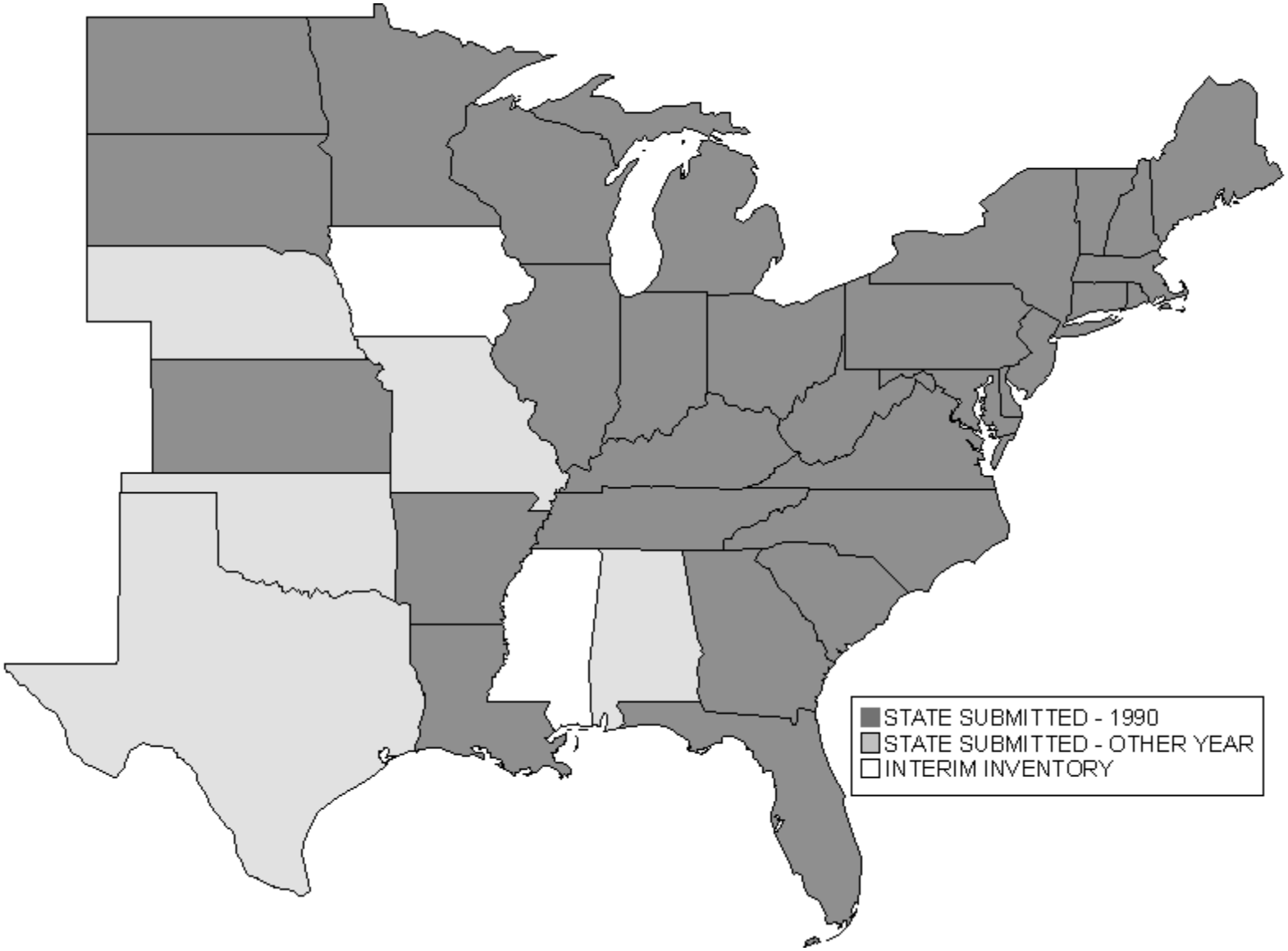


Figure 4.3-2. OTAG Inventory Data Source - Point Sources



4.4 OTHER COMBUSTION

4.4.1 What Source Categories Does the Other Combustion Sector Include?

The source categories falling under "Other Combustion" include the following Tier I and Tier II categories:

Tier I Category	Tier II Category
(03) OTHER COMBUSTION	(01-06) All
(14) MISCELLANEOUS	(02) Other Combustion

The Tier I "Other Combustion" category includes point and area source emissions associated with commercial/institutional and residential burning of all fuels (i.e., coal, oil, natural gas, and liquified petroleum gas) except solid waste. This category accounts for emissions associated with fuel combustion in external combustion boilers, space heaters, reciprocating internal combustion engines, and turbines. The Tier 1 "Miscellaneous" category includes burning of agricultural crops, forest fires/wildfires, prescribed/slash and managed burning, structure fires, and open burning.

See section 4.1.3 for instructions on how to identify the SCCs for the point and area source categories assigned to these tier categories.

4.4.2 What Information Does This Section Provide?

Section 4.4 describes the methods used to estimate 1985 through 1989 emissions, 1990 emissions for the 1990 Interim Inventory, and 1990 through 1999 emissions in the National Emission Trends (NET) inventory. Except for certain area source categories, the methods used to prepare emissions for the "Other Combustion" categories are essentially the same as those used to prepare emissions for the "Industrial" categories discussed in section 4.3. Table 4.3-1 of section 4.3 summarizes the methods applied and the pollutants for which emissions were estimated for each year.

The 1990 Interim Inventory emissions for the majority of the source categories were generated from both the point source and area source portions of the 1985 National Acid Precipitation Assessment Program (NAPAP) inventory, except for emissions from wildfires, residential wood combustion, and prescribed burning. The 1990 Interim Inventory emissions served as the base year from which the emissions for the years 1985 through 1989 were estimated. The emissions for the years 1985 through 1989 were estimated using historical data compiled by the BEA[1] or historic estimates of fuel consumption based on the DOE's SEDS.[2] Section 4.4.3 explains the methods for preparing the 1990 Interim Inventory. Section 4.4.4 explains how emissions for 1985 through 1989 were developed from the 1990 Interim Inventory.

The 1990 National Emission Trends (NET) emissions were revised to incorporate as much State-supplied data as possible. Sources of State data include the Ozone Transport Assessment Group (OTAG) emission inventory, the Grand Canyon Visibility Transport Commission (GCVTC) emission inventory, and Aerometric Information Retrieval System/Facility Subsystem (AIRS/FS). For most point sources, these emissions were projected from the revised 1990 NET inventory to the years 1991 through 1996 using BEA and SEDS data. States were surveyed to determine whether EPA should project their

1990 non-utility point source emissions or extract them from AIRS/FS. For all States that selected AIRS/FS option, the emissions in the NET inventory reflect their AIRS/FS data for the years 1991 through 1995. Additional controls were added to the projected (or grown) emissions for the year 1996. Sections 4.4.5 through 4.4.8 explain how emissions were prepared for 1990 through 1996. Section 4.4.10 explains how emissions for 1997 through 1999 were grown from the 1996 NET inventory.

The methodologies for estimating emissions for 1990 through 1999 for forest fires/wildfires, prescribed/slash and managed burning, residential wood combustion, and structure fires are described in section 4.4.9. Section 4.4.9 also explains the methodologies applied to estimate 1999 emissions for the open burning of residential municipal solid waste (MSW), leaves, and brush; and open burning of land clearing debris. Prior to 1996, emissions for these open burning categories were either grown from 1990 emissions, or not estimated. In addition, section 4.4.9 discusses how 1990-1994 PM and SO_2 emissions for residential nonwood combustion sources were estimated. The methodologies for these source categories are based on methodologies that are different from the general methodologies for Other Combustion sources discussed in sections 4.4.3 through 4.4.8.

4.4.3 How did EPA Develop the 1990 Interim Inventory?

The 1985 NAPAP inventory estimates for the **point** sources have been projected to the year 1990 based on the growth in BEA historic earnings for the appropriate State and industry, as identified by the two-digit SIC code. To remove the effects of inflation, the earnings data were converted to 1982 constant dollars using the implicit price deflator for personal consumption expenditures.[3] State and SIC-level growth factors were calculated as the ratio of the 1990 earnings data to the 1985 earnings data. Additional information on point source growth indicators is presented in section 4.4.3.4.

For the 1990 Interim inventory, the emissions from agricultural burning and open burning were based on the 1985 NAPAP inventory. The emissions estimation methodologies for these categories are described individually below.

The **agricultural burning** category includes emissions from burning practices routinely used to clear and/or prepare land for planting. Specific operations include grass stubble burning, burning of agricultural crop residues, and burning of standing field corps as part of harvesting activities (e.g., sugar cane). Emissions are estimated by multiplying the number of acres burned in each county by a fuel loading factor and the an emission factor for each pollutant.

The original emissions estimation methodology for agricultural burning was developed by IIT Research[4] and estimated the 1974 activity level in terms of acres burned per State. It was assumed that the total quantity of agricultural products burned in 1974 was the same quantity which was consumed by fire each year. If no specific crop data were available, it was assumed that the number of acres burned annually was divided equally between sugar cane and other field crops.[5] Fuel loadings for grass burning were 1 to 2 tons per acre; fuel loadings for sugar cane burning were 6 to 12 tons per acre.[6] Emission factors were taken from the 1985 *Procedures Document*[5] and AP-42.[7]

NAPAP defined **open burning** as the uncombined burning of wastes such as leaves, landscape refuse, and other rubbish. The activity factor for open burning was the quantity of solid waste burned, which was computed for the year of interest by updating the previous year's waste generation for each

sector. The update factor was determined using engineering judgement. Estimates of the quantity of solid waste burned in the most recent year were obtained from the National Emissions Data System (NEDS) point source data.[8] Generation factors were originally obtained from data in the *1968 Survey of Solid Waste Practices, Interim Report*[9] and the *Preliminary Data Analysis.*[10] Allocations were based on county population and emission factors for open burning or refuse and organic materials were taken directly from AP-42.[7]

The area source emissions from the 1985 NAPAP inventory were projected to 1990 based on BEA historic earnings data, BEA historic population data, DOE SEDS data, or other growth indicators. The specific growth indicator was assigned based on the source category. The BEA earnings data were converted to 1982 dollars as described above. The 1990 SEDS data were extrapolated from data for the years 1985 through 1989. All growth factors were calculated as the ratio of the 1990 data to the 1985 data for the appropriate growth indicator. Additional information on area source growth indicators is presented in section 4.4.3.5.

When creating the 1990 emission inventory, changes were made to emission factors, control efficiencies, and emissions from the 1985 inventory for some sources. The PM-10 control efficiencies were obtained from the PM Calculator.[11] In addition, rule effectiveness, which was not applied in the 1985 NAPAP inventory, was applied to the 1990 emissions estimated for the point sources. The CO, NO_x, and VOC point source controls were assumed to be 80 percent effective; PM-10 and SO_2 controls were assumed to be 100 percent effective.

The 1990 emissions for CO, NO_x, SO_2, NH_3, and VOC were calculated using the following steps: (1) projected 1985 controlled emissions to 1990 using the appropriate growth factors, (2) calculated the uncontrolled emissions using control efficiencies from the 1985 NAPAP Emission Inventory, and (3) calculated the final 1990 controlled emissions using revised control efficiencies and the appropriate rule effectiveness. The 1990 PM-10 and PM-2.5 emissions were calculated using the TSP emissions from the 1985 NAPAP inventory. The 1990 uncontrolled TSP emissions were estimated in the same manner as the other pollutants. The 1990 uncontrolled PM-10 estimates were calculated from these TSP emissions by applying SCC-specific uncontrolled particle size distribution factors. The controlled PM-10 emissions were estimated in the same manner as the other pollutants. Because the majority of area source emissions for all pollutants represented uncontrolled emissions, the second and third steps were not required to estimate the 1990 area source emissions.

4.4.3.1 What Control Efficiency Revisions did EPA Make?

In the 1985 NAPAP point source estimates, control efficiencies for VOC, NO_x, CO, and SO_2 sources in Texas were judged to be too high for their process/control device combination. These high control efficiencies occurred because Texas did not ask for control efficiency information, and simply applied the maximum efficiency for the reported control device.[12] High control efficiencies lead to high future growth in modeling scenarios based on uncontrolled emissions (which are based on the control efficiency and reported actual emissions). High control efficiencies also lead to extreme increases in emissions when rule effectiveness is incorporated.

Revised VOC control efficiencies were developed for Texas for the ERCAM-VOC.[13] For this analysis, revised efficiencies were also developed by SCC and control device combination for NO_x, SO_2, and CO using engineering judgement. These revised control efficiencies were applied to sources in

Texas. A large number of point sources outside of Texas had VOC and CO control efficiencies that were also judged to be too high. The VOC and CO control efficiencies used for Texas were also applied to these sources.

4.4.3.2 What Rule Effectiveness Assumptions did EPA Make?

Controlled emissions for each inventory year were recalculated, assuming that reported VOC, NO_x, and CO controls were 80 percent effective. Sulfur dioxide and PM-10 controls were assumed to be 100 percent effective.

4.4.3.3 What Emissions Calculations Did EPA Use?

A three-step process was used to calculate emissions incorporating rule effectiveness. First, base year controlled emissions are projected to the inventory year using Equation 4.4-1.

$$CE_i = CE_{BY} + (CE_{BY} \times EG_i) \qquad \text{(Eq. 4.4-1)}$$

where: CE_i = controlled emissions for inventory year I
CE_{BY} = controlled emissions for base year
EG_i = earnings growth for inventory year I

Earnings growth is calculated using Equation 4.4-2:

$$EG_i = 1 - \frac{DAT_i}{DAT_{BY}} \qquad \text{(Eq. 4.4-2)}$$

where: EG = earnings growth
DAT_i = earnings data for inventory year I
DAT_{BY} = earnings data in the base year

Second, uncontrolled emissions in the inventory year are back-calculated from the controlled emissions based on the control efficiency with Equation 4.4-3.

$$UE_i = \frac{CE_i}{\left(1 - \frac{CEFF}{100}\right)} \qquad \text{(Eq. 4.4-3)}$$

where: UE_i = uncontrolled emissions for inventory year I
CE_i = controlled emissions for inventory year I
CEFF = control efficiency (percent)

Third, controlled emissions are recalculated incorporating rule effectiveness using Equation 4.4-4:

$$CER_i = UC_i \times \left(1 - \left(\frac{REFF}{100}\right) \times \left(\frac{CEFF}{100}\right)\right) \times \left(\frac{EF_i}{EF_{BY}}\right) \quad \text{(Eq. 4.4-4)}$$

where: CER_i = controlled emissions incorporating rule effectiveness
UC_i = uncontrolled emissions
REFF = rule effectiveness (percent)
CEFF = control efficiency (percent)
EF_i = emission factor for inventory year I
EF_{BY} = emission factor for base year

4.4.3.4 How Did EPA Grow Point Source Emissions?

The changes in the point source emissions were equated with the changes in historic earnings by State and industry. Emissions from each point source in the 1985 NAPAP Emissions Inventory were projected to the years 1985 through 1990 based on the growth in earnings by industry (2-digit SIC code). Historical annual State and industry earnings data from BEA's Table SA-5[1] were used to represent growth in earnings from 1985 through 1990.

The 1985 through 1990 earnings data in Table SA-5 are expressed in nominal dollars. To be used to estimate growth, these values were converted to constant dollars to remove the effects of inflation. Earnings data for each year were converted to 1982 constant dollars using the implicit price deflator for PCE.[3] The PCE deflators used to convert each year's earnings data to 1982 dollars are:

Year	1982 PCE Deflator
1985	111.6
1987	114.3
1988	124.2
1989	129.6
1990	136.4

Several BEA categories did not contain a complete time series of data for the years 1985 through 1990. Because the SA-5 data must contain 1985 earnings and earnings for each inventory year (1985 through 1990) to be useful for estimating growth, a log linear regression equation was used where possible to fill in missing data elements. This regression procedure was performed on all categories that were missing at least one data point and which contained at least three data points in the time series.

Each record in the point source inventory was matched to the BEA earnings data based on the State and the 2-digit SIC. Table 4.4-1 shows the BEA earnings category used to project growth for each of the 2-digit SICs found in the 1985 NAPAP Emission Inventory. No growth in emissions was assumed for all point sources for which the matching BEA earnings data were not complete. Table 4.4-1 also shows the national average growth and earnings by industry from Table SA-5.

4.4.3.5 How Did EPA Grow Area Source Emissions?

Emissions from the 1985 NAPAP Inventory were grown to the Emission Trends years based on historical BEA earnings data (section 4.4.3.4), historical estimates of fuel consumption, or other category-specific growth indicators. Table 4.4-2 shows the growth indicators used for each area source by 1985 NAPAP category.

Due to the year-to-year volatility in the SEDS fuel consumption data for the commercial residual oil fuel use category, the regression technique used above did not yield realistic projections for 1990 for this category. Therefore, a different procedure was used to project 1990 data for commercial residual oil fuel use. State-level sales volumes of residual fuel to the commercial sector were obtained from *Fuel Oil and Kerosene Sales 1990*[14] for 1989 and 1990. Each State's growth in sales of residual fuel to the commercial sector from 1989 to 1990 was applied to that State's 1989 SEDS commercial residual fuel consumption to yield a 1990 consumption estimate. A summary of SEDS national fuel consumption by fuel and sector can be found in Table 4.4-3.

The SEDS data were used as an indicator of emissions growth for the area source fuel combustion categories and for the gasoline marketing categories shown in Table 4.4-3. (SEDS reports fuel consumption by sector and fuel type.) Since fuel consumption was the activity level used to estimate emissions for these categories, fuel consumption was a more accurate predictor of changes in emissions, compared to other surrogate indicators such as earnings or population. SEDS fuel consumption data were available through 1989 at the time the emission estimates were developed. The 1990 values were extrapolated from the 1985 through 1989 data using a log linear regression technique. In addition to projecting 1990 data for all fuel consumption categories, the regression procedure was used to fill in missing data points for fuel consumption categories if at least three data points in the time series (1985 to 1989) were available.

The last step in the creation of the area source inventory was matching the 1985 NAPAP categories to the new AIRS Area and Mobile Source Subsystem (AMS) categories. This matching is provided in Table 4.4-4. Note that there is not always a one-to-one correspondence between 1985 NAPAP and AMS categories. For example, the gasoline marketing NAPAP category was split into two separate AMS categories representing Stage I and Stage II emissions. In addition, three 1985 NAPAP SCCs are not included in the AMS system of codes. Therefore, AMS codes were created for process emissions from pharmaceutical manufacture, synthetic fiber manufacture, and synthetic organic chemical manufacturing industry (SOCMI) fugitive emissions.

4.4.4 How Did EPA Develop Emissions for 1985 to 1989?

The 1990 Interim Inventory was used as the base year from which emissions for 1985 to 1989 were estimated. As discussed under section 4.4.3, the 1985 NAPAP controlled emissions were grown to 1990 to serve as the starting point for preparing the 1990 Interim Inventory emissions. However, several changes were made to the 1990 emissions to improve the inventory prior to backcasting the emissions to 1985 through 1989. Consequently, the 1985 emissions estimated by this method do not match the 1985 NAPAP Emission Inventory. The factors used to backcast 1990 emissions to prior years are the same as the factors used to grow 1985 NAPAP emissions to 1990.

4.4.5 What is the 1990 NET Inventory?

The 1990 National Emission Trends is based primarily on State data, with the 1990 Interim data filling in the gaps. The data base houses U.S. annual and average summer day emission estimates for the 50 States and the District of Columbia. Seven pollutants (CO, NO_x, VOC, SO_2, PM-10, PM-2.5, and NH_3) were estimated in 1990. The State data were extracted from three sources, the OTAG inventory, the GCVTC inventory, and AIRS/FS. Sections 4.4.5.1, 4.4.5.2, and 4.4.5.3 give brief descriptions of these efforts. Section 4.4.5.4 describes the efforts necessary to supplement the inventory gaps that are either temporal, spacial, or pollutant. Since EPA did not receive documentation on how these inventories were developed, this section only describes the effort to collect the data and any modifications or additions made to the data.

4.4.5.1 OTAG

The OTAG inventory for 1990 was completed in December 1996. The data base houses emission estimates for those States in the Super Regional Oxidant A (SUPROXA) domain. The estimates were developed to represent average summer day emissions for the ozone pollutants (VOC, NO_x, and CO). This section gives a background of the OTAG emission inventory and the data collection process.

4.4.5.1.1 Inventory Components —

The OTAG inventory contains data for all States that are partially or fully in the SUPROXA modeling domain. The SUPROXA domain was developed in the late 1980s as part of the EPA regional oxidant modeling (ROM) applications. EPA had initially used three smaller regional domains (Northeast, Midwest, and Southeast) for ozone modeling, but wanted to model the full effects of transport in the eastern United States without having to deal with estimating boundary conditions along relatively high emission areas. Therefore, these three domains were combined and expanded to form the Super Domain. The western extent of the domain was designed to allow for coverage of the largest urban areas in the eastern United States without extending too far west to encounter terrain difficulties associated with the Rocky Mountains. The Northern boundary was designed to include the major urban areas of eastern Canada. The southern boundary was designed to include as much of the United States as possible, but was limited to latitude 26°N, due to computational limitations of the photochemical models. (Emission estimates for Canada were not extracted from OTAG for inclusion in the NET inventory.)

The current SUPROXA domain is defined by the following coordinates:

North:	47.00°N	East:	67.00°W
South:	26.00°N	West:	99.00°W

Its eastern boundary is the Atlantic Ocean and its western border runs from north to south through North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas. In total, the OTAG Inventory completely covers 37 States and the District of Columbia.

The OTAG inventory is primarily an ozone precursor inventory. It includes emission estimates of VOC, NO_x, and CO for all applicable source categories throughout the domain. It also includes a small amount of SO_2 and PM-10 emission data that was sent by States along with their ozone precursor data. No quality assurance (QA) was performed on the SO_2 and PM-10 emission estimates for the OTAG inventory effort.

Since the underlying purpose of the OTAG inventory is to support photochemical modeling for ozone, it is primarily an average summer day inventory. Emission estimates that were submitted as annual emission estimates were converted to average summer day estimates using operating schedule data and default temporal profiles and vice versa.

The OTAG inventory is made up of three major components: (1) the point source component, which includes segment/pollutant level emission estimates and other relevant data (e.g., stack parameters, geographic coordinates, and base year control information) for all stationary point sources in the domain; (2) the area source component, which includes county level emission estimates for all stationary area sources and non-road engines; and (3) the on-road vehicle component, which includes county/roadway functional class/vehicle type estimates of VMT and MOBILE5a input files for the entire domain. Of these three components, the NET inventory extracted all but the utility emissions. (See section 4.2 for a description of the utility NET emissions and section 4.6 for the on-road mobile NET emissions.)

4.4.5.1.2 Interim Emissions Inventory (OTAG Default) —

The primary data sources for the OTAG inventory were the individual States. Where States were unable to provide data, the 1990 Interim Inventory [15] and National Particulate Inventory (NPI)[16] was used for default inventory data. A more detailed description of the 1990 Interim Inventory is presented in section 4.4.3.

4.4.5.1.3 State Data Collection Procedures —

Since the completion of the Interim Inventory in 1992, many States had completed 1990 inventories for ozone nonattainment areas as required for preparing SIPs. In addition to these SIP inventories, many States had developed more comprehensive 1990 emission estimates covering their entire State. Since these State inventories were both more recent and more comprehensive than the 1990 Interim Inventory, a new inventory was developed based on State inventory data (where available) in an effort to develop the most accurate emission inventory to use in the OTAG modeling.

On May 5, 1995, a letter from John Seitz (Director of EPA's Office of Air Quality Planning and Standards [OAQPS]) and Mary Gade (Vice President of ECOS) to State Air Directors, States were requested to supply available emission inventory data for incorporation into the OTAG inventory.[17] Specifically, States were requested to supply all available point and area source emissions data for VOC, NO_x, CO, SO_2, and PM-10, with the primary focus on emissions of ozone precursors. Some emission inventory data were received from 36 of the 38 States in the OTAG domain. To minimize the burden to the States, there was no specified format for submitting State data. The majority of the State data was submitted in one of three formats:

1) an Emissions Preprocessor System Version 2.0 (EPS2.0) Workfile
2) an ad hoc report from AIRS/FS
3) data files extracted from a State emission inventory data base

The origin of data submitted by each State is described in section 4.4.5.1.4.1 for point sources and 4.4.5.1.4.2 for area sources.

4.4.5.1.4. State Data Incorporation Procedures/Guidelines —

The general procedure for incorporating State data into the OTAG Inventory was to take the data "as is" from the State submissions. There were two main exceptions to this policy. First, any inventory

data for years other than 1990 was backcast to 1990 using BEA Industrial Earnings data by State and 2-digit SIC code. This conversion was required for five States that submitted point source data for the years 1992 through 1994. All other data submitted were for 1990.

Second, any emission inventory data that included annual emission estimates but not average summer day values were temporally allocated to produce average summer day values. This temporal allocation was performed for point and area data supplied by several States. For point sources, the operating schedule data, if supplied, were used to temporally allocate annual emissions to average summer weekday using Equation 4.4-5

$$EMISSIONS_{ASD} = EMISSIONS_{ANNUAL} * SUMTHRU * 1/(13 * DPW) \qquad \text{(Eq. 4.4-5)}$$

where:

$EMISSIONS_{ASD}$	=	average summer day emissions
$EMISSIONS_{ANNUAL}$	=	annual emissions
SUMTHRU	=	summer throughput percentage
DPW	=	days per week in operation

If operating schedule data were not supplied for the point source, annual emissions were temporally allocated to an average summer weekday using EPA's default Temporal Allocation file. This computer file contains default seasonal and daily temporal profiles by SCC. Equation 4.4-6 was used.

$$EMISSIONS_{ASD} = EMISSIONS_{ANNUAL} / (SUMFAC_{SCC} * WDFAC_{SCC}) \qquad \text{(Eq. 4.4-6)}$$

where:

$EMISSIONS_{ASD}$	=	average summer day emissions
$EMISSIONS_{ANNUAL}$	=	annual emissions
$SUMFAC_{SCC}$	=	default summer season temporal factor for SCC
$WDFAC_{SCC}$	=	default summer weekday temporal factor for SCC

There were a small number of SCCs that were not in the Temporal Allocation file. For these SCCs, average summer weekday emissions were assumed to be the same as those for an average day during the year and were calculated using Equation 4.4-7.

$$EMISSIONS_{ASD} = EMISSIONS_{ANNUAL} / 365 \qquad \text{(Eq. 4.4-7)}$$

where:

$EMISSIONS_{ASD}$	=	average summer day emissions
$EMISSIONS_{ANNUAL}$	=	annual emissions

4.4.5.1.4.1 Point. For stationary point sources, 36 of the 38 States in the OTAG domain supplied emission estimates covering the entire State. Data from the 1990 Interim Inventory were used for the two States (Iowa and Mississippi) that did not supply data. Most States supplied 1990 point source data, although some States supplied data for later years because the later year data reflected significant improvements over their 1990 data. Inventory data for years other than 1990 were backcast to 1990 using BEA historical estimates of industrial earnings at the 2-digit SIC level. Table 4.4-5 provides a brief description of the point source data supplied by each State.

4.4.5.1.4.2 Area. For area sources, 17 of the 38 States in the OTAG domain supplied 1990 emission estimates covering the entire State, and an additional nine States supplied 1990 emission estimates covering part of their State (partial coverage was mostly in ozone nonattainment areas). 1990 Interim Inventory data were the sole data source for 12 States. Where the area source data supplied included annual emission estimates, the default temporal factors were used to develop average summer daily emission estimates. Table 4.4-6 provides a brief description of the area source data supplied by each State.

4.4.5.1.4.4 Rule Effectiveness. For the OTAG inventory, States were asked to submit their best estimate of 1990 emissions. There was no requirement that State-submitted point source data include rule effectiveness for plants with controls in place in that year. States were instructed to use their judgment about whether to include rule effectiveness in the emission estimates. As a result, some States submitted estimates that were calculated using rule effectiveness, while other States submitted estimates that were calculated without using rule effectiveness.

The use of rule effectiveness in estimating emissions can result in emission estimates that are much higher than estimates for the same source calculated without using rule effectiveness, especially for sources with high control efficiencies (95 percent or above). Because of this problem, there was concern that the OTAG emission estimates for States that used rule effectiveness would be biased to larger estimates relative to States that did not include rule effectiveness in their computations.

To test if this bias existed, county-level maps of point source emissions were developed for the OTAG domain. If this bias did exist, one would expect to see sharp differences at State borders between States using rule effectiveness and States not using rule effectiveness. Sharp State boundaries were not evident in any of the maps created. Based on this analysis, it was determined that impact of rule effectiveness inconsistencies was not causing large biases in the inventory.

4.4.5.2 Grand Canyon Visibility Transport Commission Inventory

The GCVTC inventory includes detailed emissions data for 11 States: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.[18] This inventory was developed by compiling and merging existing inventory data bases. The primary data sources used were State inventories for California and Oregon, AIRS/FS for VOC, NO_x, and SO_2 point source data for the other nine States, the 1990 Interim Inventory for area source data for the other nine States, and the 1985 NAPAP inventory for NH_3 and TSP data. In addition to these existing data, the GCVTC inventory includes newly developed emission estimates for forest wildfires and prescribed burning.

After a detailed analysis of the GCVTC inventory, it was determined that the following portions of the GCVTC inventory would be incorporated into the PM inventory:

- complete point and area source data for California
- complete point and area source data for Oregon
- forest wildfire data for the entire 11-State region
- prescribed burning data for the entire 11-State region

State data from California and Oregon were incorporated because they are complete inventories developed by the States and are presumably based on more recent, detailed and accurate data than the Interim Inventory (some of which is still based on the 1985 NAPAP inventory). The wildfire data in the GCVTC inventory represent a detailed survey of forest fires in the study area and are clearly more accurate than the wildfire data in the Interim Inventory. The prescribed burning data in the GCVTC inventory are the same as the data in the Interim Inventory at the State level, but contain more detailed county-level data.

Point source emission estimates in the GCVTC inventory from States other than California and Oregon came from AIRS/FS. Corrections were made to this inventory to the VOC and PM emissions. The organic emissions reported in GCVTC inventory for California are total organics (TOG). These emissions were converted to VOC using the profiles from EPA's SPECIATE[19] data base. Since the PM emissions in the GCVTC were reported as both TSP and PM-2.5, EPA estimated PM-10 from the TSP in a similar manner as described in section 4.4.3.

4.4.5.3 AIRS/FS

SO_2 and PM-10 (or PM-10 estimated from TSP) sources of greater than 250 tons per year as reported to AIRS/FS that were not included in either the OTAG or GCVTC inventories were appended to the NET inventory. The data were extracted from AIRS/FS using the data criteria set listed in Table 4.4-7. The data elements extracted are also listed in Table 4.4-7. The data were extracted in late November 1996. It is important to note that *default estimated* emissions were extracted.

4.4.5.4 Data Gaps

As stated above, the starting point for the 1990 NET inventory is the OTAG, GCVTC, AIRS, and 1990 Interim Inventory. Data added to these inventories include estimates of SO_2, PM-10, PM-2.5, and NH_3, as well as annual or ozone season daily (depending on the inventory) emission estimates for all pollutants. This section describes the steps taken to fill in the gaps from the other inventories.

4.4.5.4.1 SO_2 and PM Emissions —

For SO_2 and PM-10, State data from OTAG were used where possible. (The GCVTC inventory contained SO_2 and PM annual emissions.) In most cases, OTAG data for these pollutants were not available. For point sources, data for plants over 250 tons per year for SO_2 and PM-10 were added from AIRS/FS. The AIRS/FS data were also matched to the OTAG plants and the emissions were attached to existing plants from the OTAG data where a match was found. Where no match was found to the plants in the OTAG data, new plants were added to the inventory. For OTAG plants where there were no matching data in AIRS/FS and for all area sources of SO_2 and PM-10, emissions were calculated based on the emission estimates for other pollutants.

The approach to developing SO_2 and PM-10 emissions from unmatched point and area sources involved using uncontrolled emission factor ratios to calculate uncontrolled emissions. This method used SO_2 or PM-10 ratios to NO_x. NO_x was the pollutant utilized to calculate the ratio because (1) the types of sources likely to be important SO_2 and PM-10 emitters are likely to be similar to important NO_x sources and (2) the generally high quality of the NO_x emissions data. Ratios of SO_2/NO_x and PM-10/NO_x based on uncontrolled emission factors were developed. These ratios were multiplied by uncontrolled NO_x emissions to determine either uncontrolled SO_2 or PM-10 emissions. Once the uncontrolled emissions were calculated, information on VOC, NO_x, and CO control devices was used to determine if they also controlled SO_2 and/or PM-10. If this review determined that the control devices listed did not control SO_2 and/or PM-10, plant matches between the OTAG and Interim Inventory were performed to ascertain the SO_2 and PM-10 controls applicable for those sources. The plant matching component of this work involved only simple matching based on information related to the State and county FIPS code, along with the plant and point IDs.

There were two exceptions to the procedures used to develop the SO_2 and PM-10 point source estimates. For South Carolina, PM-10 emission estimates came from the Interim Inventory. This was because South Carolina had no PM data in AIRS/FS for 1990 and using the emission factor ratios resulted in unrealistically high PM-10 emissions. The residential nonwood SO_2 and PM emissions were also deemed too high for all States based on the above calculation. The emission estimates reverted to an earlier method as outlined in section 4.4.9.4.

There were no PM-2.5 data in either OTAG or AIRS/FS. Therefore, the point and area PM-2.5 emission estimates were developed based on the PM-10 estimates using source-specific uncontrolled particle size distributions and particle size specific control efficiencies for sources with PM-10 controls. To estimate PM-2.5, uncontrolled PM-10 was first estimated by removing the impact of any PM-10 controls on sources in the inventory. Next, the uncontrolled PM-2.5 was calculated by multiplying the uncontrolled PM-10 emission estimates by the ratio of the PM-2.5 particle size multiplier to the PM-10 particle size multiplier. (These particle size multipliers represent the percentage to total particulates below the specified size.) Finally, controls were reapplied to sources with PM-10 controls by multiplying the uncontrolled PM-2.5 by source/control device particle size specific control efficiencies.

4.4.5.4.2 NH_3 Emissions —

All NH_3 emission estimates incorporated into the NET Inventory came directly from EPA's NPI.[16] This methodology is the same as that reported in section 4.4.3 for the 1990 Interim Inventory. The NPI contained the only NH_3 emissions inventory available. (Any NH_3 estimates included in the OTAG or AIRS/FS inventory were eliminated due to sparseness of data.) As with SO_2 and PM-10, plant matching was performed for point sources. Emissions were attached to existing plants where there was a match. New plants were added for plants where there was no match.

4.4.5.4.4 Other Modifications —

Additional data were also used to fill data gaps for residential wood combustion and prescribed burning. Although these categories were in the OTAG inventory, the data from OTAG were not usable since the average summer day emissions were often very small or zero. Therefore, annual and average summer day emission estimates for these two sources were taken from the NET (detailed in sections 4.4.9.3 and 4.4.9.2).

Additional QA/quality control (QC) of the inventory resulted in the following changes:

- Emissions with SCCs of fewer than eight digits or starting with a digit greater than the number "6" were deleted because they are invalid codes.
- Tier assignments were made for all SCCs.
- Checked and fixed sources with PM-2.5 emissions which were greater than their PM-10 emissions.
- Checked and fixed sources with PM-10 emissions greater than zero and PM-2.5 emissions equal to zero.

4.4.6 How Did EPA Develop Emissions for 1991 to 1994?

The 1991 through 1994 area source emissions were grown in a similar manner as the 1985 through 1989 estimates, except for using a different base year inventory. The base year for the 1991 through 1994 emissions is the 1990 NET inventory. The point source inventory was also grown for those States that did not want their AIRS/FS data used. (The list of States are detailed in the AIRS/FS subsection, 4.4.6.2.) For those States requesting that EPA extract their data from AIRS/FS, the years 1990 through 1995 were downloaded from the EPA IBM Mainframe. The 1996 emissions were not extracted since States are not required to have the 1996 data uploaded into AIRS/FS until July 1997.

4.4.6.1 Grown Estimates

The 1991 through 1994 point and area source emissions were grown using the 1990 NET inventory as the basis. The algorithm for determining the estimates is detailed in section 4.4.3.3. The 1990 through 1996 SEDS and BEA data are presented in Tables 4.4-8 and 4.4-9. The 1996 BEA and SEDS data were determined based on linear interpretation of the 1988 through 1995 data. Point sources were projected using the first two digits of the SIC code by State. Area source emissions were projected using either BEA or SEDS. Table 4.4-10 lists the SCC and the source for growth.

The 1990 through 1996 earnings data in BEA Table SA-5 (or estimated from this table) are expressed in nominal dollars. In order to be used to estimate growth, these values were converted to constant dollars to remove the effects of inflation. Earnings data for each year were converted to 1992 constant dollars using the implicit price deflator for PCE. The PCE deflators used to convert each year's earnings data to 1992 dollars are:

Year	1992 PCE Deflator
1990	93.6
1991	97.3
1992	100.0
1993	102.6
1994	104.9
1995	107.6
1996	109.7

4.4.6.2 AIRS/FS

Several States responded to EPA's survey and requested that their 1991 through 1995 estimates reflect their emissions as reported in AIRS/FS. The list of these States, along with the years available in AIRS/FS is given in Table 4.4-11. As described in section 4.4.5.3, default estimated annual and ozone season daily emissions (where available) were extracted from AIRS/FS. Some changes were made to these AIRS/FS files. For example, the default emissions for some States contain rule effectiveness and the emissions were determined to be too high by EPA. The emissions without rule effectiveness were extracted from AIRS/FS and replaced the previously high estimates. The changes made to select State and/or plant AIRS/FS data are listed below.

- Louisiana — All VOC source emissions were re-extracted to obtain emissions without rule effectiveness for the year 1994.
- Colorado - Mastercraft — The VOC emissions were reported as ton/year in the initial download from AIRS. The units were changed to pounds/year in AIRS.
- Wisconsin - Briggs and Stratton — The VOC emissions for two SCCs were changed from with rule effectiveness to without rule effectiveness for the years 1991, 1993, and 1994.

As noted in Table 4.4-11, several States did not report emissions for all pollutants for all years for the 1990 to 1995 time period. To fill these data gaps, EPA applied linear interpolation or extrapolated the closest two years worth of emissions at the plant level. If only one year of emissions data were available, the emission estimates were held constant for all the years. The segment-SCC level emissions were derived using the average split for all available years. The non-emission data gaps were filled by using the most recent data available for the plant.

As described in section 4.4.5.4.1, many States did not provide PM-10 emissions to AIRS. These States' TSP emissions were converted to PM-10 emissions using uncontrolled particle size distributions and AP-42 derived control efficiencies. The PM-10 emissions are then converted to PM-2.5 in the same manner as described in section 4.4.3.3. The State of South Carolina provided its own conversion factor for estimating PM-10 from TSP.[20]

For all sources that did not report ozone season daily emissions, these emissions were estimated using the algorithm described in section 4.4.5.1.4 and equations 4.4-5 through 4.4-7.

4.4.7 How were 1995 Emissions Prepared?

The 1995 emission estimates were derived in a similar manner as the 1991 through 1994 emissions. The estimates were either extracted from AIRS/FS for 1995, estimated using AIRS/FS data for the years 1990 through 1994, or projected using the 1990 NET inventory. The method used depended on the States' responses to a survey conducted by EPA early in 1997. A description of the AIRS/FS methodology is described in section 4.4.6. The following three subsections describe the projected emissions.

4.4.7.1 Grown Estimate

The 1995 point and area source emissions were grown using the 1990 NET inventory as the basis. Growth factors were prepared for each year using either SEDS annual fuel consumption data or BEA national earnings by industry. The 1990 through 1996 SEDS and BEA data are presented in Tables 4.4-8 and 4.4-9. The algorithm for determining the estimates is detailed in section 4.4.3.3.

4.4.7.2 NO_x RACT

Major stationary source NO_x emitters in marginal and above nonattainment areas and in ozone transport regions (OTRs) are required to install Reasonably Available Control Technology (RACT)-level controls under the ozone nonattainment related provisions of Title I of the 1990 Clean Air Act Amendments (CAAA). The definition of major stationary source for NO_x differs by the severity of the ozone problem as shown in Table 4.4-12.

NO_x RACT controls for non-utility sources that were modeled for the 1995 NET emissions are shown in Table 4.4-13. These RACT-level controls were applied to point source emitters with emissions at or above the major source size definition for each area. The application of NO_x RACT controls was only applied to grown sources.

4.4.7.3 Rule Effectiveness

Rule effectiveness was revised in 1995 for all grown sources using the information in the 1990 data base file. If the rule effectiveness value was between 0 and 100 percent in 1990 and the control efficiency was greater than 0 percent, the uncontrolled emissions were calculated for 1990. The 1995 emissions were calculated by multiplying the growth factor by the 1990 uncontrolled emissions and the control efficiency and a rule effectiveness of 100 percent. The adjustment for rule effectiveness was only applied to grown sources.

4.4.8 How Did EPA Develop the 1996 NET Inventory?

The 1996 emission estimates were derived in a similar manner as the 1995 emissions. For point sources, the 1995 AIRS/FS emissions and 1995 emissions grown from 1990 emissions were merged. The following describes the projected 1996 emissions. No controls were added to the 1996 emissions.

The 1996 point and area source emissions were grown using the 1995 NET inventory as the basis. The algorithm for determining the estimates is described by Equation 4.4-8. The 1990 through 1996 SEDS and BEA data are presented in Tables 4.4-8 and 4.4-9. The 1996 BEA and SEDS data were determined using linear interpretation of the 1988 through 1995 data. Rule effectiveness was updated to 100 percent as described in section 4.4.7.3 for the AIRS/FS sources that reported rule effectiveness of less than 100 percent in 1995.

The following equation describes the calculation used to estimate the 1996 emissions:

$$CER_{1996} = UC_{1995} \times \frac{GS_{1996}}{GS_{1995}} \times \left(1 - \left(\frac{REFF}{100}\right) \times \left(\frac{CEFF}{100}\right) \times \left(\frac{RP}{100}\right)\right) \quad \text{(Eq. 4.4-8)}$$

where:
- CER_{1996} = controlled emissions incorporating rule effectiveness
- UC_{1995} = uncontrolled emissions
- GS = growth surrogate (either BEA or SEDS data)
- REFF = rule effectiveness (percent)
- CEFF = control efficiency (percent)
- RP = rule penetration (percent)

The rule effectiveness for 1996 was always assumed to be 100 percent. The control efficiencies and rule penetrations are 100 percent since no additional controls were applied.

Subsequently, EPA has been revising the 1996 NET to include base year emissions data submitted by State/local agencies to comply with the CAAA requirements to submit (1) periodic emissions inventories (PEI) every 3 years for ozone nonattainment areas (NAAs), and (2) emissions data for major point sources annually. States with ozone NAAs needed to submit their PEI for 1996 by July 1997. While the CAAA only require submittal of ozone precursor pollutant data for the PEI requirements, annual point source reporting covers all criteria air pollutants. In its guidance provided to the State/local agencies on the PEI submittal process, EPA encouraged State/local agencies to submit emission estimates for all pollutants because the NET contains estimates for all criteria pollutants and is to be the ultimate repository of the State/local agency data. To reduce the burden of preparing this inventory, EPA gave each State/local agency a copy of the 1996 NET inventory as a starting point in preparing their 1996 base year emissions. Except for the source category methodologies discussed in section 4.4.9, the methodologies used to update the 1996 NET emissions are presented in section 4.3.8.4 of section 4.3 for "Industrial" sources.

4.4.9 Alternative Methodologies for Area Source Categories

The EPA methodologies for estimating emissions for the area source categories discussed in this section are different from the methodologies previously described. This section explains the methodologies applied to estimate emissions for 1990 through 1999 for forest fires/wildfires, prescribed/slash and managed burning, residential wood combustion, and structure fires. This section also explains the methodologies applied to estimate 1999 emissions for the open burning of residential MSW, leaves, and brush; and open burning of land clearing debris. Prior to 1996, emissions for these open burning categories were either grown from 1990 emissions as discussed in sections 4.4.3 through 4.4.8, or were not estimated. Table 4.4-14 summarizes the methods applied to estimate emissions for 1989-1999 for these area source categories. Table 4.4-15 summarizes the methods applied to prepare the 1996 base year inventory from 1996 through 1999 for each of the categories. Table 4.4-16 identifies the State/local agencies that submitted 1996 base year emissions for these categories. The State/local agency emissions replaced the EPA estimates in Versions 3 and 4 of the 1996 NET inventory.

Finally, this section discussed how 1990-1994 PM and SO_2 emissions for residential nonwood combustion sources were estimated. For these categories, sections 4.4.7 and 4.4.8 discuss the

methodologies applied to prepare 1995 and 1996 emissions, respectively. The methodologies for estimating 1997 through 1999 emissions are covered in section 4.4.10.

4.4.9.1 Forest Fires/Wildfires

Forest fire/wildfire emissions are classified under SCC 2810001000. EPA developed separate methodologies to estimate emissions for the non-GCVTC States and the 11 States included in the GCVTC inventory.

4.4.9.1.1 Non-Grand Canyon States —

4.4.9.1.1.1 Non-Grand Canyon States (1985-1998). Forest fire/wildfire emissions were generated for the years 1985 through 1998 using the data on the number of acres burned (obtained from the U.S. Department of Interior [DOI][21, 22] and the U.S. Forest Service [USFS][23, 24]), AP-42 emission factors, and AP-42 fuel loading factors.[25] Equation 4.4-9 summarizes the calculation.

$$E_{state} = Activity \times Fuel\ Loading \times EF \times UCF \qquad \text{(Eq. 4.4-9)}$$

where:

	E_{state}	=	annual State emissions (tons)
	Activity	=	sum of DOI, USFS, and State and private land acres burned (acres)
	Fuel Loading	=	average fuel loading for State (tons/acre)
	EF	=	emission factor (lbs/ton)
	UCF	=	unit conversion factor (1 ton /2,000 lbs)

Table 4.4-17 shows the emission factors and fuel loading factors developed from AP-42. PM-2.5 emissions were estimated by multiplying the PM-10 emissions by State-level ratios of PM-2.5 to PM-10 developed from the 1990 inventory for non-GCVTC States.

The EPA estimates for 1996 were replaced with emissions provided by the States identified in Table 4.4-16. At Kansas' request, the 1996 emissions submitted by Kansas were held constant for 1997 through 1999. For Florida, 1998 emissions for VOC, NO_x, CO, SO_2 and PM-10 were replaced with county-level emissions provided by Florida in 1999. Florida did not provide estimates for PM-2.5; therefore, PM-2.5 emissions were estimated by multiplying the PM-10 emissions by State-level ratios of PM-2.5 to PM-10 developed from the 1990 inventory for Florida.

4.4.9.1.1.2 Non-Grand Canyon States (1999). Emissions for 1998 were held constant for 1999 because complete activity data on the number of acres burned were not available for 1999.

4.4.9.1.2 Grand Canyon States —

4.4.9.1.2.1 Grand Canyon States (1986-1993). For the years 1986 through 1993, for the States of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming, the CO, NO_x, VOC, and PM-10 emissions calculated using the methodology described above were replaced by those included in the GCVTC inventory.[18] The GCVTC inventory provided county level emissions for forest fires. PM-2.5 emissions for 1990 were also replaced by those in the GCVTC inventory. For other years, PM-2.5 emissions were estimated using State-level ratios developed from

1990 emission estimates in the GCVTC inventory. The SO_2 emissions for these States were calculated using the AP-42 emission factor ratio equation shown below. The emission factors are shown in Table 4.4-17.

$$SO_2\ Emissions = \frac{SO_2\ EF}{NO_x\ EF} \times NO_x\ Emissions \qquad \text{(Eq. 4.4-10)}$$

where: SO_2 Emissions= annual county SO_2 emissions (tons)
SO_2 EF = AP-42 emission factor for SO_x (lbs/ton)
NO_x EF = AP-42 emission factor for NO_x (lbs/ton)
NO_x Emissions = annual NO_x emissions (tons)

4.4.9.1.2.2 Grand Canyon States (1985, 1994-1998). For the years 1985, and 1994 through 1998, for the States of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming, CO, NO_x, VOC, PM-10 and PM-2.5 emissions were calculated using Equation 4.4-11.

$$County\ Emissions_{year} = \frac{State\ Activity_{year}}{State\ Activity_{1990}} \times County\ Emissions_{1990} \qquad \text{(Eq. 4.4-11)}$$

where: County $Emissions_{year}$ = annual county emissions (tons)
State Activity = DOI, State and private, and National Forest Lands burned (acres)
County $Emissions_{1990}$ = annual county emissions provided by the GCVTC (tons)

4.4.9.1.2.3 Grand Canyon States (1999). Emissions for 1998 were held constant for 1999 because complete activity data on the number of acres burned were not available for 1999.

4.4.9.1.3 Activity —

The activity factor for wildfires is land acres burned. There are three sources of data for this activity: USFS acres burned, State and private acres burned,[23, 24] and DOI acres burned.[21, 22] Data from these three sources were summed to get the total acres burned for each State.

4.4.9.1.4 Fuel Loading and Emission Factors —

AP-42 fuel loading and emission factors are shown in Table 4.4-17.[25] An average fuel loading was determined for five regions in the United States. Emission factors for SO_2, NO_x, VOC, CO, and PM-10 were used.

4.4.9.1.5 County Distribution —

All non-GCVTC States were distributed to the county-level using the same county-level distribution as was used in the 1985 NAPAP Inventory. GCVTC provided county-level emissions for 1986 through 1993. GCVTC emissions were calculated for 1985, and 1994 through 1998 using the 1990 GCVTC emissions, as described above. For 1999, the 1998 emissions were held constant.

4.4.9.2 Prescribed/Slash and Managed Burning

EPA's estimates for prescribed/slash and managed burning are reported under SCC 2810015000 in the 1990-1999 NET inventories. Some State/local agencies have submitted emission estimates for prescribed burning under SCC 2810015000 and emissions for slash burning under SCC 2810005000. The emissions supplied by State/local agencies are included in the NET inventory and replace the EPA estimates.

The prescribed burning emissions were based on a 1989 USFS inventory of PM and air toxics from prescribed burning.[26] The USFS inventory contains State-level totals for total PM, PM-10, PM-2.5, CO, carbon dioxide, methane, non-methane, and several air toxics. This inventory also contains county-level emissions for PM-10 and VOC. The NO_x, CO, and SO_2 emissions were calculated by assuming the ratio between the VOC emissions to either the NO_x, CO or SO_2 emissions in the USFS inventory was equal to the corresponding ratio using the 1985 NAPAP inventory. Equation 4.4-12 was used.

$$FS_{POL} = FS_{VOC} \times \left(\frac{NAPAP_{POL}}{NAPAP_{VOC}} \right) \qquad \text{(Eq. 4.4-12)}$$

where:
- FS_{POL} = prescribed burning (NO_x, CO, or SO_2) emissions from USFS
- FS_{VOC} = prescribed burning VOC emissions from USFS
- $NAPAP_{POL}$ = prescribed burning (NO_x, CO, or SO_2) emissions from 1985 NAPAP
- $NAPAP_{VOC}$ = prescribed burning VOC emissions from 1985 NAPAP

The resulting 1989 emissions for CO, NO_x, PM-10, SO_2, and VOC are used for all years between 1985 and 1990.

4.4.9.2.1 1991-1999 Methodology

Emissions for 1990-1999 were estimated using a ratio method as developed for the Section 812 Prospective Analysis which held the number of acres burned on private lands constant, and projected growth for public lands based on development of a national growth factor of national statistics for acres burned. Using this data, a State-level ratio of public to total lands was calculated for 1987 using U.S. Forest Service Data.[26] The 1990 State-level emissions were then multiplied by this ratio to get a State-level distribution of emissions for public lands. Growth factors were then developed from the summation of USFS and DOI acres burned for each year. The number of acres burned on DOI lands was obtained from the following agencies: Bureau of Indian Affairs (BIA), Bureau of Land Management (BLM), Fish and Wildlife Service (FWS), and National Park Service (NPS). Using 1990 as the base year, national growth factors were calculated for years 1991-1995. Using 1996 as the base year, growth factors were calculated for years 1997-1999. If a calculated growth factor resulted in a value greater than 2.0, the growth factor was set at 2.0. These growth factors were then applied to the fraction of acres burned attributed to public lands. The calculated value was then added to the acreage burned on private lands (i.e., the acreage held constant) to obtain the emissions for each year through 1999. The emissions for each year were then distributed from the State level to the county level using the existing distribution for prescribed burning that exists in the 1990 NET.

4.4.9.3 Residential Wood

EPA emission estimates for residential wood combustion are classified under SCC 2104008001 (Residential Wood Combustion: Fireplaces). Currently, information is not available to determine how to distribute wood consumption between fireplaces and wood stoves. Therefore, emissions for this category are placed with one SCC. Note that when this methodology was first implemented, SCC 2104008000 (Total: Woodstoves and Fireplaces) was not available on which emissions for this category could be placed. For consistency reasons, it was decided to continue to report total residential wood combustion emissions under SCC 2104008001 after the SCC 2104008000 became available. Some State/local agencies reported 1996 emissions under SCCs for woodstoves. Table 4.4-17 identifies the agencies that submitted emissions, and the SCCs they used to report emissions. The emissions submitted by these agencies replaced the EPA estimates in the 1996 NET inventory.

Emissions from residential wood combustion were estimated for 1985 through 1999 using annual wood consumption and an emission factor. The following general equation (Equation 4.4-13) was used to calculate emissions:

$$E_{year} = Activity \times EF \times \left(1 - \frac{CE}{100}\right) \qquad \text{(Eq. 4.4-13)}$$

where: E_{year} = county emissions (tons)
Activity = wood consumption (cords)
EF = emission factor (tons/cord)
CE = control efficiency (percent)

Activity was based on EPA's County Wood Consumption Estimation Model.[27] This model was adjusted with heating degree day information,[28] and normalized with annual wood consumption estimates.[29] AP-42 emission factors for CO, NO_x, PM-10, PM-2.5, SO_2 and VOC were used. PM-2.5 emissions are assumed to be the same as PM-10 emissions.

4.4.9.3.1 Activity - County Model —

EPA's County Wood Consumption Estimation Model is based on 1990 data and provides county level estimates of wood consumption, in cords.[27] Model F of the overall Model was used to estimate the amount of residential wood consumed per county, using a sample set of 91 counties in the northeast and northwestern United States. Model F calculates estimates of cords of wood consumed per household as a function of the number of homes heating primarily with wood with a forced intercept of zero. Using the Model F results, the percentage of the population heating with wood, the number of households in a county, land area per county, and heating degree days, county-level wood consumption for 1990 was estimated.

The counties listed below show no residential wood consumption activity. The emissions for these 18 counties for the years 1985 through 1999 are zero.

State (FIPS)	County (FIPS)
Alaska (02)	Aleutians East Borough (013)
Hawaii (15)	Kalawao (005)
Kansas (20)	Kearny (093) Stanton (187)
Montana (30)	Yellowstone National Park (113)
Texas (48)	Cochran (079) Crockett (105) Crosby (107) Garza (169) Hartley (205) Jim Hogg (247) Loving (301) Moore (341) Reagan (383) Sterling (431) Swisher (437) Terrell (443) Yoakum (501)

4.4.9.3.2 Heating Degree Days —

A heating degree day is the number of degrees per day the daily average temperature is below 65 degrees Fahrenheit. These data were collected for one site in all States (except Texas and California where data were collected for two sites) for each month and summed for the year. An average of the two sites was used for Texas and California. This information is used to adjust the model, which is partially based on 1990 heating degree days, to the appropriate year's heating degree data. Equation 4.4-14 was used.

$$Adjusted\ Model_{year} = \frac{State\ hdd\ Total_{year}}{State\ hdd\ Total_{1990}} \times County\ Model_{1990} \qquad \text{(Eq. 4.4-14)}$$

where: Adjusted Model = county wood consumption (cords)
State hdd Total = total heating degree days (degrees Fahrenheit)
County Model = EPA model consumption (cords)

4.4.9.3.3 National Wood Consumption —

The Adjusted Model wood consumption estimate was normalized on a national level using the U.S. Department of Energy (DOE) estimate of residential U.S. wood consumption. This value is reported in trillion British thermal units (Btu) and is converted to cords by multiplying by 500,000. Consumption for

the years 1985, 1986, and 1988 were unavailable from the DOE. Known year's consumption and heating degree days were used to estimate these years. The 1985 DOE estimate was calculated using the ratio of 1985 total heating degree days to 1984 total heating degree days multiplied by the 1984 DOE wood consumption estimate. The 1986 DOE estimate was calculated using the ratio of 1986 total heating degree days to 1985 total heating degree days multiplied by the "calculated" 1985 DOE wood consumption estimate. The 1988 DOE estimate was calculated using the ratio of 1988 total heating degree days to 1987 total heating degree days multiplied by the 1987 DOE wood consumption estimate.

Equation 4.4-15 shows the normalization of the Adjusted Model.

$$Activity = Adjusted\ Model_{year} \times \frac{DOE_{year}}{\Sigma Adjusted\ Model_{year}} \qquad \text{(Eq. 4.4-15)}$$

where: Activity = normalized county consumption (cords)
Adjusted Model = county wood consumption (cords)
DOE = DOE national estimate of residential wood consumption (cords)

4.4.9.3.4 Emission Factors —

Emission factors were obtained from Table 1.10-1 of AP-42, *Emission Factors for Residential Wood Combustion*, for conventional wood stoves,[25] and are shown here in Table 4.4-18. Table 4.4-18 also shows the emission factors expressed in tons per cord consumed.

4.4.9.3.5 Control Efficiency —

A control efficiency was applied nationally to PM-10 and PM-2.5 residential wood combustion for the years 1991 through 1999.[30] The control efficiency for all pollutants for 1985 through 1990, and for VOC, NO_x, CO, and SO_2 for 1991 through 1999 is zero. Table 4.4-19 shows the control efficiencies for PM-10 and PM-2.5 for 1991 through 1999.

4.4.9.4 SO_2 and PM Residential Nonwood Combustion

The residential nonwood category includes SCCs 2104001000 (anthracite coal), 2104002000 (bituminous/subbituminous coal), 2104004000 (distillate oil), 2104005000 (residual oil), 21040060xx (natural gas), 2104007000 (liquified petroleum gas (LPG)), and 2104011000 (Kerosene) for all combustor or heater types.

The 1990 SO_2 and PM NET emissions are the same as the 1990 Interim Inventory emissions. EPA estimated 1991 through 1994 emissions by applying growth factors to the 1990 emissions. The growth factors were obtained from the prereleased E-GAS, version 2.0.[31] The EGAS generates growth factors at the SCC-level for counties representative of all counties within each ozone nonattainment area classified as serious and above, and for counties representative of all counties within both the attainment portions and the marginal and moderate nonattainment areas within each State. The appropriate growth factors were applied by county and SCC to the 1990 emissions as shown by Equation 4.4-16.

$$Emissions_{(county,SCC,year)} = Growth_{(county,SCC,year)} \times Emissions_{(county,SCC,1990)} \qquad \text{(Eq. 4.4-16)}$$

There are approximately 150 representative counties in EGAS 2.0 and 2000 SCCs present in the base year inventory. This yields a matrix of 300,000 growth factors generated to determine a single year's inventory. To list all combinations would be inappropriate.

4.4.9.5 Structure Fires

Structure fire emissions are reported under SCC 2810030000.

4.4.9.5.1 1985-1989 Methodology —

Structure fires were included in the 1985 NAPAP inventory because these fires can be sources of high-level, short-term emissions of air contaminants. The activity factor for this category was the total number of fires per county, and was multiplied by a fuel loading factor and emission factors to obtain the emission estimates. For the 1985 NAPAP inventory, the total national number of building fires was obtained from the 1985 statistics from the National Fire Protection Association (NFPA).[32] Since there were no data available to allocate the number of fires to the county level, an average of four fires per 1,000 population was assumed to occur each year.[32] The fuel loading factor was 6.8 tons per fire[5] and emission factors were taken from the OAQPS Technical Tables.[5]

4.4.9.5.2 1990 Methodology for County-Level Emissions Provided by OTAG States —

During development of the OTAG inventory, several States provided 1990 emissions for structure fires by county. Some States provided emissions for only a portion of the State (e.g., for nonattainment area counties). These emissions were included in the 1990 NET inventory when provided. The States did not provide any information on the methodologies they used to prepare the county-level emission estimates.

4.4.9.5.3 1990 Methodology for All Other Counties —

Work by the Emission Inventory Improvement Program (EIIP) identified a revision to the loading factor used to estimate emissions from structure fires. The revised loading factor of 1.15 tons per fire[33] was obtained from the California Air Resources Board (CARB).[33] For the non-OTAG States, and the counties for which OTAG States did not provide 1990 emissions, the 1990 emissions were prepared using the revised loading factor, county population in 1990, an average of four fires per 1,000 population, and pollutant-specific emission factors for VOC, NO_x, CO, SO_2, and PM-10. For PM-2.5, emissions are estimated by multiplying PM-10 emissions by 0.91.

4.4.9.5.4 1991-1995 Methodology for All States —

Using 1990 as the base year, 1991-1995 estimates were calculated using a growth factor calculated from a regression equation developed from EGAS. This equation was develop by relating national estimates of tons of material burned to population for 1972 through 1992. State-level population was then used as an input to predict the amount of material burned in each State using the regression equation. Both non-OTAG and OTAG States were grown using the equation. The equation is as follows:

$$GF_{sf} = b + m_1 x + m_2 x^2 \qquad \text{(Eq. 4.4-17)}$$

where: GF_{sf} = growth factor for structure fires
b (y intercept) = -66809.3

m_1 (slope)	=	0.721
x	=	State population (year)
m_2 (slope)	=	-0.000001744

4.4.9.5.5 1996 Methodology for County-Level Emissions Provided by OTAG States —

Unless a State/local agency provided 1996 base year emissions, the 1990 county-level emissions provided by OTAG States were grown using Equation 4.4-17 and year-specific population. The grown estimates were replaced with county-level emissions included in a State/local agency's inventory.

4.4.9.5.6 1996 Methodology for All Other Counties —

For 1996, estimates were developed using updated activity data and the revised loading factor for non-OTAG States. The U.S. Fire Administration maintains the National Fire Incident Reporting System (NFIRS). The NFIRS represents the most comprehensive data base of fire incident information currently available at a State level. However, since State participation in NFIRS is voluntary, it is incomplete. Currently, 42 States and the District of Columbia report data to NFIRS, and within these States, not all fire stations report data. Using the number of structure fires each State reported to NFIRS, and the percentage of fire stations reporting relative to the total number of fire stations within each State, the number of fires for each State was scaled up to estimate the actual number (i.e., reported and unreported) of fires occurring within a State for 1996. From these data, and from State population, State-specific per capita factors were developed and multiplied by the emission factors used for 1990 emissions to estimate Statewide emissions. State-level emissions were allocated to the county level using the ratio of county-to-State population for 1990.

The number of fires reported to NFIRS is scaled as follows to account for fire departments that did not report to NFIRS in 1996:

Percentage of Fire Departments Reporting= Number of Fire Departments Reporting/Number of Fire Departments

Scaled Number of Fires=Number of Fires/(Percentage of Fire Departments Reporting)

Then, the average number of fires/1,000 population is calculated using the scaled number of fires and State-level population for the current year obtained from the Census.

If the information needed to calculate the data was unavailable, the national NFPA default value of 2.18 fires/1,000 population was substituted. In addition, use of the NFIRS data for Alabama, Hawaii, and Washington State resulted in estimates of 0.28, 0.68, and 0.31 fires per 1,000 population, respectively. For Oklahoma, use of the NFIRS data yielded an estimate of 10.99 fires/1,000 population. Because the estimates for these four States were significantly outside of the range of the estimates for the other States reporting to NFIRS, the national NFPA default value of 2.18 fires/1,000 population was used to calculate emissions for each of the four States.

The average number of fires/1,000 population is multiplied by the State population to get the number of fires per State for that year. Table 4.4-20 shows the reference for the number of fires reported by State, and the average number of fires per 1,000 population used to estimate emissions for each State.

4.4.9.5.7 1997-1999 Methodology for All States —

Equation 4.4-17 was used to grow 1996 county-level emissions to 1997 through 1999, using year-specific population.

4.4.9.6 Open Burning Emission Estimates for the Year 1999

Emission estimates for open burning categories were updated for 1999 by obtaining more recent activity data, applying updated emission factors, and making further adjustments based on expected open burning practices. The open burning categories for which updated emission estimates were developed include:

SCC	SCC Name
2610030000	Residential municipal solid waste burning
2610000100	Residential leaf burning
2610000400	Residential brush burning
2610000500	Land clearing debris burning

Residential MSW refers to nonhazardous refuse produced by households (e.g., paper, plastics, metals, wood, glass, rubber, leather, textiles, and food wastes). Residential yard waste refers to materials such as leaves, trimmings from trees and shrubs, and grass. Land clearing debris refers to the clearing of land for new construction and the burning of organic material (i.e., trees, shrubs and other vegetation). The SCCs for residential brush burning and land clearing debris burning are new SCCs. Previous years estimates for open burning were reported under SCC 2610000000 (Total for all open burning categories). In the 1999 NET, this SCC was removed and the 1999 emissions were reported on the SCCs listed above to avoid double-counting of emissions.

4.4.9.6.1 How Did We Estimate Emissions for Residential Municipal Solid Waste (MSW) Burning? —

Emission estimates for residential MSW burning were developed by first estimating the amount of waste generated for each county in the United States. The method assumes that the amount of waste open burned can be estimated based on the total amount of waste generated. The amount of waste generated was estimated using a national average per capita waste generation factor, as reported in *Characterization of Municipal Solid Waste in the United States: 1998 Update*.[34] To better reflect the actual amount of household residential waste subject to being burned, non-combustibles (glass and metals) are subtracted out. In addition, since yard waste is considered a separate open burning category, yard waste generation was subtracted out as well. The latest available per capita waste generation factor was for 1997, and was estimated to be 3.28 lbs/person/day. This factor was then applied to the portion of the county's total population that is considered rural based on 1990 Census data on rural and urban population, since open burning is generally not practiced in urban areas.

The percentage of total waste generated that is burned was estimated from survey data as reported in *Emission Characteristics of Burn Barrels*.[35] This study estimated that for rural populations, 25 to

32 percent of the municipal waste generated is burned. A median value of 28 percent was assumed for the nation, and this correction factor was applied to the total amount of waste generated.

Controls (or burning bans) were accounted for by assuming that no burning takes place in counties where the urban population exceeds 80 percent of the total population (i.e., urban plus rural). Zero open burning emissions were attributed to these counties.

To summarize, the following steps were taken:

Step 1 - Estimate the amount of waste generated for each county in the United States using a national average per capita waste generation factor applied to the portion of the county's total population that is considered rural. Rural versus urban percentages for each county were obtained from 1990 Census data.

Step 2 - Estimate the amount of waste generated by rural populations that is burned using a correction factor of 0.28.

Step 3 - Estimate the emissions from MSW burning by applying emission factors as presented in Table 4.4-21.

4.4.9.6.2 How Did We Estimate Emissions for Residential Yard Waste Burning? —

Similar to residential MSW, a national per capita waste generation value was used as the basis for yard waste emissions for 1999. EPA's report *Characterization of Municipal Solid Waste in the United States: 1998 Update*,[34] reports an average daily value of 0.57 lbs yard waste/person/day. Of the total amount of yard waste generated, the yard waste composition was assumed to be 25 percent leaves, 25 percent brush, and 50 percent grass by weight. It was determined that open burning of grass clippings is not typically practiced by homeowners, and as such only estimates for leaf burning and brush burning were developed. Emissions for leaves and residential brush were calculated separately, since emission factors vary by yard waste type. It was assumed that 28 percent of the total yard waste generated is burned and that burning occurs primarily in rural areas, similar to the assumptions used for residential MSW burning.

To adjust for variations in vegetation, we obtained data on the percentage of forested acres from Version 3.1 of the Biogenic Emissions Landcover Database (BELD3) within EPA's Biogenic Emission Inventory System (BEIS). This data base contains the number of acres of rural forest, urban forest, agricultural land, and miscellaneous vegetation per county. We first determined the percentage of forested acres per county (including rural forest and urban forest). To better account for the native vegetation that would likely be occurring in the residential yards of farming States, we subtracted out the agricultural lands before calculating the percentage of forested acres. We then used the following ranges to make adjustments to the amount of yard waste that is assumed to be generated per county:

Percent forested acres per county	Adjustment for yard waste generated
< 10%	Zero out
>=10%, and <50%	Multiply by 50%
>=50%	Assume 100%

To summarize, the following steps were taken:

Step 1 - Estimate the amount of waste generated for each county in the United States using a national average per capita waste generation factor applied to the portion of the county's total population that is considered rural. Rural versus urban percentages for each county are obtained from 1990 Census data.

Step 2 - Estimate the amount of leaves, brush and grass waste generated by rural populations (by assuming 25 percent leaves, 25 percent brush, and 50 percent grass). Zero out the yard waste portion that corresponds to grass since it is assumed that grass is not burned.

Step 3 - Adjust the amount of yard waste generated per county using data on forested acres per county, discounting the number of acres of agricultural land.

Step 4 - Estimate the amount of brush and leaves that is burned using a correction factor of 0.28.

Step 5 - Estimate the emissions from each yard waste type using emission factors as presented in Table 4.4-21.

4.4.9.6.3 How Did We Estimate Emissions for Land Clearing Debris Burning? —

Activity data for this category are the acres cleared multiplied by a fuel loading factor. National data on the number of acres cleared for all States are not available from known data sources. As such, a value for the acres disturbed by construction activity must be estimated using surrogate data, which is then converted to acres using an appropriate conversion factor.[36] Three general types of construction are accounted for to estimate land clearing activity: 1) residential construction; 2) nonresidential construction; and 3) roadway construction. This approach assumes that all land clearing debris that is cleared is then burned.

The formula for calculating the county-level emissions from land clearing debris is:

$$Emissions = Acres \times LF \times EF$$

where: Acres = total acres disturbed by construction
LF = weighted loading factor to convert acres to tons of available fuel
EF = emission factor in lbs pollutant/ton of fuel

4.4.9.6.3.1 Residential Construction. For residential construction, housing permit data for single-family units, two-family units, and apartments were obtained at the county level from the U.S. Department of Commerce's (DOC) Bureau of the Census.[37] County permit data were then adjusted to

equal regional housing start data, which would more accurately reflect actual construction, also obtained from the Bureau of the Census.[38] Once the number of buildings in each category were estimated, the total acres disturbed by construction can be estimated by applying conversion factors to the available activity data for each category as follows:

- Single family - 1/4 acre/bldg
- Two-family - 1/3 acre/bldg
- Apartment - ½ acre/bldg

4.4.9.6.3.2 Nonresidential Construction. The emissions produced from the construction of nonresidential buildings are calculated using the value of construction put in place. The national value of construction put in place was obtained from the Bureau of the Census,[39] and was allocated to counties using construction employment data for SIC 154.[40] A conversion factor of 1.6 acres/10^6 dollars ($) was applied to the construction valuation data. This conversion factor was developed by adjusting the 1992 value of 2 acres/$10^6 to 1999 constant dollars using the Price and Cost Indices for Construction.

4.4.9.6.3.3 Road Construction. To estimate the acres disturbed by road construction, we first obtained Federal Highway Administration (FHWA) State expenditure data for capital outlay according to the following six classifications:[41]

- Interstate, urban
- Interstate, rural;
- Other arterial, urban;
- Other arterial, rural;
- Collectors, urban; and
- Collectors, rural

We obtained data from the North Carolina Department of Transportation (NCDOT) on the $/mile spent on various road construction projects.[42] For interstate expenditures, we used an average of $4 million/mile corresponding to freeways and interstate projects listed for: 1) new location; 2) widen existing 2-lane shoulder section; and 3) widen existing 4-lane w/ median. For expenditures on other arterial and collectors, we used an average of $1.9 million/mile corresponding to all other projects (excluding freeways and interstate projects) listed for: 1) new location; 2) widen existing 2-lane shoulder section; and 3) widen existing 4-lane w/ median.

Once the new miles of road constructed were estimated using the above $/mile conversions, then the miles were converted to acres for each of the 6 road types using the following estimates of acres disturbed per mile:

- Interstate, urban and rural; Other arterial, urban - 15.2 acres/mile
- Other arterial, rural - 12.7 acres/mile
- Collectors, urban - 9.8 acres/mile
- Collectors, rural - 7.9 acres/mile

State-level estimates of acres disturbed were then distributed to counties according to the housing starts per county (similar to residential construction). Once the number of acres disturbed per county was

estimated for each construction type, these values were added together to obtain a county-level estimate of total acres disturbed by land clearing.

The fuel loading at any given location will vary depending on the predominant vegetation in the area being cleared. Ideally, one would account for where within the county the land clearing is actually occurring, and what type of vegetation is being cleared. In the absence of these data, we used the BELD3 data base in BEIS to determine the number of acres of hardwoods, softwoods, and grasses in each county. Average loading factors[43] are weighted according to the percent contribution of each type of vegetation class to the total land area for each county. The loading factors for slash hardwood and slash softwood were further adjusted by a factor of 1.5 to account for the mass of tree that is below the soil surface that would also be subject to burning once the land is cleared. Average loading factors are as follows:

Fuel type	Fuel loading (tons/acre)[1]
Hardwood	99
Softwood	57[2]
Grass	4.5

[1]Original values for hardwood and softwood slash were adjusted by a factor of 1.5 to account for the mass of tree that is below the soil surface.
[2]This value represents the average of a loading factor value reported for long-needle pine slash (21 tons/acre) and mixed conifer slash (54 tons/acre).

4.4.10 How Were Nonutility Point and Area Source Emissions Prepared for the 1997 through 1999 NET?

Emissions for 1997 through 1999 for the Other Combustion categories were grown from the 1996 NET inventory. Section 4.3.9.1 for Industrial nonutility point and area sources explains how the growth factors and energy intensity factors were prepared and applied to estimate emissions for Versions 2, 3, and 4 1997 through 1999 of the NET. No control factors were applied to the 1996 emissions when preparing the 1997 through 1999 emissions for Other Combustion sources. As previously discussed, section 4.4.9 explains the methodologies applied to estimate 1996 through 1999 emissions for forest fires/wildfires, prescribed/slash and managed burning, residential wood combustion, and structure fires; and 1999 emissions for open burning.

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Table 4.4-1. Bureau of Economic Analysis's SA-5 National Changes in Earnings by Industry

Industry	SIC	Percent Growth from: 1985 to 1987	1987 to 1988	1988 to 1989	1989 to 1990
Wholesale trade	50, 51	5.01	5.87	2.44	-1.02
Retail trade	52 to 59	5.19	4.39	0.65	-0.94
Banking and credit agencies	60, 61	12.44	2.45	-0.33	-0.49
Insurance	63, 64	14.09	4.20	1.52	2.71
Real estate	65, 66	92.14	-6.98	-7.87	-0.48
Holding companies and investment services	67	39.05	-34.86	-12.18	16.91
Hotels and other lodging places	70	12.65	5.59	1.71	2.29
Personal services	72	7.17	2.35	7.44	5.41
Private households	88	-5.68	2.41	0.83	-3.69
Business and miscellaneous repair services	76	17.05	-17.34	5.79	4.34
Auto repair, services, and garages	75	6.65	2.46	3.00	3.93
Amusement and recreation services and motion pictures	78, 79	17.93	16.43	4.06	7.59
Health services	80	15.15	7.08	5.11	6.28
Legal services	81	20.14	9.92	4.09	4.80
Educational services	82	9.35	7.17	3.88	2.60
Social services and membership organizations	83	17.39	8.45	7.95	7.37
Miscellaneous professional services	84	11.28	5.04	7.08	4.12
Federal, civilian	91	-0.54	3.79	1.21	1.96
Federal, military	97	1.96	-1.07	-1.58	-3.19
State and local government	92 to 96	7.88	3.63	3.19	3.04

Table 4.4-2. Area Source Growth Indicators

NAPAP SCC	Category Description	Data Source	Growth Indicator
1	Residential Fuel - Anthracite Coal	SEDS	Res - Anthracite
2	Residential Fuel - Bituminous Coal	SEDS	Res - Bituminous
3	Residential Fuel - Distillate Oil	SEDS	Res - Distillate oil
4	Residential Fuel - Residual Oil		Zero growth
5	Residential Fuel - Natural Gas	SEDS	Res - Natural gas
6	Residential Fuel - Wood	BEA	Population
7	Commercial/Institutional Fuel - Anthracite Coal	SEDS	Comm - Anthracite
8	Commercial/Institutional Fuel - Bituminous Coal	SEDS	Comm - Bituminous
9	Commercial/Institutional - Distillate Oil	SEDS	Comm - Distillate oil
10	Commercial/Institutional - Residual Oil	SEDS	Comm - Residual oil
11	Commercial/Institutional - Natural Gas	SEDS	Comm - Natural gas
12	Commercial/Institutional - Wood	BEA	Services
60	Forest Wild Fires		Zero growth
61	Managed Burning - Prescribed		Zero growth
62	Agricultural Field Burning	BEA	Farm
64	Structural Fires		Zero growth
99	Minor Point Sources	BEA	Population

Table 4.4-3. SEDS National Fuel Consumption

Category	1985	1986	1987	1988	1989	1990
Anthracite Coal (thousand short tons)						
Commercial	524	494	478	430	422	410
Residential	786	740	717	646	633	615
Bituminous Coal (thousand short tons)						
Commercial	4,205	4,182	3,717	3,935	3,323	3,470
Residential	2,264	2,252	2,002	2,119	1,789	1,869
Distillate Fuel (thousand barrels)						
Commercial	107,233	102,246	101,891	98,479	91,891	95,385
Residential	171,339	173,736	176,822	182,475	178,629	184,501
Motor Gasoline (thousand barrels)						
All Sectors	2,493,361	2,567,436	2,630,089	2,685,145	2,674,669	2,760,414
Natural Gas (million cubic feet)						
Commercial	2,432	2,318	2,430	2,670	2,719	2,810
Residential	4,433	4,314	4,315	4,630	4,777	4,805
Residual Fuel (thousand barrels)						
Commercial	30,956	39,480	41,667	42,256	35,406	27,776

Table 4.4-4. AMS to NAPAP Source Category Correspondence

AMS		NAPAP	
SCC	**Category**	**SCC**	**Category**
Stationary Source Fuel Combustion			
2103001000	Commercial/Institutional - Anthracite Coal (Total: All Boiler Types)	7	Commercial/Institutional Fuel - Anthracite Coal
2103002000	Commercial/Institutional - Bituminous/Subbituminous Coal (Total: All Boiler Types)	8	Commercial/Institutional Fuel - Bituminous Coal
2103004000	Commercial/Institutional - Distillate Oil (Total: Boilers & I.C. Engines)	9	Commercial/Institutional - Distillate Oil
2103005000	Commercial/Institutional - Residual Oil (Total: All Boiler Types)	10	Commercial/Institutional - Residual Oil
2103006000	Commercial/Institutional - Natural Gas (Total: Boilers & I.C. Engines)	11	Commercial/Institutional - Natural Gas
2103008000	Commercial/Institutional - Wood (Total: All Boiler Types)	12	Commercial/Institutional - Wood
2104001000	Residential - Anthracite Coal (Total: All Combustor Types)	1	Residential Fuel - Anthracite Coal
2104002000	Residential - Bituminous/Subbituminous Coal (Total: All Combustor Types)	2	Residential Fuel - Bituminous Coal
2104004000	Residential - Distillate Oil (Total: All Combustor Types)	3	Residential Fuel - Distillate Oil
2104005000	Residential - Residual Oil (Total: All Combustor Types)	4	Residential Fuel - Residual Oil
2104006000	Residential - Natural Gas (Total: All Combustor Types)	5	Residential Fuel - Natural Gas
2104008000	Residential - Wood (Total: Woodstoves and Fireplaces)	6	Residential Fuel - Wood
Miscellaneous Area Sources			
2801500000	Agriculture Production - Crops - Agricultural Field Burning (Total)	62	Agricultural Field Burning
2801520000	Agriculture Production - Crops - Orchard Heaters (Total)	63	Frost Control - Orchard Heaters
2810001000	Other Combustion - Forest Wildfires (Total)	60	Forest Wild Fires
2810015000	Other Combustion - Managed (Slash/Prescribed) Burning (Total)	61	Managed Burning - Prescribed
2810030000	Other Combustion - Structure Fires	64	Structural Fires

Table 4.4-5. Point Source Data Submitted by OTAG States

State	Data Source/Format	Temporal Resolution	Year of Data	Adjustments to Data
Alabama	AIRS/FS - Ad hoc retrievals	Annual	1994	Backcast to 1990 using BEA. Average Summer Day estimated using methodology described above.
Arkansas	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using default temporal factors.
Connecticut	State - EPS Workfile	Daily	1990	None
Delaware	State - EPS Workfile	Daily	1990	None
District of Columbia	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Florida	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Georgia - Atlanta Urban Airshed (47 counties) domain	State - State format	Daily	1990	None
Georgia - Rest of State	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using default temporal factors.
Illinois	State - EPS Workfiles	Daily	1990	None
Indiana	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Kansas	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Kentucky - Jefferson County	Jefferson County - EPS Workfile	Daily	1990	None
Kentucky - Rest of State	State - EPS Workfile	Daily	1990	None
Louisiana	State - State Format	Annual	1990	Average Summer Day estimated using methodology described above.
Maine	State - EPS Workfile	Daily	1990	None
Maryland	State - EPS Workfile	Daily	1990	None
Massachusetts	State - EPS Workfile	Daily	1990	None
Michigan	State - State Format	Annual	1990	Average Summer Day estimated using methodology described above.
Minnesota	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Missouri	AIRS/FS - Ad hoc retrievals	Annual	1993	Backcast to 1990 using BEA. Average Summer Day estimated using methodology described above.
Nebraska	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
New Hampshire	State - EPS Workfile	Daily	1990	None
New Jersey	State - EPS Workfile	Daily	1990	None
New York	State - EPS Workfile	Daily	1990	None
North Carolina	State - EPS Workfiles	Daily	1990	None
North Dakota	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Ohio	State - State Format	Annual	1990	Average Summer Day estimated using methodology described above.
Oklahoma	State - State Format	Annual	1994	Backcast to 1990 using BEA. Average Summer Day estimated using methodology described above.
Pennsylvania - Allegheny County	Allegheny County - County Format	Daily	1990	None
Pennsylvania - Philadelphia County	Philadelphia County - County Format	Daily	1990	None
Pennsylvania - Rest of State	State - EPS Workfile	Daily	1990	None
Rhode Island	State - EPS Workfile	Daily	1990	None
South Carolina	AIRS/FS - Ad hoc retrievals	Annual	1991	Average Summer Day estimated using default temporal factors.
South Dakota	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.

Table 4.4-5 (continued)

State	Data Source/Format	Temporal Resolution	Year of Data	Adjustments to Data
Tennessee	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using default temporal factors.
Texas	State - State Format	Daily	1992	Backcast to 1990 using BEA.
Vermont	State - EPS Workfile	Daily	1990	None
Virginia	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
West Virginia	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Wisconsin	State - State Format	Daily	1990	None

Table 4.4-6. Area Source Data Submitted by OTAG States

State	Data Source/Format	Temporal Resolution	Geographic Coverage	Adjustments to Data
Connecticut	State - EPS Workfile	Daily	Entire State	None
Delaware	State - EPS Workfile	Daily	Entire State	None
District of Columbia	State - Hard copy	Daily	Entire State	None
Florida	AIRS/AMS - Ad hoc retrievals	Daily	Jacksonville, Miami/ Ft. Lauderdale, Tampa	Added Non-road emission estimates from Int. Inventory to Jacksonville (Duval County)
Georgia	State - State format	Daily	Atlanta Urban Airshed (47 Counties)	None
Illinois	State - State format	Daily	Entire State	None
Indiana	State - State format	Daily	Entire State	Non-road emissions submitted were county totals. Non-road emissions distributed to specific SCCs based on Int. Inventory
Kentucky	State - State Format	Daily	Kentucky Ozone Nonattainment Areas	None
Louisiana	State - State Format	Daily	Baton Rouge Nonattainment Area (20 Parishes)	None
Maine	State - EPS Workfile	Daily	Entire State	None
Maryland	State - EPS Workfile	Daily	Entire State	None
Michigan	State - State Format	Daily	49 Southern Michigan Counties	None
Missouri	AIRS/AMS- Ad hoc retrievals	Daily	St. Louis area (25 counties)	Only area source combustion data was provided. All other area source data came from Int. Inventory
New Hampshire	State - EPS Workfile	Daily	Entire State	None
New Jersey	State - EPS Workfile	Daily	Entire State	None
New York	State - EPS Workfile	Daily	Entire State	None
North Carolina	State - EPS Workfiles	Annual	Entire State	Average Summer Day estimated using default temporal factors.
Ohio	State - Hard copy	Daily	Canton, Cleveland Columbus, Dayton, Toledo, and Youngstown	Assigned SCCs and converted from kgs to tons. NO_x and CO from Int. Inventory added to Canton, Dayton, and Toledo counties.
Pennsylvania	State - EPS Workfile	Daily	Entire State	Non-road emissions submitted were county totals. Non-road emissions distributed to specific SCCs based on Int. Inventory
Rhode Island	State - EPS Workfile	Daily	Entire State	None
Tennessee	State - State format	Daily	42 Counties in Middle Tennessee	No non-road data submitted. Non-road emissions added from Int. Inventory
Texas	State - State Format	Annual	Entire State	Average Summer Day estimated using default temporal factors.
Vermont	State - EPS Workfile	Daily	Entire State	None
Virginia	State - EPS Workfile	Daily	Entire State	None
West Virginia	AIRS/AMS - Ad hoc retrievals	Daily	Charleston, Huntington/Ashland, and Parkersburg (5 counties total)	None
Wisconsin	State - State Format	Daily	Entire State	None

Table 4.4-7. Ad Hoc Report

Criteria		Plant Output		Point Output		Stack Output		Segment Output General		Segment Output Pollutant	
Regn	GT 0	YINV	YEAR OF INVENTORY	STTE	STATE FIPS CODE	STTE	STATE FIPS CODE	STTE	STATE FIPS CODE	STTE	STATE FIPS CODE
PLL4	CE VOC	STTE	STATE FIPS CODE	CNTY	COUNTY FIPS CODE	CNTY	COUNTY FIPS CODE	CNTY	COUNTY FIPS CODE	CNTY	COUNTY FIPS CODE
PLL4	CE CO	CNTY	COUNTY FIPS CODE	PNED	NEDS POINT ID	PNED	NEDS POINT ID	PNED	NEDS POINT ID	PNED	NEDS POINT ID
PLL4	CE SO2	CYCD	CITY CODE	PNUM	POINT NUMBER	STNB	STACK NUMBER	STNB	STACK NUMBER	STNB	STACK NUMBER
PLL4	CE NO2	ZIPC	ZIP CODE	CAPC	DESIGN CAPACITY	LAT2	LATITUDE STACK	PNUM	POINT NUMBER	PNUM	POINT NUMBER
PLL4	CE PM-10	PNED	NEDS POINT ID	CAPU	DESIGN CAPACITY UNITS	LON2	LONGITUDE STACK	SEGN	SEGMENT NUMBER	SEGN	SEGMENT NUMBER
PLL4	CE PT	PNME	PLANT NAME	PAT1	WINTER THROUGHPUT	STHT	STACK HEIGHT	SCC8	SCC	SCC8	SCC
DES4	GE 0	LAT1	LATITUDE PLANT	PAT2	SPRING THROUGHPUT	STDM	STACK DIAMETER	HEAT	HEAT CONTENT	PLL4	POLLUTANT CODE
DUE4	ME TY	LON1	LONGITUDE PLANT	PAT3	SUMMER THROUGHPUT	STET	STACK EXIT TEMPERATURE	FPRT	ANNUAL FUEL THROUGHPUT	D034	OSD EMISSIONS
YINV	ME 90	SIC1	STANDARD INDUSTRIAL CODE	PAT4	FALL THROUGHPUT	STEV	STACK EXIT VELOCITY	SULF	SULFUR CONTENT	DU04	OSD EMISSION UNITS
		OPST	OPERATING STATUS	NOHD	NUMBER HOURS/DAY	STFR	STACK FLOW RATE	ASHC	ASH CONTENT	DES4	DEFAULT ESTIMATED EMISSIONS
		STRS	STATE REGISTRATION NUMBER	NODW	NUMBER DAYS/WEEK	PLHT	PLUME HEIGHT	PODP	PEAK OZONE SEASON DAILY PROCESS RATE	DUE4	DEFAULT ESTIMATED EMISSIONS UNITS
				NOHY	NUMBER HOURS/YEAR					CLEE	CONTROL EFFICIENCY
										CLT1	PRIMARY CONTROL DEVICE CODE
										CTL2	SECONDARY CONTROL DEVICE CODE
										REP4	RULE EFFECTIVENESS
										DME4	METHOD CODE
										Emfa	Emission factor

Table 4.4-8. SEDS National Fuel Consumption, 1990-1996 (trillion Btu)

Fuel Type	End-User	Code	1990	1991	1992	1993	1994	1995	1996
Anthracite Coal									
	Commercial	ACCCB	12	11	11	11	11	11	11
	Residential	ACRCB	19	17	17	16	16	16	16
Bituminous Coal									
	Commercial	BCCCB	80	72	75	72	70	69	68
	Residential	BCRCB	43	39	40	40	40	39	39
Distillate Fuel									
	Commercial	DFCCB	487	482	464	464	450	435	422
	Residential	DFRCB	837	832	865	913	887	862	836
Kerosene									
	Commercial	KSCCB	12	12	11	14	13	12	11
	Residential	KSRCB	64	72	65	76	67	59	51
Liquid Petroleum Gas									
	Commercial	LGCCB	64	69	67	70	70	70	70
	Residential	LGRCB	365	389	382	399	398	397	397
Natural Gas									
	Commercial	NGCCB	2,698	2,808	2,884	2,996	3,035	3,074	3,114
	Residential	NGRCB	4,519	4,685	4,821	5,097	5,132	5,166	5,201
Residual Fuel									
	Commercial	RFCCB	233	213	191	175	170	168	167
Population									
		TPOPP	248,709	252,131	255,025	257,785	259,693	261,602	263,510

Table 4.4-9. BEA SA-5 National Earnings by Industry, 1990-1996 (million $)

Industry	LNUM	SIC	1990	1991	1992	1993	1994	1995	1996
Total population as of July 1 (thousands)	020	999	0	0	0	0	0	0	0
Total population as of July 1 (thousands)	030	999	1	1	1	1	1	1	1
Total population as of July 1 (thousands)	040	999	3,634	3,593	3,732	3,785	3,891	4,011	4,086
Total population as of July 1 (thousands)	041	999	238	242	248	253	265	273	280
Total population as of July 1 (thousands)	045	999	3,395	3,350	3,483	3,531	3,626	3,737	3,805
Total population as of July 1 (thousands)	046	999	971	947	907	914	934	980	981
Total population as of July 1 (thousands)	047	999	735	791	858	888	912	951	994
Total population as of July 1 (thousands)	050	999	2,932	2,891	2,975	3,003	3,082	3,182	3,231
Total population as of July 1 (thousands)	060	999	321	331	351	371	383	394	408
Total population as of July 1 (thousands)	070	999	381	370	405	410	426	436	447
Total population as of July 1 (thousands)	071	999	34	28	34	32	29	18	16
Total population as of July 1 (thousands)	072	999	347	342	372	378	396	418	432
Farm	081	1, 2	48	41	46	45	42	31	29
Farm	082	1, 2	3,586	3,552	3,686	3,740	3,849	3,980	4,058
Farm	090	1, 2	3,001	2,957	3,079	3,126	3,228	3,353	3,423
Agricultural services, forestry, fisheries, and other	100	7-9	24	24	24	24	26	27	27
Agricultural services, forestry, fisheries, and other	110	7-9	20	20	21	22	23	24	25
Agricultural services, forestry, fisheries, and other	120	7-9	4	3	3	3	3	3	3
Agricultural services, forestry, fisheries, and other	121	7-9	1	1	1	0	1	1	1
Agricultural services, forestry, fisheries, and other	122	7-9	2	2	2	2	2	2	1
Agricultural services, forestry, fisheries, and other	123	7-9	1	1	1	1	1	1	1
Agricultural services, forestry, fisheries, and other	200	7-9	36	37	36	34	35	35	35
Metal mining	210	10	2	3	3	2	2	2	3
Coal mining	220	11, 12	8	8	8	6	6	6	6
Oil and gas extraction	230	13	20	22	21	21	21	21	21
Nonmetallic minerals, except fuels	240	14	4	4	4	4	4	4	4
Construction	300	15-17	218	197	195	199	216	219	219
Construction	310	15-17	54	47	46	47	51	51	50
Construction	320	15-17	29	28	28	27	29	29	29
Construction	330	15-17	135	123	121	125	136	138	139
Manufacturing	400	998	710	690	705	705	725	740	747
Durable goods	410	996	437	418	423	424	440	452	456
Lumber and wood products	413	24	22	21	22	22	24	25	25
Furniture and fixtures	417	25	13	12	13	13	14	14	14
Stone, clay, and glass products	420	32	20	18	19	19	20	20	20
Primary metal industries	423	33	33	30	31	30	32	33	32
Fabricated metal products	426	34	51	48	49	49	51	53	53
Machinery, except electrical	429	35	86	83	83	84	86	90	91
Electric and electronic equipment	432	36	63	62	62	63	65	68	69
Motor vehicles and equipment	435	371	41	38	42	46	53	56	60
Transportation equipment, excluding motor vehicles	438	37	54	52	50	45	43	42	39
Instruments and related products	441	38	43	42	42	40	40	40	39
Miscellaneous manufacturing industries	444	39	11	11	11	12	12	12	12
Nondurable goods	450	997	273	272	281	282	285	288	291
Food and kindred products	453	20	51	51	52	52	53	53	54
Tobacco manufactures	456	21	3	3	3	2	2	3	3
Textile mill products	459	22	16	16	17	17	17	17	17
Apparel and other textile products	462	23	20	20	20	19	19	19	19
Paper and allied products	465	26	28	27	28	28	29	29	29
Printing and publishing	468	27	54	54	55	56	57	58	59
Chemicals and allied products	471	28	61	63	66	65	65	67	68
Petroleum and coal products	474	29	9	9	10	9	10	9	9
Rubber and miscellaneous plastic products	477	30	27	26	28	29	30	31	31
Leather and leather products	480	31	3	3	2	3	3	2	2

Table 4.4-9 (continued)

Industry	LNUM	SIC	1990	1991	1992	1993	1994	1995	1996
Leather and leather products	500	31	243	245	251	260	269	277	283
Railroad transportation	510	40	12	12	13	12	12	12	12
Trucking and warehousing	520	42	59	58	60	62	66	69	71
Water transportation	530	44	7	7	7	6	6	6	6
Water transportation	540	44	48	49	50	51	50	52	53
Local and interurban passenger transit	541	41	8	8	9	9	9	10	10
Transportation by air	542	45	30	30	31	31	31	31	31
Pipelines, except natural gas	543	46	1	1	1	1	1	1	1
Transportation services	544	47	12	13	14	14	15	16	17
Communication	560	48	63	63	64	67	71	75	78
Electric, gas, and sanitary services	570	49	49	52	53	56	56	56	57
Wholesale trade	610	50, 51	236	231	238	235	242	255	258
Retail trade	620	52-59	342	335	342	347	359	372	378
Retail trade	621	52-59	18	18	18	19	20	21	21
Retail trade	622	52-59	40	38	39	39	40	41	41
Retail trade	623	52-59	56	56	57	56	57	58	58
Retail trade	624	52-59	55	54	54	56	60	62	64
Retail trade	625	52-59	18	18	18	18	18	18	18
Retail trade	626	52-59	22	20	19	19	21	22	22
Retail trade	627	52-59	76	78	80	82	85	88	90
Retail trade	628	52-59	57	54	57	57	59	62	63
Retail trade	700	52-59	246	247	280	290	291	302	313
Banking and credit agencies	710	60, 61	82	81	86	89	89	90	91
Banking and credit agencies	730	60, 61	163	166	194	201	202	212	221
Banking and credit agencies	731	60, 61	38	40	50	53	51	55	58
Insurance	732	63, 64	56	59	61	62	63	63	65
Insurance	733	63, 64	34	33	33	34	36	37	38
Real estate	734	65, 66	28	25	36	43	44	47	51
Holding companies and investment services	736	62, 67	8	10	14	10	9	10	10
Services	800	995	946	951	1,008	1,032	1,066	1,128	1,164
Hotels and other lodging places	805	70	31	31	32	33	33	35	36
Personal services	810	72	33	32	33	36	36	36	37
Private households	815	88	10	9	10	10	10	11	11
Business and miscellaneous repair services	820	76	170	162	175	180	191	213	221
Auto repair, services, and garages	825	75	29	28	28	30	31	33	34
Auto repair, services, and garages	830	75	15	13	13	14	14	15	15
Amusement and recreation services	835	78, 79	29	30	34	33	35	37	39
Amusement and recreation services	840	78, 79	16	16	16	17	18	20	20
Health services	845	80	290	304	325	330	341	355	368
Legal services	850	81	80	80	85	84	84	85	86
Educational services	855	82	39	41	42	44	45	46	48
Social services and membership organizations	860	83, 86	29	31	34	35	38	40	42
Social services and membership organizations	865	83, 86	1	1	1	1	2	2	2
Social services and membership organizations	870	83, 86	35	36	36	38	40	41	42
Social services and membership organizations	875	83, 86	125	121	127	130	132	141	145
Miscellaneous professional services	880	84, 87, 89	14	14	15	15	17	18	19
Government and government enterprises	900	995	585	594	607	613	621	626	635
Federal, civilian	910	43, 91, 97	118	120	123	124	125	123	124
Federal, military	920	992	50	50	51	48	45	44	43
State and local	930	92-96	417	425	433	441	451	459	468
State and local	931	92-96	125	128	128	130	134	136	138
State and local	932	92-96	292	297	305	311	317	323	330

Table 4.4-10. Area Source Listing by SCC and Growth Basis

SCC	SCC DESC	FILE	CODE
2103001000	Stationary Source Fuel Combustion Commercial/Institutional Anthracite Coal Total: All Boiler Types	SEDS	ACCCB
2103002000	Stationary Source Fuel Combustion Commercial/Institutional Bituminous/Subbituminous Coal Total: All Boiler Types	SEDS	BCCCB
2103004000	Stationary Source Fuel Combustion Commercial/Institutional Distillate Oil Total: Boilers and IC Engines	SEDS	DFCCB
2103005000	Stationary Source Fuel Combustion Commercial/Institutional Residual Oil Total: All Boiler Types	SEDS	RFCCB
2103006000	Stationary Source Fuel Combustion Commercial/Institutional Natural Gas Total: Boilers and IC Engines	SEDS	NGCCB
2103007000	Stationary Source Fuel Combustion Commercial/Institutional Liquified Petroleum Gas (LPG) Total: All Combustor Types	SEDS	LGCCB
2103008000	Stationary Source Fuel Combustion Commercial/Institutional Wood Total: All Boiler Types	BEA	400
2103011000	Stationary Source Fuel Combustion Commercial/Institutional Kerosene Total: All Combustor Types	SEDS	KSCCB
2199004000	Stationary Source Fuel Combustion Total Area Source Fuel Combustion Distillate Oil Total: Boilers and IC Engines	SEDS	DFTCB
2199005000	Stationary Source Fuel Combustion Total Area Source Fuel Combustion Residual Oil Total: All Boiler Types	SEDS	RFTCB
2199006000	Stationary Source Fuel Combustion Total Area Source Fuel Combustion Natural Gas Total: Boilers and IC Engines	SEDS	NGTCB
2199007000	Stationary Source Fuel Combustion Total Area Source Fuel Combustion Liquified Petroleum Gas (LPG) Total: All Boiler Types	SEDS	LGTCB
2199011000	Stationary Source Fuel Combustion Total Area Source Fuel Combustion Kerosene Total: All Heater Types	SEDS	KSTCB
2810001000	Miscellaneous Area Sources Other Combustion Forest Wildfires Total	NG	
2810003000	Miscellaneous Area Sources Other Combustion Cigarette Smoke Total	SEDS	TPOPP
2810005000	Miscellaneous Area Sources Other Combustion Managed Burning, Slash - (Use A28-10-015-000) Total	BEA	100
2810010000	Miscellaneous Area Sources Other Combustion [unknown]	BEA	100
2810025000	Miscellaneous Area Sources Other Combustion Charcoal Grilling Total	SEDS	TPOPP
2810035000	Miscellaneous Area Sources Other Combustion Firefighting Training Total	SEDS	TPOPP
2810050000	Miscellaneous Area Sources Other Combustion Motor Vehicle Fires Total	SEDS	TPOPP
2810060000	Miscellaneous Area Sources Other Combustion	SEDS	TPOPP

NOTE(S): * BEA Code is equal to LNUM on previous table.

Table 4.4-11. Emission Estimates Available from AIRS/FS by State, Year, and Pollutant

State	1990						1991						1992						1993						1994						1995					
	C	N	S	P	T	V	C	N	S	P	T	V	C	N	S	P	T	V	C	N	S	P	T	V	C	N	S	P	T	V	C	N	S	P	T	V
Alabama	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Alaska	✓	✓	✓		✓	✓													✓	✓	✓		✓	✓	✓	✓	✓		✓	✓						
Arizona	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
California	✓	✓	✓	✓	✓	✓													✓						✓	✓		✓	✓	✓						
Colorado	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Connecticut	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓
Hawaii	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Illinois	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Louisiana	✓	✓	✓		✓	✓													✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓						
Michigan	✓	✓	✓	✓	✓	✓													✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓
Minnesota	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Montana	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Nebraska	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
Nevada	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
New Hampshire	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
New Mexico	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
North Dakota	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓
Oregon	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pennsylvania	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
South Carolina																			✓	✓	✓		✓	✓												
South Dakota		✓	✓	✓	✓	✓		✓	✓	✓		✓		✓	✓	✓		✓		✓	✓	✓		✓		✓	✓	✓		✓		✓	✓	✓		✓
Texas	✓	✓	✓	✓	✓	✓													✓	✓	✓	✓	✓	✓							✓	✓	✓	✓		✓
Utah	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓		✓	✓		✓	✓		✓	✓		✓
Vermont	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Virginia	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Washington	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Wisconsin	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
Wyoming	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes: C = CO N = NO_2 S = SO_2 P = PM-10 T = TSP V = VOC

Pennsylvania only includes Allegheny County (State 42, County 003); New Mexico only includes Albuquerque (State 35, County 001); Washington only includes Puget Sound (State 53, County 033, 053, or 061); Nebraska includes all except Omaha City (State 31, County 055); the CO emissions in NET were maintained for South Dakota (State 46).

Table 4.4-12. NO_x and VOC Major Stationary Source Definition

Ozone Nonattainment Status	Major Stationary Source (tons)
Marginal/Moderate	100
Serious	50
Severe	25
Extreme	10
Ozone Transport Region	50

Table 4.4-13. Summary of Revised NO_x Control Efficiencies

Pod ID	Pod Name	Estimated Efficiency	Control
58	Commercial/Institutional - Coal	50	LNB
59	Commercial/Institutional - Oil	50	LNB
60	Commercial/Institutional - Gas	50	LNB

Controls: LNB - Low NO_x Burner

Table 4.4-14. Methods for Developing Annual Emission Estimates for Other Combustion Sources for the Years 1989-1999

For the category	For the years	For the pollutant(s)	EPA estimated emissions by
Forest Fires/Wildfires	1989-1998	VOC, NO_x, CO, SO_2, PM_{10}	1) Obtaining acres burned data at the State level for DOI, USFS, and State/private lands; 2) Applying AP-42 emission factors and fuel loading factors; 3) Distributing emissions to the county level. County distribution for non-GCVTC States and GCVTC States performed differently. Non-GCVTC States were distributed to the county level using 1985 NAPAP distribution. Emissions were distributed to counties using 1990 county-to-State level emissions in GCVTC inventory.
	1990-1998	$PM_{2.5}$	Multiplying PM_{10} emissions by State-level ratios of $PM_{2.5}/PM_{10}$ developed from 1990 inventory for non-GCVTC States. For GCVTC States, use State-level ratios developed from 1990 emission estimates they supplied. Emissions data supplied by State/local agencies replaced EPA default emission estimates.
	1999	PM_{10}, $PM_{2.5}$	Holding 1998 emissions constant.
Prescribed/Slash and Managed Burning	1989	VOC, PM_{10}	Obtaining county level emissions from the 1989 USDA Forest Service inventory of particulate matter and air toxics from prescribed burning.
	1989	NO_x, CO, SO_2	Assuming the ratio between VOC emissions to either NO_x, CO, and SO_2 emissions in the Forest Service inventory was equal to the corresponding emission ratios in the 1985 NAPAP prescribed burning inventory.
	1990	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Holding 1989 emissions constant, but incorporating State-supplied data into emission estimates.
	1991-1996	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Growing 1990 emissions to each year using growth factors developed from national acres burned data, and distributing the State-level emissions to the county-level using the existing distribution for prescribed burning in the 1990 NET. Emissions data supplied by State/local agencies replaced EPA default emission estimates.
	1997-1999	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Growing 1996 emissions to each year using growth factors developed from national acres burned data, and distributing the State-level emissions to the county-level using the existing distribution for prescribed burning in the 1990 NET.

Table 4.4-14 (continued)

For the category	For the years	For the pollutant(s)	EPA estimated emissions by
Residential Wood Combustion	1989	VOC, NO_x, CO, SO_2, PM_{10}	Updating county-level wood consumption estimates using national total for residential wood consumption, heating degree day data and AP-42 emission factor.
	1990	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Running the County Wood Consumption Estimation Model, which was adjusted with heating degree day information and normalized with annual wood consumption estimates.
	1991-1999	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Updating activity estimates using national total for residential wood consumption and heating degree days. AP-42 emission factors and a control efficiency are applied to emissions for counties classified as nonattainment areas. Emissions data supplied by State/local agencies replaced EPA default emission estimates.
Structure Fires	1989	VOC, NO_x, CO, SO_2, PM_{10}	Backcasting 1990 Interim Inventory Emissions with historical BEA data.
	1990 (Interim Inventory)	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Projecting 1985 NAPAP emissions.
	1990 (NET)	VOC, NO_x, CO, PM_{10}, $PM_{2.5}$	Supplementing 1990 Interim Inventory data with State-supplied data.
	1991-1996	VOC, NO_x, CO, PM_{10}, $PM_{2.5}$	Using updated activity data of number of fires per State, and the California Air Resources Board's revised loading factor of 1.15 tons/fire to develop emissions for non-OTAG States. For OTAG States, emissions are grown from 1990 using EGAS growth factors. Emissions data supplied by State/local agencies replaced EPA default emission estimates.
	1997-1999	VOC, NO_x, CO, PM_{10}, $PM_{2.5}$	Growing 1996 emissions to each year using EGAS regression equation that relates population to number of structure fires.

Table 4.4-14 (continued)

For the category	For the years	For the pollutant(s)	EPA estimated emissions by
Open Burning (Non-Ag, Non-Wildland)	1989	VOC, CO, SO_2, PM_{10}	Backcasting 1990 Interim Inventory Emissions with historical BEA data.
	1990 (Interim Inventory)	VOC, CO, SO_2, PM_{10}, $PM_{2.5}$	Projecting 1985 NAPAP emissions.
	1990 (NET)	VOC, CO, SO_2, PM_{10}, $PM_{2.5}$	Supplementing 1990 Interim Inventory data with State-supplied data.
	1991-1995	VOC, CO, SO_2, PM_{10}, $PM_{2.5}$	Projecting 1990 NET emissions to the appropriate year using BEA or SEDS data, and replacing projected data with State data where provided under OTAG or GCVTC, or State directed EPA to use AIRS/FS data.
	1996-1998	VOC, CO, SO_2, PM_{10}, $PM_{2.5}$	Projecting 1995 NET emissions to the appropriate year using BEA or SEDS data, and replacing projected data with data supplied by State/local agencies.
	1999	VOC, CO, SO_2, PM_{10}, $PM_{2.5}$	Updating emissions for residential municipal solid waste and yard waste by 1) obtaining 1999 population and waste generation activity data; 2) multiplying resulting activity by more current emission factors; and 3) making further adjustments based on expected open burning practices. Updating emissions for land clearing debris burning by 1) estimating the acres of land cleared due to residential, commercial, and road construction based on surrogate activity data, including residential units built, commercial valuation, and State highway expenditures; 2) applying vegetation-specific fuel loading factors (in tons/acre) to the acres cleared; and; 3) multiplying tons of fuel by more current emission factors.

Table 4.4-15. Comparison of Methodologies Used to Develop 1996 Base Year Emissions for Other Combustion Area Source Categories for Versions 1 through 4 of the NET Inventory

For the Category	For the Pollutant(s)	EPA estimated 1996 Base Year emissions for			
		Version 1 by	Version 2 by	Version 3 by	Version 4 by
Forest Fires/Wildfires	VOC, NO_x, CO, SO_2, PM_{10}	For all States 1) Obtaining acres burned data at the State level for DOI, USFS, and State/private lands; 2) Applying AP-42 emission factors and fuel loading factors; and 3) Distributing emissions to the county level. County distribution for non-GCVTC States and GCVTC States performed differently. State-level emissions for non-GCVTC States were distributed to the county level using 1985 NAPAP distribution. State-level emissions for GCVTC States were distributed to counties using ratio of county-to-State emissions for 1990 in GCVTC inventory.	Using same methodology as used in Version 1.	Using same methodology as used in Version 1. Emissions data supplied by State/local agencies replaced EPA default estimates.	Using same methodology as used in Version 1. Emissions data supplied by State/local agencies replaced EPA default estimates.
	$PM_{2.5}$	Multiplying PM_{10} emissions by 0.23.	Using same methodology as used in Version 1.	Using State-level ratios for $PM_{2.5}$ multiplied by county-level PM_{10} emissions to get current year $PM_{2.5}$ emission because 0.23 was not an accurate multiplier to estimate $PM_{2.5}$ emissions from PM_{10}. Emissions data supplied by State/local agencies replaced EPA default estimates.	Using same methodology as used in Version 3. Emissions data supplied by State/local agencies replaced EPA default estimates.
Prescribed/Slash and Managed Burning	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Growing 1990 emissions to each year using growth factors developed from national acres burned data, and distributing the State-level emissions to the county-level using the existing distribution for prescribed burning in the 1990 NET. Emissions data supplied by State/local agencies replaced EPA default emission estimates.	Using same methodology as used in Version 1.	Calculating a State-level ratio of public to total lands using U.S. Forest Service Data. Multiplying 1990 State-level emissions by this ratio to estimate prescribed burning emissions attributable to public lands. Holding private land acres constant and projecting growth for public lands based on national growth factor developed from national statistics for acres burned. Emissions data supplied by State/local agencies replaced EPA default estimates.	Using same methodology as used in Version 3. Emissions data supplied by State/local agencies replaced EPA default estimates.

Table 4.4-15 (continued)

For the Category	For the Pollutant(s)	EPA estimated 1996 Base Year emissions for Version 1 by	Version 2 by	Version 3 by	Version 4 by
Residential Wood	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Using annual wood consumption data for 1990 from EPA's County Wood Consumption Estimation Model. Adjusting 1990 model results using 1996 heating degree day information from the National Climatic Data Center, and normalizing it with U.S. DOE national estimate of residential wood consumption. Applying AP-42 emission factors and a control efficiency. Applying a national control efficiency of 10.8% for PM_{10} and $PM_{2.5}$. For all other pollutants, the control efficiency was zero.	Using same methodology as used in Version 1.	Using same methodology as used in Version 1. Emissions data supplied by State/local agencies replaced EPA default estimates.	Using same methodology as used in Version 1. Emissions data supplied by State/local agencies replaced EPA default estimates.
Structure Fires	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Estimating 1996 BEA and SEDS data using linear interpolation of 1988 to 1995 data and growing from 1995 NET.	1) Revising methodology for 42 States and the District of Columbia using data from the National Fire Incident Reporting System (NFIRS) to develop a State-specific per capita factor. 2) Using this factor to allocate activity to the county level. 3) Using a national estimate of structure fires from the National Fire Protection Agency (NFPA) for any State that did not report to NFIRS. 4) Applying appropriate loading and emission factors. 5) Growing 1990 data, that was supplied by the remaining States under OTAG, to the current year using population as a surrogate.	Growing OTAG State emissions using an EGAS regression equation using 1990 as the base year. For non-OTAG States, applied loading factor of 1.15 tons/fire from the California Air Resources Board (CARB). Emissions data supplied by State/local agencies replaced EPA default estimates.	Using same methodology as used in Version 3. Emissions data supplied by State/local agencies replaced EPA default estimates.
Open Burning (Non-Ag., Non-Wildland)	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Using 1985 NAPAP inventory and SEDS or BEA data. Replacing any projected data with State data where provided under OTAG or GCVTC, or State directed EPA to use AIRS/FS data.	Using same methodology as used in Version 1.	Using same methodology as used in Version 1. Emissions data supplied by State/local agencies replaced EPA default estimates.	Using same methodology as used in Version 1. Emissions data supplied by State/local agencies replaced EPA default estimates.

Notes: Version 1 corresponds to December 1997 Trends report, Version 2 estimates correspond to December 1998 Trends report, Version 3 corresponds to March 2000 Trends report, and Version 4 is for report yet to be published.

Table 4.4-16. Other Combustion Area Source Categories: Summary of State-Submitted Emissions for 1996 Included in Versions 3 and 4 of the NET Inventory

Source Category/ SCC	State	Geographic Coverage	Temporal	VOC	NO_x	CO	SO_2	PM-10	PM-25	NH_3	1996 NET Version	Comments
Wildfires (2810001000)												
	CA	Statewide	Annual/Daily	x	x	x		x	x		3 and 4	
	DE	Statewide	Annual	x	x	x					4	
	KS	Statewide	Annual	x	x	x	x	x	x		3 and 4	
	LA	Statewide	Annual/Daily	x	x	x	x	x	x		3 and 4	
	MD	Statewide	Annual/Daily	x	x	x	x	x	x		3 and 4	
	VA	Statewide	Annual/Daily	x	x	x	x	x	x		3 and 4	
	AL	2 Counties	Annual/Daily	x	x	x	x	x	x		3 and 4	
	GA	13 Counties	Annual	x	x	x					4	
	TX	16 Counties	Annual/Daily	x	x	x	x	x	x		3 and 4	
Prescribed Burning (2810015000 and 2810005000)*												
	CA	Statewide	Annual	x	x	x		x	x		3 and 4	Emissions reported under both SCCs
	DE	Statewide	Annual	x		x					4	Emissions reported under both SCCs
	LA	Statewide	Annual/Daily	x	x	x	x	x	x		3 and 4	
	MD	Statewide	Annual/Daily	x	x	x		x			3 and 4	Emissions reported under both SCCs
	VA	Statewide	Annual/Daily	x	x	x	x	x	x		3 and 4	Emissions reported under both SCCs
	WA	Statewide	Annual/Daily	x	x	x	x	x	x		3 and 4	
	AL	2 Counties	Annual/Daily	x	x	x		x			3 and 4	Emissions reported under both SCCs
	GA	13 Counties	Annual	x		x					4	Emissions reported under both SCCs
	MO	4 Counties	Annual/Daily	x	x	x		x			3 and 4	
	TX	16 Counties	Annual/Daily	x	x	x	x	x	x		3 and 4	Emissions reported under both SCCs
Residential Wood (2104008000, 2104008001, 2104008010, 2104008030, 2104008050, 2104008051)												
	CA	Statewide	Annual/Daily	x	x	x	x	x	x		3 and 4	Emissions reported under SCCs 2104008001 and 2104008010
	CT	Statewide	Annual/Daily	x	x	x	x	x	x		3 and 4	Emissions reported under SCC 2104008001, 2104008030, 2104008050, and 2104008051
	DE	Statewide	Annual	x	x	x					4	Emissions reported under SCC 2104008051
	IN	Statewide	Annual/Daily	x	x	x					3 and 4	Emissions reported under SCC 2104008050
	LA	Statewide	Annual/Daily	x	x	x	x	x	x		3 and 4	Emissions reported under SCC 2104008001
	OK	Statewide	Annual/Daily	x	x	x	x	x	x		3 and 4	Emissions reported under SCC 2104008001
	VA	Statewide	Annual/Daily	x	x	x	x	x			3 and 4	Emissions reported under SCC 2104008000
	AL	2 Counties	Annual/Daily	x	x	x	x	x			3 and 4	Emissions reported under SCC 2104008000
	GA	13 Counties	Annual	x	x	x					4	Emissions reported under SCC 2104008000
	TX	16 Counties	Annual/Daily	x	x	x	x	x			3 and 4	Emissions reported under SCC 2104008000
Structure Fires (2810030000)												
	CA	Statewide	Annual/Daily	x	x	x		x	x		3 and 4	
	CT	Statewide	Annual/Daily	x	x	x		x	x		3 and 4	
	DE	Statewide	Annual	x	x	x					4	
	LA	Statewide	Annual/Daily	x	x	x		x	x		3 and 4	
	MD	Statewide	Annual/Daily	x	x	x		x	x		3 and 4	
	VA	Statewide	Annual/Daily	x	x	x		x	x		3 and 4	
	AL	2 Counties	Annual/Daily	x	x	x		x	x		3 and 4	
	GA	13 Counties	Annual	x	x	x					4	

Table 4.4-16 (continued)

Source Category/ SCC	State	Geographic Coverage	Temporal	VOC	NO_x	CO	SO_2	PM-10	PM-25	NH_3	1996 NET Version	Comments
	TX	16 Counties	Annual/Daily	x	x	x		x	x		3 and 4	
Open Burning (Non-Ag, Non-Wildland) (2610000000, 2610030000, 2610000100, 2610000400, 2610000500)**												
	CA	Statewide	Annual/Daily	x	x	x	x	x	x		3 and 4	Emissions reported under SCC 2610000000
	CT	Statewide	Annual/Daily	x	x	x					3 and 4	Emissions reported under SCC 2610000000
	DE	Statewide	Annual	x	x	x					4	Emissions reported under SCC 2610030000
	IN	Statewide	Annual/Daily	x	x	x	x	x	x		3 and 4	Emissions reported under SCC 2610030000
	LA	Statewide	Annual/Daily	x	x	x	x	x	x		3 and 4	Emissions reported under SCCs 2610000000 and 2610030000
	OK	Statewide	Annual/Daily	x	x	x	x	x	x		3 and 4	Emissions reported under SCC 2610030000
	VA	Statewide	Annual/Daily	x	x	x	x	x	x		3 and 4	Emissions reported under SCCs 2610000000 and 2610030000
	AL	2 Counties	Annual/Daily	x	x	x	x	x	x		3 and 4	Emissions reported under SCC 2610030000
	GA	13 Counties	Annual	x	x	x					4	Emissions reported under SCC 2610030000
	MO	6 Counties	Annual/Daily	x	x	x	x	x	x		3 and 4	Emissions reported under SCC 2610030000
	TX	16 Counties	Annual/Daily	x	x	x					3 and 4	Emissions reported under SCC 2610000000

* EPA emission estimates are for both prescribed and slash burning are reported under SCC 2810015000. Some State/local agencies have submitted emission estimates for prescribed burning under SCC 2810015000 and emissions for slash burning under SCC 2810005000.

** First two SCCs in Open Burning category are in 1996-1998 NET. In the 1999 NET, SCCs 2610000000 (Total for all open burning categories) was removed and emissions calculated by EPA were reported under SCCs 2610030000, 2610000100, 2610000400, and 2610000500.

Table 4.4-17. Wildfires

Region	Fuel loading Tons/Acre Burned
Rocky Mountain	37
Pacific	19
North Central	11
South	9
East	11

Pollutant	Emission Factor lbs/ton
TSP	17
SO_2	0.15
NO_x	4
VOC	19.2
CO	140
PM-10	13

States Comprising Regions

South	East	Rocky Mountain	North Central	Pacific
Alabama	Connecticut	Arizona	Illinois	Alaska
Arkansas	Delaware	Colorado	Indiana	California
Florida	Maine	Idaho	Iowa	Guam
Georgia	Maryland	Kansas	Michigan	Hawaii
Kentucky	Massachusetts	Montana	Minnesota	Oregon
Louisiana	New Hampshire	Nebraska	Missouri	Washington
Mississippi	New Jersey	Nevada	Ohio	
North Carolina	New York	New Mexico	Wisconsin	
Oklahoma	Pennsylvania	North Dakota		
South Carolina	Rhode Island	South Dakota		
Tennessee	Vermont	Utah		
Texas	West Virginia	Wyoming		
Virginia				

Table 4.4-18. Emission Factors for Residential Wood Combustion by Pollutant

Pollutant	Emission Factor (lbs/ton)	Emission Factor (tons/cord)
CO	230.80	1.342 E-1
NO_x	2.80	1.628 E-3
VOC	43.80	2.547 E-2
SO_2	0.40	2.326 E-4
PM-10[a]	30.60	1.779 E-2
PM-2.5[a]	30.60	1.779 E-2

[a]All PM is considered to be less than 2.5 microns.

Table 4.4-19. PM Control Efficiencies for 1991 through 1999

Year	Control Efficiency (%)
1991	1.4
1992	2.8
1993	4.8
1994	6.8
1995	8.8
1996-1999	10.8

Table 4.4-20. Basis for 1996 Structure Fire Emission Estimates

State	Reference for Activity or Emissions Data	Number of Fires per 1,000 Population
Alabama	NFPA	2.18
Alaska	NFIRS	2.08
Arizona	NFPA	2.18
Arkansas	NFIRS	4.40
California	NFIRS	1.96
Colorado	NFIRS	4.43
Connecticut	OTAG	NA
Delaware	OTAG	NA
District of Columbia	OTAG	NA
Florida	NFIRS	1.74
Georgia	NFIRS	3.70
Hawaii	NFPA	2.18
Idaho	NFIRS	2.61
Illinois	OTAG	NA
Indiana	OTAG	NA
Iowa	NFIRS	2.69
Kansas	NFIRS	2.69
Kentucky	NFIRS	1.66
Louisiana	NFIRS	2.58
Maine*	OTAG	NA
Maryland	OTAG	NA
Massachusetts	NFIRS	2.13
Michigan	NFIRS	2.23
Minnesota	NFIRS	1.79
Mississippi	NFPA	2.18
Missouri	NFPA	2.18
Montana	NFIRS	3.00
Nebraska	NFIRS	2.32
Nevada	NFPA	2.18
New Hampshire	OTAG	NA
New Jersey	OTAG	NA
New Mexico	NFIRS	2.83
New York	OTAG	NA
North Carolina	OTAG	NA
North Dakota	NFPA	2.18
Ohio	NFIRS	2.55
Oklahoma	NFPA	2.18
Oregon	NFPA	2.18
Pennsylvania	OTAG	NA
Rhode Island	OTAG	NA
South Carolina	NFIRS	2.02
South Dakota	NFIRS	2.35
Tennessee	NFIRS	4.14
Texas	OTAG	NA
Utah	NFIRS	1.49

Table 4.4-20 (continued)

State	Reference for Activity or Emissions Data	Number of Fires per 1,000 Population
Vermont*	OTAG	NA
Virginia	OTAG	NA
Washington	NFPA	2.18
West Virginia	NFIRS	2.48
Wisconsin	OTAG	NA
Wyoming	NFPA	2.18
United States		

NFPA=National Fire Protection Association; OTAG=Ozone Transport Assessment Group; and NFIRS=National Fire Incident Reporting System.
NA = Not applicable. Grew 1990 emissions supplied during development of 1990 OTAG inventory.

Table 4.4-21. Criteria Pollutant Emission Factors For Open Burning, lb/ton

SCC		VOC	NO_x	CO	SO_2	PM-10	PM-2.5	Source
2610030000	Residential MSW	30	6	85	1	38[1]	34.8[1]	AP-42, Table 2.5-1[25]
2610000100	Yard waste - leaves	28	NA	112	NA	38	38	AP-42, Table 2.5-6[25]
2610000400	Yard waste - brush	19	NA	140	NA	17	17	AP-42, Table 2.5-5[25]
2610000500	Land clearing debris	11.6	NA	169	NA	17	17	Ward, 1989

[1] PM-10 and PM-2.5 emission factors for residential MSW were obtained from a report, entitled "Evaluation of Emissions from the Open Burning of Household Waste in Barrels."[44]
NA = Not available

4.5 SOLVENT UTILIZATION

4.5.1 What sources are included in this category?

The point and area source categories under the "Solvent Utilization" heading include the following Tier I and Tier II categories:

Tier I Category	Tier II Category
(08) SOLVENT UTILIZATION	(01-07) All

4.5.2 What is EPA's Current Methodology for Estimating Emissions from Solvent Utilization?

EPA's methodologies for estimating emissions from solvent utilization apply to the years 1985 through 1999. EPA's current methodology for estimating solvent utilization emissions is to use emissions data submitted by State/local agencies wherever possible. However, for some State/local agencies that have either not supplied or not estimated emissions from some or all solvent utilization sources, the EPA uses the 1990 National Emissions Trends (NET) inventory as the base year from which emissions are grown through 1999.

The 1990 Interim Inventory was used as the base year from which emissions for 1985 to 1989 were estimated. As discussed under section 4.3.3 for "Industrial" point and area sources, the 1985 National Acid Precipitation Assessment Program (NAPAP) controlled emissions were grown to 1990 to serve as the starting point for preparing the 1990 Interim Inventory emissions. However, several changes were made to the 1990 emissions to improve the inventory prior to backcasting the emissions to 1985 through 1989. Consequently, the 1985 emissions estimated by this method do not match the 1985 NAPAP emission inventory. The factors used to backcast 1990 emissions to prior years are the same as the factors used to grow 1985 NAPAP emissions to 1990.

4.5.3 Are Pollutants Other than VOC Estimated for Solvent Utilization Sources?

Yes. Although VOC is the primary pollutant associated with solvent utilization, EPA includes estimates for other pollutants when information is available. For example, Version 4 of the 1996 through 1999 point source NET contains emissions for CO, NO_x, SO_2, PM-10, PM-2.5, and NH_3 for about half of the 383 Source Classification Codes (SCCs) grouped under the solvent utilization Tier I category.

4.5.4 How Did EPA Prepare Solvent Utilization Emissions for Point and Area Sources When Not Provided by State/Local Agencies?

The estimates in the 1990 NET inventory were developed using as much State/local agency data as possible. To understand the basis for emission estimates for 1991-1995, one needs to understand how the 1990 estimates were developed. For solvents, the 1990 NET inventory estimates were derived from one of four sources: 1) estimates prepared for the 1990 Ozone Transport Assessment Group (OTAG) inventory, 2) estimates prepared as part of the Grand Canyon Visibility Transport Commission (GCVTC) inventory, 3) Aerometric Information Retrieval System/Facility Subsystem (AIRS/FS), or 4) a mass balance approach that was used to develop the 1990 Interim Inventory.

The majority of emission estimates for 1991-1995 are derived by using growth factors to project the 1990 NET inventory to the appropriate year. The methodologies used to prepare 1991 through 1995 emissions for "Industrial" point and area sources are the same methodologies that were used to prepare point and area source solvent utilization emissions. To avoid duplication of the methodologies in this section, the reader is referred to sections 4.3.6 and 4.3.7 of section 4.3 for the methodologies applied to estimate solvent utilization emissions for 1991 through 1995.

The emissions in the NET for 1996 are a mixture of data received from the State/local agencies as part of their 1996 periodic emission inventory (PEI) submittals or annual submittal for major point sources, coupled with grown emissions from the previous version of the 1996 NET inventory. Growth factors used to project the 1996 inventory to 1997 through 1999 were developed using the Economic Growth Analysis System (EGAS) version 4 prototype. Additional details on the use of growth factors to project emissions for the years 1997-1999 are given in section 4.5.7.

4.5.5 How did EPA Develop the Solvent Portion of the 1990 NET Inventory?

EPA developed the NET by using State/local agency data and filling in the data gaps with the 1990 Interim Inventory data. (See section 4.5.1, page 140 of Reference 1 for details on how solvent emissions were developed for the 1990 Interim Inventory.) EPA obtained State data for the NET from the OTAG inventory, GCVTC inventory, and AIRS/FS.

4.5.5.1 How did EPA use the OTAG Inventory?

The 1990 OTAG inventory houses average summer day VOC, NO_x, and CO emission estimates for those States that are either partially or fully in the Super Regional Oxidant A (SUPROXA) domain. The OTAG SUPROXA domain is defined by the following coordinates:

North:	47.00°N	East:	67.00°W
South:	26.00°N	West:	99.00°W

The SUPROXA domain's eastern boundary is the Atlantic Ocean and its western boundary runs north to south through North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas. The western extent of the domain allows for coverage of the largest urban areas in the eastern United States without extending too far west to encounter terrain difficulties associated with the Rocky Mountains. The northern boundary includes the major urban areas of eastern Canada. The southern boundary includes as much of the United States as possible, but is limited to latitude 26°N due to computational limitations of the photochemical models. In total, the OTAG inventory completely includes 37 States and the District of Columbia.

The OTAG inventory is primarily an ozone precursor inventory and includes emission estimates of VOC, NO_x, and CO for all applicable source categories throughout the domain. It also includes a small amount of SO_2 and PM-10 emission data as well as ozone precursor data submitted by State/local agencies. The OTAG inventory effort did not undertake any quality assurance (QA) procedures on the SO_2 and PM-10 emission estimates.

Since the underlying purpose of the OTAG inventory was to support photochemical modeling for ozone, it is primarily an average summer day inventory. EPA used operating schedule data and default

temporal profiles to convert any annual emission estimates submitted by the States to average summer day estimates.

The OTAG inventory has three major components: (1) the point source component, which includes segment/pollutant level emission estimates and other relevant data (e.g., stack parameters, geographic coordinates, and base year control information) for all stationary point sources in the domain; (2) the area source component, which includes county-level emission estimates for all stationary area sources; and (3) the on-road vehicle component, which includes county/roadway functional class/vehicle type estimates of VMT and MOBILE 5a input files for the entire domain. The NET inventory extracted all point sources except utilities.

The general procedure for incorporating State data from the OTAG inventory into the NET inventory involved using the data "as is" from the State submissions, with two main exceptions. First, for the five States that submitted point source data for the years 1992 through 1994, EPA backcast the inventory data to 1990 using BEA Industrial Earnings by State and two-digit SIC code.[2] Second, EPA temporally allocated any emission inventory data that only included annual emission estimates in order to produce average summer day values. EPA performed this allocation for point and area source data supplied by several States. For point sources, EPA used the operating schedule data, if supplied, to temporally allocate annual emissions to average summer data emissions using Equation 4.5-1.

$$EMISSIONS_{ASD} = EMISSIONS_{ANNUAL} * SUMTHRU * 1/(13 * DPW) \qquad \text{(Eq. 4.5-1)}$$

where: $EMISSIONS_{ASD}$ = average summer day emissions
$EMISSIONS_{ANNUAL}$ = annual emissions
SUMTHRU = summer throughput percentage
DPW = days per week in operation

If a State did not supply operating schedule data for a point source, then EPA used its default Temporal Allocation file and Equation 4.5-2 to temporally allocate annual emissions to an average summer weekday. The Temporal Allocation file contains default seasonal and daily temporal profiles by SCC.

$$EMISSIONS_{ASD} = EMISSIONS_{ANNUAL} \ / \ (SUMFAC_{SCC} * WDFAC_{SCC}) \qquad \text{(Eq. 4.5-2)}$$

where: $EMISSIONS_{ASD}$ = average summer day emissions
$EMISSIONS_{ANNUAL}$ = annual emissions
$SUMFAC_{SCC}$ = default summer season temporal factor for SCC
$WDFAC_{SCC}$ = default summer weekday temporal factor for SCC

For the small number of SCCs not included in the Temporal Allocation file, EPA assumed that the average summer weekday emissions equaled those for an average day during the year. EPA used Equation 4.5-3 to calculate these emissions.

$$EMISSIONS_{ASD} = EMISSIONS_{ANNUAL} \ / \ 365 \qquad \text{(Eq. 4.5-3)}$$

where: $EMISSIONS_{ASD}$ = average summer day emissions
$EMISSIONS_{ANNUAL}$ = annual emissions

For stationary point sources, 36 of the 38 States in the OTAG domain supplied emission estimates for their entire State. EPA used data from the 1990 Interim Inventory for the two States (Iowa and Mississippi) that did not supply data. Table 4.5-1 provides a brief description of the point source data supplied by each State, including information on temporal resolution, year of data, and EPA adjustments to the data.

For area sources, 17 of the 38 States in the OTAG domain supplied emission estimates for their entire State, and an additional 9 States supplied emission estimates covering part of their State (partial coverage primarily covered ozone nonattainment areas). The 1990 Interim Inventory served as the sole data source for 12 States. In those cases where the area source data supplied included annual emission estimates, EPA used the default Temporal Allocation file to develop average summer daily emission estimates. Table 4.5-2 provides a brief description of the area source data supplied by each State, including information on temporal resolution, geographic coverage, and EPA adjustments to the data.

4.5.5.2 How did EPA use the GCVTC Inventory?

The 1990 GCVTC inventory includes detailed emissions data for the following 11 States: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.[3] The GCVTC compiled this inventory by merging existing inventory data bases. The primary data sources used were State-supplied inventories for California and Oregon, AIRS/FS for VOC, NO_x, and SO_2 point source data for the other nine States, the 1990 Interim Inventory for area source data for the other nine States, and the 1985 NAPAP inventory for NH_3 and total suspended particulate (TSP) data.

With respect to solvent emissions, EPA incorporated the following portions of the GCVTC inventory into the 1990 NET inventory:

- complete point and area source data for California
- complete point and area source data for Oregon

The organic compound emissions reported in the GCVTC inventory for California are total organics (TOG). EPA converted these emissions to VOC using the profiles from EPA's SPECIATE data base.[4] Since the PM emissions in the GCVTC were reported as both TSP and PM-2.5, EPA estimated PM-10 from the TSP by applying SCC-specific uncontrolled particle size distribution factors.[5] For solvent utilization, PM and SO_2 emissions are relatively minor.

4.5.5.3 What AIRS/FS Data did EPA Use?

EPA appended to the NET inventory those SO_2 and PM-10 (or PM-10 estimated from TSP) sources of greater than 250 tons per year as reported to AIRS/FS that were not included in either the OTAG or GCVTC inventories. In late 1996, EPA extracted the data from AIRS/FS using the data criteria set shown in Table 4.5-3. Table 4.5-3 also lists the data elements that were extracted. Note that EPA extracted the *estimated* emissions. As mentioned above, PM and SO_2 emissions are relatively minor for this source category, so few data were derived from AIRS.

4.5.5.4 How did EPA Fill the Data Gaps Remaining from these Inventories?

For SO_2 and PM-10, EPA used the State data from OTAG, where possible. (The GCVTC inventory contained SO_2 and PM annual emissions.) In most cases, OTAG data for these pollutants were not available. For point sources, EPA added data from AIRS/FS for plants over 250 tons per year of SO_2 and PM-10. EPA also matched the AIRS/FS data to the OTAG plants and attached the emissions to the existing OTAG plants when a match was found. If no match to the OTAG plant data was found, EPA added new plants to the inventory. For OTAG plants where there were no matching data in AIRS/FS and for all area sources of SO_2 and PM-10, EPA calculated emissions based on the emission estimates for other pollutants.

This approach to developing SO_2 and PM-10 emissions from unmatched point and area sources involved using uncontrolled emission factor ratios of SO_2 to NO_x or PM-10 to NO_x to calculate uncontrolled emissions. EPA used NO_x to calculate the ratio because (1) the types of sources likely to be important SO_2 and PM-10 emitters are likely to be similar to important NO_x sources, and (2) the generally high quality of the NO_x emissions data. EPA developed the SO_2/NO_x and PM-10/NO_x ratios based on uncontrolled emission factors. It then multiplied these ratios by uncontrolled NO_x emissions to determine the uncontrolled SO_2 and PM-10 emissions. EPA then reviewed information on VOC, NO_x, and CO control devices to determine if these devices also controlled SO_2 and/or PM-10. If this review showed that the listed control devices did not control SO_2 and/or PM-10, EPA matched the OTAG and Interim Inventory plants to determine the SO_2 and PM-10 control applicable for those sources. The plant matching component of this task involved only simple matching based on the State and county FIPS codes and plant and point IDs. Because solvent utilization sources are relatively minor emitters of PM or SO_2, there were few sources that had significant emissions of these pollutants added via this method.

4.5.6 How did EPA Prepare the 1996 NET Inventory for Solvent Utilization Sources?

Initially, the 1996 emission inventory was developed by merging the 1995 AIRS/FS emissions with 1995 emissions grown from 1990 emissions for the States that did not submit emissions data to AIRS/FS. Subsequently, EPA has been revising the 1996 NET to include base year emissions data submitted by State/local agencies to comply with the CAAA requirements to submit (1) a PEI every 3 years for ozone nonattainment areas (NAAs), and (2) emissions data for major point sources annually. States with ozone NAAs needed to submit their PEI for 1996 by July 1997. To reduce the burden of preparing this inventory, EPA gave each State/local agency a copy of the 1996 NET inventory as a starting point in preparing their 1996 base year emissions. The methodologies used to prepare and revise the 1996 NET emissions are presented in section 4.3.8.4 of section 4.3 for "Industrial" sources.

4.5.7 How Were Nonutility Point and Area Source Emissions Prepared for the 1997 through 1999 NET?

Emissions for 1997 through 1999 for the Solvent Utilization categories were grown from the 1996 NET inventory. Section 4.3.9.1 for Industrial nonutility point and area sources explains how the growth and control factors were prepared and applied to estimate emissions for Versions 2, 3, and 4 1997 through 1999 of the NET. The methods EPA used to prepare and apply growth and control factors for Solvent Utilization point and area sources are the same as those described in section 4.3.9.1. Table 4.5-4 presents the MACT control efficiencies applied to uncontrolled 1996 VOC emissions for Solvent Utilization sources to prepare 1997 through 1999 emissions.

4.5.8 References

1. *National Air Pollutant Emission Trends Procedures Document, Sections 1, 4, and 6 1985-1996, Projections 1999-2010*, EPA-454/R-98-008, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, June 1998.

2. *Table SA-5 – Total Personal Income by Major Sources 1969-1990, Data files*, U.S. Department of Commerce, Bureau of the Census, Washington, DC, 1991.

3. *An Emission Inventory for Assessing Regional Haze on the Colorado Plateau*, Grand Canyon Visibility Transport Commission, Denver, CO, January 1995.

4. *Volatile Organic Compound (VOC)/Particulate Matter (PM) Speciation Data System (SPECIATE) User's Manual, Version 1.5*, Final Report, Radian Corporation, EPA Contract No. 68-D0-0125, Work Assignment No. 60, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC, February 1993.

5. Barnard, W.R., and P. Carlson. *PM-10 Emission Calculation, Table 1 and 4*, E.H. Pechan & Associates, Inc., Contract No. 68-D0-1-2-, U.S. Environmental Protection Agency, Research Triangle Park, NC, June 1992.

Table 4.5-1. Point Source Data Submitted by OTAG States

State	Data Source/Format	Temporal Resolution	Year of Data	Adjustments to Data
Alabama	AIRS/FS - Ad hoc retrievals	Annual	1994	Backcast to 1990 using BEA. Average Summer Day estimated using methodology described above.
Arkansas	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using default temporal factors.
Connecticut	State - EPS Workfile	Daily	1990	None
Delaware	State - EPS Workfile	Daily	1990	None
District of Columbia	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Florida	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Georgia - Atlanta Urban Airshed (47 counties) domain	State - State format	Daily	1990	None
Georgia - Rest of State	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using default temporal factors.
Illinois	State - EPS Workfiles	Daily	1990	None
Indiana	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Kansas	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Kentucky - Jefferson County	Jefferson County - EPS Workfile	Daily	1990	None
Kentucky - Rest of State	State - EPS Workfile	Daily	1990	None
Louisiana	State - State Format	Annual	1990	Average Summer Day estimated using methodology described above.
Maine	State - EPS Workfile	Daily	1990	None
Maryland	State - EPS Workfile	Daily	1990	None
Massachusetts	State - EPS Workfile	Daily	1990	None
Michigan	State - State Format	Annual	1990	Average Summer Day estimated using methodology described above.
Minnesota	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Missouri	AIRS/FS - Ad hoc retrievals	Annual	1993	Backcast to 1990 using BEA. Average Summer Day estimated using methodology described above.
Nebraska	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
New Hampshire	State - EPS Workfile	Daily	1990	None
New Jersey	State - EPS Workfile	Daily	1990	None
New York	State - EPS Workfile	Daily	1990	None
North Carolina	State - EPS Workfiles	Daily	1990	None
North Dakota	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Ohio	State - State Format	Annual	1990	Average Summer Day estimated using methodology described above.
Oklahoma	State - State Format	Annual	1994	Backcast to 1990 using BEA. Average Summer Day estimated using methodology described above.
Pennsylvania - Allegheny County	Allegheny County - County Format	Daily	1990	None
Pennsylvania - Philadelphia County	Philadelphia County - County Format	Daily	1990	None
Pennsylvania - Rest of State	State - EPS Workfile	Daily	1990	None
Rhode Island	State - EPS Workfile	Daily	1990	None
South Carolina	AIRS/FS - Ad hoc retrievals	Annual	1991	Average Summer Day estimated using default temporal factors.

Table 4.5-1 (continued)

State	Data Source/Format	Temporal Resolution	Year of Data	Adjustments to Data
South Dakota	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Tennessee	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using default temporal factors.
Texas	State - State Format	Daily	1992	Backcast to 1990 using BEA.
Vermont	State - EPS Workfile	Daily	1990	None
Virginia	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
West Virginia	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Wisconsin	State - State Format	Daily	1990	None

Table 4.5-2. Area Source Data Submitted by OTAG States

State	Data Source/Format	Temporal Resolution	Geographic Coverage	Adjustments to Data
Connecticut	State - EPS Workfile	Daily	Entire State	None
Delaware	State - EPS Workfile	Daily	Entire State	None
District of Columbia	State - Hard copy	Daily	Entire State	None
Florida	AIRS/AMS - Ad hoc retrievals	Daily	Jacksonville, Miami/ Ft. Lauderdale, Tampa	Added Nonroad emission estimates from Int. Inventory to Jacksonville (Duval County)
Georgia	State - State format	Daily	Atlanta Urban Airshed (47 Counties)	None
Illinois	State - State format	Daily	Entire State	None
Indiana	State - State format	Daily	Entire State	Nonroad emissions submitted were county totals. Nonroad emissions distributed to specific SCCs based on Int. Inventory
Kentucky	State - State Format	Daily	Kentucky Ozone Nonattainment Areas	None
Louisiana	State - State Format	Daily	Baton Rouge Nonattainment Area (20 Parishes)	None
Maine	State - EPS Workfile	Daily	Entire State	None
Maryland	State - EPS Workfile	Daily	Entire State	None
Michigan	State - State Format	Daily	49 Southern Michigan Counties	None
Missouri	AIRS/AMS- Ad hoc retrievals	Daily	St. Louis area (25 counties)	Only area source combustion data was provided. All other area source data came from Int. Inventory
New Hampshire	State - EPS Workfile	Daily	Entire State	None
New Jersey	State - EPS Workfile	Daily	Entire State	None
New York	State - EPS Workfile	Daily	Entire State	None
North Carolina	State - EPS Workfiles	Annual	Entire State	Average Summer Day estimated using default temporal factors.
Ohio	State - Hard copy	Daily	Canton, Cleveland Columbus, Dayton, Toledo, and Youngstown	Assigned SCCs and converted from kgs to tons. NO_x and CO from Int. Inventory added to Canton, Dayton, and Toledo counties.
Pennsylvania	State - EPS Workfile	Daily	Entire State	Nonroad emissions submitted were county totals. Nonroad emissions distributed to specific SCCs based on Int. Inventory
Rhode Island	State - EPS Workfile	Daily	Entire State	None
Tennessee	State - State format	Daily	42 Counties in Middle Tennessee	No nonroad data submitted. Nonroad emissions added from Int. Inventory
Texas	State - State Format	Annual	Entire State	Average Summer Day estimated using default temporal factors.
Vermont	State - EPS Workfile	Daily	Entire State	None
Virginia	State - EPS Workfile	Daily	Entire State	None
West Virginia	AIRS/AMS - Ad hoc retrievals	Daily	Charleston, Huntington/Ashland, and Parkersburg (5 counties total)	None
Wisconsin	State - State Format	Daily	Entire State	None

Table 4.5-3. Ad Hoc Report

Criteria		Plant Output		Point Output		Stack Output		Segment Output General		Segment Output Pollutant	
Regn	GT 0	YINV	YEAR OF INVENTORY	STTE	STATE FIPS CODE	STTE	STATE FIPS CODE	STTE	STATE FIPS CODE	STTE	STATE FIPS CODE
PLL4	CE VOC	STTE	STATE FIPS CODE	CNTY	COUNTY FIPS CODE	CNTY	COUNTY FIPS CODE	CNTY	COUNTY FIPS CODE	CNTY	COUNTY FIPS CODE
PLL4	CE CO	CNTY	COUNTY FIPS CODE	PNED	NEDS POINT ID	PNED	NEDS POINT ID	PNED	NEDS POINT ID	PNED	NEDS POINT ID
PLL4	CE SO_2	CYCD	CITY CODE	PNUM	POINT NUMBER	STNB	STACK NUMBER	STNB	STACK NUMBER	STNB	STACK NUMBER
PLL4	CE NO_2	ZIPC	ZIP CODE	CAPC	DESIGN CAPACITY	LAT2	LATITUDE STACK	PNUM	POINT NUMBER	PNUM	POINT NUMBER
PLL4	CE PM-10	PNED	NEDS POINT ID	CAPU	DESIGN CAPACITY UNITS	LON2	LONGITUDE STACK	SEGN	SEGMENT NUMBER	SEGN	SEGMENT NUMBER
PLL4	CE PT	PNME	PLANT NAME	PAT1	WINTER THROUGHPUT	STHT	STACK HEIGHT	SCC8	SCC	SCC8	SCC
DES4	GE 0	LAT1	LATITUDE PLANT	PAT2	SPRING THROUGHPUT	STDM	STACK DIAMETER	HEAT	HEAT CONTENT	PLL4	POLLUTANT CODE
DUE4	ME TY	LON1	LONGITUDE PLANT	PAT3	SUMMER THROUGHPUT	STET	STACK EXIT TEMPERATURE	FPRT	ANNUAL FUEL THROUGHPUT	D034	OSD EMISSIONS
YINV	ME 90	SIC1	STANDARD INDUSTRIAL CODE	PAT4	FALL THROUGHPUT	STEV	STACK EXIT VELOCITY	SULF	SULFUR CONTENT	DU04	OSD EMISSION UNITS
		OPST	OPERATING STATUS	NOHD	NUMBER HOURS/DAY	STFR	STACK FLOW RATE	ASHC	ASH CONTENT	DES4	DEFAULT ESTIMATED EMISSIONS
		STRS	STATE REGISTRATION NUMBER	NODW	NUMBER DAYS/WEEK	PLHT	PLUME HEIGHT	PODP	PEAK OZONE SEASON DAILY PROCESS RATE	DUE4	DEFAULT ESTIMATED EMISSIONS UNITS
				NOHY	NUMBER HOURS/YEAR					CLEE	CONTROL EFFICIENCY
										CLT1	PRIMARY CONTROL DEVICE CODE
										CTL2	SECONDARY CONTROL DEVICE CODE
										REP4	RULE EFFECTIVENESS
										DME4	METHOD CODE
										Emfa	Emission factor

Table 4.5-4. MACT Control Efficiencies Applied to 1996 VOC Emissions for Point and Area Solvent Emission Sources

SCC	POD	MACT Control Efficiency (%)[1] 1997	1998	1999	SCC1_DESC	SCC3_DESC	SCC6_DESC	SCC8_DESC
Point Sources								
40100201	61	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Stoddard (Petroleum Solvent): Open-top Vapor Degreasing
40100202	65	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	1,1,1-Trichloroethane (Methyl Chloroform): Open-top Vapor Degreasing
40100203	65	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Perchloroethylene: Open-top Vapor Degreasing
40100204	65	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Methylene Chloride: Open-top Vapor Degreasing
40100205	65	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Trichloroethylene: Open-top Vapor Degreasing
40100206	61	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Toluene: Open-top Vapor Degreasing
40100207	65	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Trichlorotrifluoroethane (Freon): Open-top Vapor Degreasing
40100209	61	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Butyl Acetate
40100221	62	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Stoddard (Petroleum Solvent): Conveyorized Vapor Degreasing
40100222	66	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	1,1,1-Trichloroethane (Methyl Chloroform):Conveyorized Vapor Degreaser
40100223	66	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Perchloroethylene: Conveyorized Vapor Degreasing
40100224	66	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Methylene Chloride: Conveyorized Vapor Degreasing
40100225	66	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Trichloroethylene: Conveyorized Vapor Degreasing
40100235	62	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Entire Unit: with Vaporized Solvent: Conveyorized Vapor Degreasing
40100236	62	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Entire Unit: with Non-boiling Solvent: Conveyorized Vapor Degreasing
40100251	61	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Stoddard (Petroleum Solvent): General Degreasing Units
40100252	65	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	1,1,1-Trichloroethane (Methyl Chloroform): General Degreasing Units
40100253	65	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Perchloroethylene: General Degreasing Units
40100254	65	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Methylene Chloride: General Degreasing Units
40100255	65	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Trichloroethylene: General Degreasing Units
40100256	61	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Toluene: General Degreasing Units
40100257	65	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Trichlorotrifluoroethane (Freon): General Degreasing Units
40100258	61	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Trichlorofluoromethane: General Degreasing Units
40100259	61	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	1,1,1-Trichloroethane (Methyl Chloroform): General Degreasing Units
40100275	61	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	
40100295	62	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Other Not Classified: General Degreasing Units

Table 4.5-4 (continued)

SCC	POD	MACT Control Efficiency (%)[1] 1997	1998	1999	SCC1_DESC	SCC3_DESC	SCC6_DESC	SCC8_DESC
Point Sources								
40100296	62	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Other Not Classified: General Degreasing Units
40100297	61	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Other Not Classified: Open-top Vapor Degreasing
40100298	62	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Other Not Classified: Conveyorized Vapor Degreasing
40100299	61	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Degreasing	Other Not Classified: Open-top Vapor Degreasing
40100301	63	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Cold Solvent Cleaning/Stripping	Methanol
40100302	63	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Cold Solvent Cleaning/Stripping	Methylene Chloride
40100303	63	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Cold Solvent Cleaning/Stripping	Stoddard (Petroleum Solvent)
40100304	63	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Cold Solvent Cleaning/Stripping	Perchloroethylene
40100305	63	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Cold Solvent Cleaning/Stripping	1,1,1-Trichloroethane (Methyl Chloroform)
40100306	61	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Cold Solvent Cleaning/Stripping	Trichloroethylene
40100307	63	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Cold Solvent Cleaning/Stripping	Isopropyl Alcohol
40100308	63	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Cold Solvent Cleaning/Stripping	Methyl Ethyl Ketone
40100309	63	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Cold Solvent Cleaning/Stripping	Freon
40100310	63	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Cold Solvent Cleaning/Stripping	Acetone
40100335	63	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Cold Solvent Cleaning/Stripping	Entire Unit
40100336	63	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Cold Solvent Cleaning/Stripping	Degreaser: Entire Unit
40100398	63	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Cold Solvent Cleaning/Stripping	Other Not Classified
40100399	63	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Cold Solvent Cleaning/Stripping	Other Not Classified
40100401	63	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Knit Fabric Scouring with Chlorinated Solvent	Perchloroethylene
40100499	63	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Knit Fabric Scouring with Chlorinated Solvent	Other Not Classified
40188801	63	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Fugitive Emissions	Specify in Comments Field
40188802	63	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Fugitive Emissions	Specify in Comments Field
40188805	63	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Fugitive Emissions	Specify in Comments Field
40188898	63	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Fugitive Emissions	Specify in Comments Field
40199999	63	0	63	63	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Fugitive Emissions	
40201901	39	0	60	60	Petroleum and Solvent Evaporation	Surface Coating Operations	Wood Furniture Surface Coating	Coating Operation
40201903	39	0	60	60	Petroleum and Solvent Evaporation	Surface Coating Operations	Wood Furniture Surface Coating	Coating Mixing
40201999	39	0	60	60	Petroleum and Solvent Evaporation	Surface Coating Operations	Wood Furniture Surface Coating	Other Not Classified
40202301	132	0	24	24	Petroleum and Solvent Evaporation	Surface Coating Operations	Large Ships	Prime Coating Operation
40202302	132	0	24	24	Petroleum and Solvent Evaporation	Surface Coating Operations	Large Ships	Cleaning/Pretreatment
40202305	132	0	24	24	Petroleum and Solvent Evaporation	Surface Coating Operations	Large Ships	Equipment Cleanup
40202306	132	0	24	24	Petroleum and Solvent Evaporation	Surface Coating Operations	Large Ships	Topcoat Operation
40202399	132	0	24	24	Petroleum and Solvent Evaporation	Surface Coating Operations	Large Ships	Other Not Classified
40202401	52	0	0	60	Petroleum and Solvent Evaporation	Surface Coating Operations	Large Aircraft	Prime Coating Operation
40202402	52	0	0	60	Petroleum and Solvent Evaporation	Surface Coating Operations	Large Aircraft	Cleaning/Pretreatment
40202403	52	0	0	60	Petroleum and Solvent Evaporation	Surface Coating Operations	Large Aircraft	Coating Mixing
40202405	52	0	0	60	Petroleum and Solvent Evaporation	Surface Coating Operations	Large Aircraft	Equipment Cleanup

Table 4.5-4 (continued)

SCC	POD	MACT Control Efficiency (%)[1] 1997	1998	1999	SCC1_DESC	SCC3_DESC	SCC6_DESC	SCC8_DESC
Point Sources								
40202406	52	0	0	60	Petroleum and Solvent Evaporation	Surface Coating Operations	Large Aircraft	Topcoat Operation
40202499	52	0	0	60	Petroleum and Solvent Evaporation	Surface Coating Operations	Large Aircraft	Other Not Classified
40500301	181	0	0	32	Petroleum and Solvent Evaporation	Printing/Publishing	General	Printing: Flexographic
40500311	181	0	0	32	Petroleum and Solvent Evaporation	Printing/Publishing	General	Printing: Flexographic
40500312	181	0	0	32	Petroleum and Solvent Evaporation	Printing/Publishing	General	Printing: Flexographic
40500313	181	0	0	32	Petroleum and Solvent Evaporation	Printing/Publishing	General	
40500314	181	0	0	32	Petroleum and Solvent Evaporation	Printing/Publishing	General	Printing: Flexographic: Propyl Alcohol Cleanup
40500501	183	0	0	27	Petroleum and Solvent Evaporation	Printing/Publishing	General	Gravure: 2754
40500511	183	0	0	27	Petroleum and Solvent Evaporation	Printing/Publishing	General	Gravure: 2754
40500512	183	0	0	27	Petroleum and Solvent Evaporation	Printing/Publishing	General	Gravure: 2754
40500513	183	0	0	27	Petroleum and Solvent Evaporation	Printing/Publishing	General	Gravure: 2754
40500514	183	0	0	27	Petroleum and Solvent Evaporation	Printing/Publishing	General	Gravure: Cleanup Solvent
40500598	183	0	0	27	Petroleum and Solvent Evaporation	Printing/Publishing	General	Ink Thinning Solvent: Other Not Specified
40500599	183	0	0	27	Petroleum and Solvent Evaporation	Printing/Publishing	General	Ink Thinning Solvent: Other Not Specified

Table 4.5-4 (continued)

SCC	POD	MACT Control Efficiency (%)[1] 1997	1998	1999	SCC1_DESC	SCC3_DESC	SCC6_DESC	SCC8_DESC
Area Sources								
2401005000	246	0	0	36	Solvent Utilization	Surface Coating	Auto Refinishing: SIC 7532	Total: All Solvent Types
2401020000	225	0	30	30	Solvent Utilization	Surface Coating	Wood Furniture: SIC 25	Total: All Solvent Types
2401075000	250	0	0	59	Solvent Utilization	Surface Coating	Aircraft: SIC 372	Total: All Solvent Types
2415000000	232	0	63	63	Solvent Utilization	Degreasing	All Processes/All Industries	Total: All Solvent Types
2415000385	232	0	63	63	Solvent Utilization	Degreasing	All Processes/All Industries	Trichloroethylene
2415000999	232	0	63	63	Solvent Utilization	Degreasing	All Processes/All Industries	Solvents: NEC
2415035000	232	0	63	63	Solvent Utilization	Degreasing	Transportation Equipment (SIC 37): All Processes	Total: All Solvent Types
2415045000	232	0	63	63	Solvent Utilization	Degreasing	Miscellaneous Manufacturing (SIC 39): All Processes	Total: All Solvent Types
2415045999	232	0	63	63	Solvent Utilization	Degreasing	Miscellaneous Manufacturing (SIC 39): All Processes	Solvents: NEC
2415060000	232	0	63	63	Solvent Utilization	Degreasing	Miscellaneous Repair Services (SIC 76): All Processes	Total: All Solvent Types
2415065000	232	0	63	63	Solvent Utilization	Degreasing	Auto Repair Services (SIC 75): All Processes	Total: All Solvent Types
2415100000	232	0	63	63	Solvent Utilization	Degreasing	All Industries: Open Top Degreasing	Total: All Solvent Types
2415105000	232	0	63	63	Solvent Utilization	Degreasing	Furniture and Fixtures (SIC 25): Open Top Degreasing	Total: All Solvent Types
2415110000	232	0	63	63	Solvent Utilization	Degreasing	Primary Metal Industries (SIC 33): Open Top Degreasing	Total: All Solvent Types
2415120000	232	0	63	63	Solvent Utilization	Degreasing	Fabricated Metal Products (SIC 34): Open Top Degreasing	Total: All Solvent Types
2415125000	232	0	63	63	Solvent Utilization	Degreasing	Industrial Machinery and Equipment (SIC 35): Open Top Degreasing	Total: All Solvent Types
2415130000	232	0	63	63	Solvent Utilization	Degreasing	Electronic and Other Elec. (SIC 36): Open Top Degreasing	Total: All Solvent Types
2415135000	232	0	63	63	Solvent Utilization	Degreasing	Transportation Equipment (SIC 37): Open Top Degreasing	Total: All Solvent Types
2415140000	232	0	63	63	Solvent Utilization	Degreasing	Instruments and Related Products (SIC 38): Open Top Degreasing	Total: All Solvent Types
2415145000	232	0	63	63	Solvent Utilization	Degreasing	Miscellaneous Manufacturing (SIC 39): Open Top Degreasing	Total: All Solvent Types
2415200000	232	0	63	63	Solvent Utilization	Degreasing	All Industries: Conveyerized Degreasing	Total: All Solvent Types
2415230000	232	0	63	63	Solvent Utilization	Degreasing	Electronic and Other Elec. (SIC 36): Conveyerized Degreasing	Total: All Solvent Types
2415245000	232	0	63	63	Solvent Utilization	Degreasing	Miscellaneous Manufacturing (SIC 39): Conveyerized Degreasing	Total: All Solvent Types
2415260000	232	0	63	63	Solvent Utilization	Degreasing	Auto Repair Services (SIC 75): Conveyerized Degreasing	Total: All Solvent Types
2415300000	241	0	63	63	Solvent Utilization	Degreasing	All Industries: Cold Cleaning	Total: All Solvent Types
2415305000	241	0	63	63	Solvent Utilization	Degreasing	Furniture and Fixtures (SIC 25): Cold Cleaning	Total: All Solvent Types
2415310000	241	0	63	63	Solvent Utilization	Degreasing	Primary Metal Industries (SIC 33): Cold Cleaning	Total: All Solvent Types
2415315000	241	0	63	63	Solvent Utilization	Degreasing	Secondary Metal Industries (SIC 33): Cold Cleaning	Total: All Solvent Types
2415320000	241	0	63	63	Solvent Utilization	Degreasing	Fabricated Metal Products (SIC 34): Cold Cleaning	Total: All Solvent Types

Table 4.5-4 (continued)

SCC	POD	MACT Control Efficiency (%)[1] 1997	1998	1999	SCC1_DESC	SCC3_DESC	SCC6_DESC	SCC8_DESC
Area Sources								
2415325000	241	0	63	63	Solvent Utilization	Degreasing	Industrial Machinery and Equipment (SIC 35): Cold Cleaning	Total: All Solvent Types
2415330000	241	0	63	63	Solvent Utilization	Degreasing	Electronic and Other Elec. (SIC 36): Cold Cleaning	Total: All Solvent Types
2415335000	241	0	63	63	Solvent Utilization	Degreasing	Transportation Equipment (SIC 37): Cold Cleaning	Total: All Solvent Types
2415340000	241	0	63	63	Solvent Utilization	Degreasing	Instruments and Related Products (SIC 38): Cold Cleaning	Total: All Solvent Types
2415345000	241	0	63	63	Solvent Utilization	Degreasing	Miscellaneous Manufacturing (SIC 39): Cold Cleaning	Total: All Solvent Types
2415350000	241	0	63	63	Solvent Utilization	Degreasing	Transportation Maintenance Facilities (SIC 40-45): Cold Cleaning	Total: All Solvent Types
2415355000	241	0	63	63	Solvent Utilization	Degreasing	Automotive Dealers (SIC 55): Cold Cleaning	Total: All Solvent Types
2415360000	241	0	63	63	Solvent Utilization	Degreasing	Auto Repair Services (SIC 75): Cold Cleaning	Total: All Solvent Types
2415365000	241	0	63	63	Solvent Utilization	Degreasing	Miscellaneous Repair Services (SIC 76): Cold Cleaning	Total: All Solvent Types
2440020000	226	0	63	63	Solvent Utilization	Miscellaneous Industrial	Adhesive (Industrial) Application	Total: All Solvent Types
2460000000	249	0	0	20	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Processes	Total: All Solvent Types
2465000000	249	0	0	20	Solvent Utilization	Miscellaneous Non-industrial: Consumer	All Products/Processes	Total: All Solvent Types
2465100000	249	0	0	20	Solvent Utilization	Miscellaneous Non-industrial: Consumer	Personal Care Products	Total: All Solvent Types
2465200000	249	0	0	20	Solvent Utilization	Miscellaneous Non-industrial: Consumer	Household Products	Total: All Solvent Types
2465400000	249	0	0	20	Solvent Utilization	Miscellaneous Non-industrial: Consumer	Automotive Aftermarket Products	Total: All Solvent Types
2465600000	269	0	0	20	Solvent Utilization	Miscellaneous Non-industrial: Consumer	Adhesives and Sealants	Total: All Solvent Types
2465800000	249	0	0	20	Solvent Utilization	Miscellaneous Non-industrial: Consumer	Pesticide Application	Total: All Solvent Types
2465900000	249	0	0	20	Solvent Utilization	Miscellaneous Non-industrial: Consumer	Miscellaneous Products: NEC	Total: All Solvent Types
2495000000	249	0	0	20	Solvent Utilization	All Solvent User Categories	All Processes	Total: All Solvent Types

[1] Percent reduction from uncontrolled emissions in 1996 NET inventory.

4.6 ON-ROAD VEHICLES

4.6.1 Which Sources Does EPA Include in the On-road Vehicle Category?

The "on-road vehicles" category includes motorized vehicles that are normally operated on public roadways. This includes passenger cars, motorcycles, minivans, sport-utility vehicles, light-duty trucks, heavy-duty trucks, and buses. Section 4.6 discusses the methodologies EPA uses to calculate on-road vehicle emissions. The on-road vehicle category includes all on-road vehicles from the following Tier I and Tier II categories:

Tier I Category	Tier II Category
(11) On-road Vehicles	All

4.6.2 What Is EPA's Current Methodology for Developing Emission Estimates for On-road Vehicles?

EPA uses a consistent methodology to calculate on-road vehicle emissions for all years from 1970 through1999. On-road emissions inventories for all pollutants (CO, NO_x, VOC, PM-10, PM-2.5, SO_2, and NH_3) are calculated by multiplying an appropriate emission factor in grams per mile by the corresponding VMT in millions of miles, and then converting the product to units of tons of emissions. Emission estimates for all years 1970 through 1999 include calculations by month, county, road type, and vehicle type. Table 4.6-1 summarizes the current methodologies used to calculate on-road emissions from 1989 through 1999. In addition, Table 4.6-2 tracks how the methodology used to calculate the 1996 on-road emissions has changed from Version 1 of the NEI through Version 4.

EPA uses its MOBILE5a model for the years 1970 to 1994 and its MOBILE5b model for the years 1995 through 1999 to calculate monthly state-level emission factors by vehicle type for VOC, NO_x, and CO. The PART5 model is used to calculate emission factors PM-10, PM-2.5, and SO_2. These emission factors from PART5 do not vary by month, so the same emission factors are multiplied by the monthly VMT at the county, roadway type, and vehicle type (for the twelve PART5 vehicle types) level of detail. NH_3 emission factors vary only by vehicle type, so the eight emission factors by vehicle type are multiplied by VMT representing the same vehicle type at the monthly, county, and roadway type level of detail. The NH_3 emission factors used from 1990 through 1995 were based on test data from Volkswagen, while the factors from 1996 through 1999 are based on emission test data from EPA's Office of Air Transportation and Quality's (OTAQ), formerly the Office of Mobile Sources, which capture the impact of catalytic converters on NH_3 emission.

EPA does not calculate emission factors separately for every county. To determine the emission factor sets to be modeled in each State, EPA prepared a county-level database for each year modeled. The data base includes information on non-default inputs to be modeled, such as registration distributions and other State-supplied data from OTAG, for each county. For each county, the control programs applicable in that year were indicated. Next, EPA determined for each State all unique combinations of control programs and other non-default inputs for each modeled year. MOBILE5 model runs were then made modeling each of these unique combinations. Each combination was identified using the county code of one of the counties with this combination of controls and inputs. To apply the emission factors to the appropriate counties, EPA developed a county correspondence file which mapped all counties with

the same unique set of input data and control programs to the MOBILE5 emission factors modeled for the county representing that unique combination of inputs and control programs. For some States, EPA applied a single set of emission factors to all counties in the State, while for other States, EPA calculated a separate set of emission factors for each county. Most States, though, had several sets of emission factors calculated for the State, with each set applying to one or more counties within the State. A similar process was followed in mapping the PART5 emission factors to the appropriate counties.

4.6.3 How Does EPA Estimate Vehicle Miles Traveled (VMT)?

Vehicle miles traveled (VMT) is the activity factor EPA uses to estimate on-road vehicle emissions; therefore, the development of a VMT database is critical to the estimation process. Using State VMT totals for each year, EPA allocates VMT by county, roadway type, and vehicle type for each year between 1970 and 1999. Each State and county combination in the output files contains 96 assigned source classification codes (SCCs) representing the 6 rural and 6 urban roadway types and 8 vehicle types. This section describes how the VMT estimation procedure described in the previous Trends procedure document was modified for the years 1996 through 1999. In addition, the VMT estimated previously for 1990 through 1995 was modified in the allocation procedure by vehicle type. These two sets of VMT modifications are described here. The reader should refer to the earlier procedures document to understand the VMT estimation methodology prior to 1990 and for the basis of the VMT calculations prior to the 1990 through 1999 adjustments. (see http://www.epa.tov/ttn/chief/trends/procedures/)[1]

4.6.3.1 How Does EPA Develop 1970 to 1979 VMT Data?

EPA's current methodology for allocating VMT totals for 1970 through 1979 is based on State totals published in the Department of Transportation's (DOT) Federal Highway Administration's (FHWA) *Highway Statistics.*[2] For each year, EPA allocates State totals by county, roadway type, and vehicle type using a ratio from the 1980 VMT file for each State/county/SCC combination expressed as a percentage of the 1980 State total. Quality assurance is performed by comparing statewide totals for each year's output to the FHWA's State totals.

4.6.3.2 How Does EPA Develop 1980 to 1995 VMT Data?

To develop VMT for the period 1980 through 1995, EPA relies on data supplied by the FHWA regarding the latest mileage and daily travel summary areawide records reported to the Highway Performance Monitoring System (HPMS).[3] These records contain state-level summaries of miles of daily travel by functional system and by rural, small urban (population of 5,000 to 49,999), and individual urban (population of 50,000 and more) areas. Rural daily VMT is provided on a state level for the following six roadway types: principal arterial-interstate, other principal arterial, minor arterial, major collector, minor collector, and local. Small urban and urban area daily VMT are provided for the following six roadway types: principal arterial - interstate, principal arterial - other freeways and expressways, other principal arterial, minor arterial, collector, and local.

What is the Highway Performance Monitoring System? The HPMS is a national data collection and reporting system administered by the FHWA in cooperation with State highway programs. The HPMS contains data on the following: mileage, extent, and usage of various functional road systems; the condition and performance of pavements; physical attributes of roads; road capacity and improvement

needs; and other data important to the structural integrity and operation of the nation's road systems. Each State highway program submits the data that make up HPMS to the FHWA on an annual basis.

The HPMS consists of three main data components: a universe database, a sample database, and an areawide database. The universe data base contains a complete inventory of all mileage for all functional systems except local roads. The sample data base contains more detailed information for a subset of the highway sections in the universe data base. Each record in the sample data base composes part of a sample panel which can be expanded to represent the universe of highway mileage. The areawide data base contains annual state-level summaries of the major HPMS components. Most of the state-level data in the areawide data base are divided into rural, small urban, and individualized urban area components. Table 4.6-3 illustrates the main data components of HPMS and the type of data contained within each component.

The HPMS travel data, which is based on samples of daily traffic counts taken at various points in a State's roadway network, is critical to estimating VMT. These daily traffic counts are expanded to annual average daily traffic (AADT). To calculate VMT for a specific section of road, EPA multiplies the AADT for that section of road by the road length.[4] EPA uses the HPMS data to create the county/ roadway type/vehicle type level VMT data file necessary for it to calculate emissions from 1980 to 1995.

What Problems Exist with Using HPMS to Estimate VMT? While the HPMS is an important tool for EPA, several difficulties are associated with using its data to estimate VMT for the Trends inventory. First, the geographic scope of HPMS data differs from that of the Trends inventory. All data in HPMS are divided into rural, small urban, and individualized urban geographic areas, whereas the Trends inventory relies on the county as its basic geographic unit. Because of this difference, EPA had to develop a mechanism to distribute VMT from rural, small urban, and individual urban area levels to county levels in order to use the HPMS data. Second, the level of detail of reporting in the sample data base (the most detailed data base containing VMT information) varies from State to State. In the sample data base, some States report data for each individual urban area, some States report combined data for all individual urban areas, and some States report data separately for some individual urban areas and combined for the remaining individual urban areas. These variations complicate the task of distributing VMT from the sample data base to counties. As a result, EPA relied on the areawide data base to generate county-level VMT estimates. Unlike the sample date base, all States reported data for individual urban areas separately to the areawide data base and only the area wide data base contains travel data for local road systems.

How did EPA Calculate County-level VMT for 1980 to 1995? VMT from the HPMS areawide data base is distributed to counties based on each county's rural, small urban, and urban area population. The EPA relied upon two tables in the Bureau of the Census 1980 Number of Inhabitants (CNOI) documents[5] as the source for population data for the years 1980 to 1994. EPA had to use the 1980 population data to allocate the VMT because the Census Urbanized Area boundaries were changed for the 1990 census. Because of this change, use of the 1990 Census Urbanized Area boundaries would prevent a one-to-one match between HPMS large, urban-area VMT and urbanized area population, making VMT distribution difficult. Although not exactly the same, the large urban area boundaries used in HPMS are based on the 1980 Census Urbanized Area boundaries. 1990 Census data were used starting with the 1995 inventory.[6]

The two CNOI tables used to distribute VMT to counties are:

Table 3: **Population of Counties by Urban and Rural Residence**. This table lists the urban population living inside census-defined urban areas, the urban population living outside census-defined urban areas, and the rural population for each county.

Table 13: **Population of Urban Areas**. This table divides an urban area's population among the counties that contain portions of that urban area.

EPA calculates county-level rural VMT, small urban VMT, and urbanized area VMT separately using the following methodologies.

How Does EPA Estimate Rural VMT from 1980 to 1995? To calculate rural VMT by county from 1980 to 1995, EPA follows two steps. First, we calculate the percentage of the State's rural population by county using county rural population data from CNOI Table 3. Next, we calculate each county's rural VMT by distributing State rural VMT from the HPMS areawide data base, based on the percentage of the State's rural population in each county. Equation 4.6-1 shows this calculation.

$$VMT_{R,C} = VMT_{R,S} \times \frac{POP_{R,C}}{POP_{R,S}} \qquad \text{(Eq. 4.6-1)}$$

where:
$VMT_{R,C}$ = Rural VMT in county C (calculated)
$VMT_{R,S}$ = Rural VMT, State total (HPMS)
$POP_{R,C}$ = Rural population in county C (CNOI)
$POP_{R,S}$ = Rural population, State total (CNOI)

How Does EPA Estimate Small Urban VMT from 1980 to 1995? To calculate each county's small urban VMT from 1980 to 1995, EPA uses a methodology similar to that used to calculate rural VMT. First, EPA uses data from CNOI Table 3 on the urban population living outside census-defined urban areas to calculate the percentage of the State's small urban population living in each county. Next, EPA distributes the State small urban VMT from the HPMS areawide data base based on the percentage of the State's small urban population living in each county. Equation 4.6-2 shows this calculation.

$$VMT_{SU,C} = VMT_{SU,S} \times \frac{POP_{SU,C}}{POP_{SU,S}} \qquad \text{(Eq. 4.6-2)}$$

where:
$VMT_{SU,C}$ = Small urban VMT in county C (calculated)
$VMT_{SU,S}$ = Small urban VMT, State total (HPMS)
$POP_{SU,C}$ = Small urban population in county C (CNOI)
$POP_{SU,S}$ = Small urban population, State total (CNOI)

How Does EPA Estimate Urban Area VMT from 1980 to 1995? EPA's approach to allocating HPMS urban area Daily VMT from 1980 to 1995 differs slightly from the approach used to allocate rural and small urban Daily VMT. EPA assigns each urban area in the HPMS file a unique 3-digit code. To allocate Daily VMT totals by road type for each individual urban area, an urban area population file is used to link a given urban area code to the corresponding population in each component county. Because the boundaries of urban and small urban areas change from year to year, some urban areas in the HPMS input files do not contain population figures for component counties. In these cases, the VMT for these urban areas is added to the HPMS small urban VMT total by road category and allocated by small urban population ratios.

For each urban area, EPA uses data from CNOI Table 13 to calculate the percentage of population in each county containing a portion of the urban area. As shown in Equation 4.6-3, EPA then calculates each county's share of an urban area's VMT by distributing urban area VMT from the HPMS areawide data base based on the percentage of the urban area's population in each county.

$$VMT_{UA,C} = VMT_{UA,S} \times \frac{POP_{UA,C}}{POP_{UA,S}} \qquad \text{(Eq. 4.6-3)}$$

where:

$VMT_{UA,C}$	=	Urban area's VMT in county C (calculated)
$VMT_{UA,S}$	=	Urban area's VMT, State total (HPMS)
$POP_{UA,C}$	=	Urban area's population in county C (CNOI)
$POP_{UA,S}$	=	Urban area's population, State total (CNOI)

In a few cases, a single county contains parts of more than one urban area. For those counties, urban VMT equals the sum of the county's proportion of VMT from each of the large urban areas in the county and the county's small urban VMT.

How Does EPA Determine 1980 to 1995 VMT by Roadway Type and Vehicle Type? To calculate 1980 to 1995 VMT at the county/roadway type/vehicle type level, the Daily VMT totals for the 12 rural and urban roadway categories need to be allocated among the 8 MOBILE model vehicle type categories. For each year between 1980 and 1995, EPA calculates a percentage distribution for each vehicle type for both the rural and urban classifications. To develop this percentage distribution, EPA first obtained VMT totals by vehicle type and by year from FHWA's *Highway Statistics*.[2] *Highway Statistics* provides rural and urban VMT for the following vehicles types: passenger cars, motorcycles, buses, two-axle/four-tire single-unit trucks, other single-unit trucks, and combination trucks. (In the years prior to 1990, FHWA did not provide a VMT breakdown between passenger cars and motorcycles; instead, it provided a total VMT for Personal Passenger Vehicles is provided. EPA assumes that the division between passenger car VMT and motorcycle VMT prior to 1990 matches that reported for 1990.) For each of the six vehicle type categories for which VMT is reported in *Highway Statistics*, a percentage of the total is calculated for both rural and urban VMT. To convert these percentages for the six HPMS categories to the eight MOBILE vehicle type categories, EPA provides a breakdown that reconciles the vehicle class categories used in the HPMS to those used in EPA's MOBILE model.[7] This method of conversion from HPMS categories to MOBILE categories is based on a matching scheme that allows States to apportion VMT as it is reported in HPMS categories to the eight MOBILE model vehicle class categories. Table 4.6-4 shows the apportionment percentages supplied by EPA.

After allocating HPMS Daily VMT totals by county, roadway category, and vehicle type, EPA converts the Daily VMT values to millions of annual VMT by multiplying the Daily VMT values by 365. Quality assurance was performed on the output files for each of the years by comparing State totals to the HPMS data provided by State. (It is important to note that for certain years, slight discrepancies exist between the HPMS totals and the totals reported in *Highway Statistics*.) The resulting annual county-level, vehicle, and roadway type-specific VMT data were temporally allocated to months. EPA used seasonal 1985 National Acid Precipitation Assessment Program (NAPAP) temporal allocation factors[8] were used to apportion the VMT to the four seasons. Monthly VMT data were obtained using a ratio between the number of days in a month and the number of days in the corresponding season. These temporal factors are shown in Table 4.6-5.

4.6.3.3 What States Provided 1990 VMT Data?

For 1990 VMT data, thirteen of the 38 Ozone Transport Assessment Group (OTAG) States supplied VMT estimates for their entire State, an additional 3 States supplied VMT estimates covering part of their State, and the remaining 22 plus parts of the 3 States used *Emission Trends* VMT data. These State-provided data replaced the 1990 VMT data calculated as discussed above. Table 4.6-6 lists the state-level daily VMT totals in the OTAG Inventory. Figure 4.6-1 shows which States supplied VMT.

4.6.3.4 What Changes Did EPA Make to the VMT Estimation Methodology for the Years 1996 through 1998?

The primary changes EPA made to the 1996 through 1998 VMT estimation procedure fall into two categories. These are changes in (1) the allocation of State or metropolitan area VMT by roadway type to the counties within that State or metropolitan area, and (2) the allocation of VMT from the HPMS vehicle classes to the MOBILE5b vehicle classes.

In prior years, population was the sole surrogate for allocating State-level or metropolitan area-level VMT to the counties within that area. This allocation was modified for all road types except rural local roadways and urban local roadways. The modified procedure differed for rural interstates and for the remaining nine roadway types. The surrogate for allocating VMT from rural interstates was changed from population to interstate mileage within a county. The Federal Highway Administration provided data on roadway mileage by State, county, and roadway type. Rural interstate VMT totals for each State were then multiplied by the fraction of rural interstate mileage within a given county divided by the total State rural interstate mileage to give rural interstate VMT by county.

For the remaining nine roadway types (all roadway types except rural interstate, rural local, and urban local), a combination of population and the existence of roadway mileage in the given county of the specified roadway type were used to allocate State-level or metropolitan-level VMT. For each State or metropolitan area, the VMT from a given roadway type were allocated by population to all counties within that State or metropolitan area that had mileage greater than 0 of the given roadway type. In other words, for each of these nine roadway types, the State or metropolitan area VMT was multiplied by the fraction of population within a given county divided by the total population of counties in that State or area with mileage of the specified roadway type.

The second category of VMT methodology change for 1996 through 1998 involves the allocation of VMT by vehicle type. The allocation of HPMS to MOBILE5 vehicle categories was updated by OTAQ and varied by year from. This updated HPMS to MOBILE5 vehicle type mapping was prepared by EPA in its development of VMT estimates that were used in the 2007 heavy-duty vehicle final rule analyses.[9] As was done previously, the allocations of VMT by vehicle type in a given year differed for rural and urban roadway types, but did not differ by State. OTAQ developed data showing how to allocate the total VMT from each of the HPMS vehicle categories to the MOBILE5 vehicle categories. HPMS VMT totals by vehicle category, summed separately for total urban roadway types and total rural roadway types, were multiplied by the OTAQ allocation factor for that year and vehicle category. Once VMT totals for each of the MOBILE5 vehicle types were calculated for total urban roadways and total rural roadways, these values were converted to the fraction of total VMT by vehicle type and urban or rural area. Thus, each VMT value by county and roadway type was then multiplied by the eight MOBILE5 vehicle type fractions for either rural or urban roadways, depending on whether the VMT was from an urban or rural roadway type.

4.6.3.5 How Did EPA Project 1999 VMT Data?

The 1999 VMT data should be considered a projection of the 1998 VMT data. FHWA VMT data for 1999 are preliminary data and are not available at the same level of detail as the historical VMT data. FHWA provided preliminary 1999 VMT totals by State and roadway type. The 1998 VMT data were totaled by State and roadway type, and then the ratio of 1999 VMT by State and roadway type to the 1998 VMT by State and roadway type were calculated. Each State and roadway type 1999 to 1998 fraction was then multiplied by the 1998 VMT at the county, roadway type, and vehicle type level of detail.

4.6.3.6 How Did EPA Modify 1990 through 1995 VMT Allocations?

Modifications were made to the 1990 through 1995 VMT calculated in prior years. These changes were made only to the final step of allocating VMT from the county and roadway type level to the county/roadway type/vehicle type level of detail. In 1997, FHWA updated their data showing VMT by the HPMS vehicle type categories. This shift accounted for the more accurate classification of minivans and sport utility vehicles from the passenger car category to the 2-axle, 4-tire single-unit truck category. VMT fractions by vehicle type were calculated as done previously, except with the updated HPMS data. The VMT data in the previous 1990 through 1995 VMT databases were then multiplied by the ratio of the new MOBILE5 vehicle type fraction to the previous MOBILE5 vehicle type fraction for the given year.

4.6.4 How Does EPA Develop Emission Factors for VOC, NO_x, and CO?

As mentioned previously, EPA relied upon its MOBILE5a and MOBILE5b models to calculate VOC, NO_x, and CO emission factors for on-road sources for the years 1970 through 1994 and the years 1995 through 1999, respectively.[10] More specifically, EPA modeled exhaust VOC, evaporative VOC (which includes resting loss, running loss, and evaporative emissions), exhaust NO_x, and exhaust CO. VOC emissions include aldehydes and hydrocarbons measured by Flame Ionization Detector (FID) testing. These emission factors are expressed as grams of pollutant per vehicle mile traveled (VMT). The MOBILE model takes into consideration a number of parameters in tailoring emission factor

calculations. A discussion of how EPA develops these parameters follows. Where applicable, EPA used State-supplied MOBILE model inputs for 1990 and 1995 and later years.

4.6.4.1 What Temperature Data Does EPA Input to the MOBILE Model?

The temperature data inputs to the MOBILE model for the Emission Trends inventory include monthly average daily maximum and minimum temperature for each State for each year from 1970 to 1999. These data were obtained from The National Climatic Data Center.[11] EPA selected one city from each State to represent that particular State's temperature conditions. Each chosen city is thought to be the most representative of the average conditions within the State. Generally this means either centrally located cities or, in States with a majority of VMT clustered in one area, the most populous cities. Due to the great temperature variation and the wide VMT distribution throughout California, EPA divides California into two geographic regions, with Los Angeles representing the southern and interior portions of the State and San Francisco representing the northern coastal region of the State. Table 4.6-7 lists the cities used to represent each State's temperature conditions from 1970 to 1999.

In cases where temperature data is missing for a month or more, EPA relies on 30-year average monthly maximum and minimum temperature values reported by the Department of Commerce's Statistical Abstracts.[12] The temperature range for input to the MOBILE model is 0°F to 100°F for the minimum daily temperatures and 10°F to 110°F for the maximum daily temperatures. In the few cases where temperatures fall outside of these ranges, EPA substitutes the endpoint of the range for the actual temperatures.

4.6.4.2 How Does EPA Calculate the Monthly RVP Inputs?

Allocating monthly RVP values for each State is an important part of the MOBILE modeling process. To determine these values, EPA first assigned a weighted January and July RVP for each year to each State and then estimated the RVP for each State for the remaining ten months. For some areas, EPA adjusted the calculated RVP values for those areas not receiving reformulated gasoline (RFG) in order to eliminate the effects of lower RVP values associated with the use of RFG. In addition, some States provided summer RVP data to OTAG that differed from the values calculated for the emissions inventory. The procedures used to account for these discrepancies are described below.

To help with assigning the weighted January and July RVP values, OTAQ provided historic RVP data for the years 1970 through 1999. This historic data includes the average January and July RVP values weighted by the market share of each type of gasoline (regular unleaded, intermediate unleaded, premium unleaded, etc.) from each of the 23 cities included in the American Automobile Manufacturer's Association (AAMA) (replaced in 1999 by the Alliance of Automobile Manufacturers (AAM)) fuel surveys.[13,14] The OTAQ also provided a listing that matches each nonattainment area and many Metropolitan Statistical Areas (MSAs) throughout the United States with the corresponding AAMA survey city with which the RVP should be used to represent that nonattainment areas. Using these data, EPA assigns January and July RVP values to each State for each year. These assignments were based on pipeline distribution maps and are shown in Table 4.6-8. EPA then assigns the corresponding January and July weighted RVP values to each of the nonattainment areas. EPA averages the January or July RVP values for a given year for all nonattainment areas and listed MSAs within a State to estimate a single statewide January or July RVP value. For those States that had no nonattainment areas or MSAs

included in the OTAQ cross reference listing, OTAQ assigned survey cities to these States based on a combination of location and pipeline maps. These assignments are as follows:

State	Survey City
Idaho	Billings, MT and Seattle, WA
Iowa	Minneapolis, MN
Nebraska	Kansas City, MO and Minneapolis, MN
North Dakota	Minneapolis, MN
South Dakota	Minneapolis, MN
Wyoming	Billings, MT and Denver, CO

For States with two or more survey cities assigned to its nonattainment areas and MSAs, EPA averaged the RVP values assigned to each of the nonattainment areas or MSAs within that State. Alaska and Hawaii are not matched with survey cities; instead, they are assigned winter and summer RVP values based on guidance from OTAQ. Based on this guidance, Alaska received a winter RVP value of 14.5 psi and a summer RVP value of 12.5 psi while Hawaii received a winter RVP value of 10.0 psi and a summer RVP value of 9.5 psi. These assignments apply to each year from 1970 through 1999. An Alaskan city has been included as a survey city in the RVP surveys in recent years.

The next step in the process of allocating RVP values is to estimate statewide RVP values for the remaining months based on the January and July RVP values. The ASTM schedule of seasonal and geographical volatility classes provides the basis for the RVP allocation by month.[15] This schedule assigns one or two volatility classes to each State for each month of the year. Volatility classes are designated by a letter (A through E), with A being the least volatile. The ASTM schedule divides several States into two or more regions, with each region having its own set of volatility class guidelines. The MOBILE4 *User's Guide*[16] provides guidance on which ASTM class to assign to each State for each month when more than one region is included for a State, or when two ASTM classes are listed for a given State in a given month. EPA followed this guidance to select a single ASTM class for each State and month. The MOBILE4 User's Guide also lists RVP limits that correspond to each ASTM class. These RVP limits are as follows:

- ASTM class A = 9.0 psi
- ASTM class B = 10.0 psi
- ASTM class C = 11.5 psi
- ASTM class D = 13.5 psi
- ASTM class E= 15.0 psi

EPA assigns the January ASTM class designation to the calculated January RVP value for each State and the July ASTM class designation to the calculated July RVP value for each State. Those months with the same ASTM class designation as either January or July are assigned the January or July RVP value for that State. The RVP values for months with intermediate ASTM class designations are calculated by interpolation using the January and July RVP values and the ASTM class RVP limits. This interpolation uses Equation 4.6-5.

$$IM = [(IA - SA) \times (WM - SM) / (WA - SA)] + SM \qquad \text{(Eq. 4.6-5)}$$

where: IM = Intermediate month's (not January or July) RVP value
WM = Winter (January) RVP value
SM = Summer (July) RVP value
IA = Intermediate month's (not-January or July) ASTM RVP limit
WA = Winter (January) ASTM RVP limit
SA = Summer (July) ASTM RVP limit

EPA makes calculations for each intermediate month for each State. Starting in 1989, summer RVP values were limited by EPA's Phase I RVP limits and in 1995 by the Phase II RVP limits. After the May through September RVP values are calculated for each State using the procedure above, the values are replaced by the State-specific monthly Phase I (for 1989 to 1991) or the Phase II (for 1992 and later years) limit if the corresponding limit was lower than the calculated monthly RVP value.

How does EPA Eliminate the RVP Effects of Reformulated Gasoline? Several of the AAMA survey cities sold RFG starting in 1995. The July RVP of RFG sold in a particular geographic area is almost always lower than the July RVP of regular gasoline sold in that same geographic area. As a result, using an RFG survey city to represent RVP values for areas receiving regular gasoline results in inappropriately low RVP values for these areas. To correct this situation, OTAQ provided each of the AAMA survey cities receiving reformulated gasoline in 1995 and later years with a substitute survey city to use when calculating the July RVP values of areas without reformulated gasoline.[17] This substitute survey city assignment is shown in Table 4.6-9. The procedure discussed above for determining state-level July RVP values in States that receive both RFG and regular gasoline was modified to determine separate RVP values for both types of areas. To calculate the July RVP of regular gasoline in the State, the RVP of the substitute survey cities replaced the RVP of the original survey cities and the RVP was recalculated. This value was then used for areas in the State that did not receive reformulated gasoline.

How Was State-supplied RVP Data Used? Some States supplied summer 1995 RVP data to OTAG that differed from the values calculated using the methodology discussed above. In these cases, EPA used the State-supplied RVP data instead of the calculated 1995 through 1997 RVP values for the months from May through September. In some cases, the State-supplied data varied within a State. EPA maintained these distinctions in the Trends modeling. The resultant 1996 monthly RVP data for all areas are shown in Table 4.6-10.

How Did EPA Calculate Ozone Season 1998 and 1999 RVP Values? The procedure discussed above was **NOT** applied to the ozone season months in 1998 and 1999 because most of the cities in the RVP surveys by 1998 were implementing either a low RVP program or reformulated gasoline. Therefore, the RVP values from these cities would not be applicable to a majority of the remaining areas in the United States. For 1998 and 1999, Reid vapor pressure (RVP) data for the ozone season months (May through September) was based on data from OTAQ showing RVP throughout the ozone season by State or county, if a particular county's RVP varied from the remainder of the State's RVP. This information can be found at: http://www.epa.gov/oms/regs/fuels/rfg/sumrvp4.pdf. The July RVP value from this table was applied in all five of the ozone season months for a given county. These data were then superceded by actual July RVP survey data for areas included in American Automobile Manufacturer's Association (AAMA) fuel survey (1998)[13] or the Alliance of Automobile Manufacturers (AAM) fuel survey (1999)[14]. RVP values for the remaining months were calculated at the State level, based on the AAMA 1998 and AAM 1999 January RVP survey data. To estimate RVP values for the

remaining months in 1998 and 1999, EPA first assigned a weighted January RVP for each year to each State as discussed above for the earlier years. However, the July RVP value used in this procedure for estimating the values for the non-ozone season months, was the area's Phase II RVP limit (with 8.7 psi used to represent the 9.0 psi limit in most areas to account for the typical margin of safety used by most refiners) rather than the July values from the RVP survey data.

4.6.4.3 How Does EPA Develop Speed Inputs?

Speed is another input to the MOBILE model calculations. EPA has developed representative national speeds for each vehicle type/roadway type combination. Average overall speed data, output from the HPMS impact analysis were obtained for the years 1987 through 1990.[3] The average overall speed for each vehicle type varied less than one mile per hour (mph) over the four-year span. Therefore, EPA used 1990 speed data for all years from 1970 to 1999. Table 4.6-11 lists the average overall speed output for 1990 from the HPMS impact analysis. To determine the actual speeds to use in modeling the emission factors, EPA used the following HPMS vehicle types to represent the speeds for each MOBILE model vehicle type:

- Passenger cars — correspond to the MOBILE model's light-duty gasoline vehicles (LDGVs), light-duty diesel vehicles (LDDVs) and motorcycles (speeds for small and large cars were the same)

- Pick-ups and vans — correspond to the MOBILE model's light-duty gasoline trucks [LDGT1s (pick-ups, minivans, passenger vans, and sport-utility vehicles) up to 6,000 lbs gross vehicle weight (GVW)], LDGT2s (LDGTs of 6,000 to 8,500 lb GVW), and light-duty diesel trucks (LDDTs) up to 8500 lb GVW

- Multi-trailer trucks with five or more axles — correspond to the MOBILE model's heavy-duty gasoline vehicles (HDGVs) and heavy-duty diesel vehicles (HDDVs), both of which include vehicles weighing 8501 lb or more GVW

To reduce the number of speeds that need to be modeled, EPA rounds the HPMS speeds to the nearest 5 mph. Speeds on local roads are not included in the HPMS impact analysis output. To make up for this omission, EPA assumes that speeds on local rural roads are the same as speeds on minor collector roads and that speeds on local urban roads are the same as speeds on collector roads. Table 4.6-12 lists the average speed used for each road type/vehicle type combination. EPA does not use State-supplied speed data in making its Trends calculations.

EPA recognizes that the abolition of the national speed limit in 1995 may have caused overall speeds to increase, particularly on rural interstates. Unfortunately, little data is currently available to assess the impacts of the speed limit change on actual travel speeds. In addition, the maximum speed that can be modeled in MOBILE5b is 65 mph, so even if speed data were available, emission factors for these higher speeds could not currently be modeled with MOBILE5b.

4.6.4.4 What Operating Mode Inputs Does EPA Use?

EPA uses the operating mode assumptions of the Federal Test Procedure (FTP) for all MOBILE runs at all speeds, with the exception of Maryland and Texas, as described below. According to FTP

results, 20.6 percent of all VMT is accumulated in the cold start mode (or Bag 1 of the FTP), 27.3 percent of all VMT is accumulated in the hot start mode (or Bag 3 of the FTP), and 52.1 percent of all VMT is accumulated in the hot stabilized mode (or Bag 2 of the FTP).

Maryland and Texas supplied their own operating mode data. EPA substituted these State-supplied operating modes for the default FTP operating mode in the 1995 and later MOBILE5b input files for these States. The operating mode data modeled for these two States are shown in Table 4.6-13.

4.6.4.5 What Altitude Inputs Does EPA Use?

The States of Colorado, Nevada, New Mexico, and Utah were all modeled as high altitude areas; all other States are treated as low altitude areas in the MOBILE5 modeling.

4.6.4.6 How Does EPA Develop Registration Distribution Data?

All of the MOBILE input files include a national vehicle registration distribution. These registration distributions vary by calendar year and show the fraction of vehicles registered in the given calendar year by model year. Each vehicle type has a separate registration distribution, although single registration distributions are used for LDGVs and LDDVs and for LDGT1s and LDDTs. Registration distributions developed under earlier Emission Trends work assignments were used for calendar years 1970 through 1994. EPA developed new registration distributions for each year thereafter.

The specific procedures used in developing the national annual registration distributions are discussed in detail in the following sections. In some cases, the methods used for this version of Emission Trends inventory correspond to procedures used in previous years, while in other cases, EPA has made improvements to the estimation procedure.

EPA developed a computer program to calculate vehicle registration distributions for 1991 through 1999. (This program performs the computations that had been done in a spreadsheet model for earlier Emission Trends inventories.) This registration distribution program estimates the distribution of vehicles operating by model year for calendar years 1991 and later for each of the eight MOBILE vehicle types. For automobiles, the registration distribution is based on the number of cars in operation by model year as reported in AAMA's (and in 1999, Ward's) *Facts and Figures*[18,19] and sales data from Automotive News' *Market Data Book*.[20] For each of the five MOBILE truck classes, the distribution is based on sales figures from AAMA and *Automotive News*, as well as the number of trucks in operation by model year from AAMA. For motorcycles, the registration distribution for these three years did not change from previous years; this distribution was taken from the default distribution from the previous *Emission Trends* procedures, which covered a 12-model-year range. The specific procedure used to calculate the registration distribution for automobiles and trucks is discussed below.

How Does EPA Calculate the Registration Distribution for Automobiles? The 1998 national registration distribution was calculated starting with Ward's *Motor Vehicle Facts and Figures 1999* tables showing the number of cars in operation by model year.[19] 1998 is the most recent calendar year for which data are available from this source. EPA uses the number of cars in operation in 1998 for each model year from 1983 through 1999 as a preliminary estimate of the number of cars from these model years operating in 1999. (These will be updated in the next version of Emission Trends inventory by

Ward's actual estimates for the 1999 calendar year.) Table 4.6-14 shows the 1998 national registration distribution

The 1983 model year is the earliest model year for which data are provided on the number of cars operating in 1998. An aggregate estimate of the number of cars in operation in 1998 from model years prior to 1983 is also given. EPA developed a methodology to distribute the cars operating from model year 1983 and earlier years over the remaining 9 years required for developing a 25-year registration distribution. To do this, EPA derived a formula using automobile survival rates to project estimates of operation for these older cars by model year to 1999.[21] Based on AAMA data for previous years, the number of cars from each model year from 1974 through 1982 still in operation in 1999 was estimated using Equation 4.6-6.

$$\textit{Model Year}_N \textit{ Cars in Operation in Year}_{1999} = A \times \frac{C}{B} \qquad \text{(Eq. 4.6-6)}$$

where:
- A = AAMA number of Model $Year_N$ Cars Operating in $Year_Y$
- B = Survival rate for age_{Y-N}
- C = Survival rate for age_{1999-N}
- Year = Last calendar year for which an estimate is available for this particular model year (as of July 1)
- N = Most current model year for which *'Number of Automobiles in Operation'* are available

For example, in calculating the 1995 registration distribution, 1990 is the most recent calendar year for which data on the number of 1976 model year cars still in operation is available. *Facts and Figures*[18] indicates that 2.981 million 1976 model year cars were operating in 1990. The car survival rate from 1976 to 1995 (19 years of survival) is 0.10130.[21] The car survival rate from 1976 to 1990 (14 years of survival) is 0.32221.[21] Thus, of the 2.981 million 1976 model year cars that survived to 1990, it is expected that 31 percent (0.10130/0.32221) or 0.937 million will survive to 1995.

To develop an estimate of the number of 1999 model year cars were operating in 1999, the number of 1998 registrations of model year 1998 automobiles was multiplied by 0.75, since by July 1, three-quarters of the car model year had passed (new model year automobiles are generally released in October).

Using this complete set of automobile registrations by model year for the 25-year period from 1975 to 1999, EPA calculated the registration distribution by dividing the number of cars in operation by model year by the total number of cars operating over the 25-year period. EPA repeats this process to develop a registration distribution for other years back to 1991. The only difference for these years is that the number of cars in operation in the most recent model year is available from AAMA for these previous years and therefore, no projections of the number of cars in operation were made for the latest model year.

How Does EPA Calculate the Registration Distribution for Trucks? For each truck type, the 1998 registration distribution is calculated using truck sales figures by type and model year, which are weighted by the distribution of truck registrations (the total over all truck types) from Ward's *Motor Vehicle Facts and Figures 1999*.[19]

EPA first determines 1998 truck sales by MOBILE5b truck category. (Sales figures for years prior to 1998 did not change from those used in calculating previous years' registration distributions.) Because Ward's truck categories do not directly correspond to the categories used in MOBILE5b, EPA uses the method described below to allocate sales from Ward's weight class categories to the MOBILE truck categories. The data needed for the 1998 model year for each of the formulas listed below were obtained from *Facts and Figures 1999.*[19] The sales data for the earlier model years needed for a 1998 registration distribution were already calculated for registration distributions prepared for previous Trends inventories, and used similar data from earlier versions of *Facts and Figures.*[18] The equations used to estimate sales for each MOBILE5b truck category are listed below. Equations 4.6-7 through 4.6-11 show the formulas used for the 1991 through 1999 distribution.

$$LDGT1 = RetailSales(domestic + import)_{(0-6{,}000lbs)} - DieselFactorySales_{(0-6{,}000lbs)} \qquad \text{(Eq. 4.6-7)}$$

$$LDGT2 = \left(\begin{matrix} Retail \\ Sales \end{matrix} - VCC - M - (0.05 \times CP) - \begin{matrix} Diesel \\ Factory \\ Sales \end{matrix} \right)_{(6{,}000-10{,}000lbs)} \qquad \text{(Eq. 4.6-8)}$$

where: VCC = Retail sales of van cutaway chassis
M = Retail sales of multi-stops
CP = Retail sales of conventional pickups

$$HDGT = (VCC + M + [0.05 \times CP])_{(6{,}000-10{,}000lbs)} - \left(\begin{matrix} Heavy-Duty \\ Diesel\,Trucks \end{matrix} \right) + \left(\begin{matrix} Retail \\ Sales \end{matrix} \right)_{(>10{,}000lbs)} \qquad \text{(Eq. 4.6-9)}$$

$$LDDT = DieselFactorySales_{(0-6{,}000lbs)} + (0.10 \times DieselFactorySales)_{(6{,}000-10{,}000lbs)} \qquad \text{(Eq. 4.6-10)}$$

$$HDDT = [0.9 \times (DieselFactorySales)_{(6{,}000-10{,}000lbs)}] + \Sigma\,(DieselFactorySales)_{(>10Klbs)} \qquad \text{(Eq. 4.6-11)}$$

Once EPA converted AAMA sales data for the 1998 model year into sales data for the MOBILE5b truck categories, it calculated the fraction of total 1998 truck sales in each of these five MOBILE5b truck categories. EPA did this for each model year from 1974 through 1997, using data from earlier versions of *Facts and Figures.*

Next, EPA calculated a full 25-year distribution of trucks in operation in 1998 by model year from the 1974 through the 1998 model years. The AAMA lists the total number of trucks (of all types) in operation by model year in 1998 back to 1983. All trucks in operation from model years 1982 and earlier were provided as an aggregate figure. The total number of trucks in operation from 1982 and earlier model years was distributed to each model year from 1974 to 1982 using the method described above for distributing the figure of cars in operation from the 1982 and earlier model years to the same set of model

years. The survival rates used for distributing the number of trucks in operation were specific to trucks, rather than cars.

Using the fraction of truck sales by truck type for each of the 25 model years needed and the number of total trucks in operation in 1998 for each of the 25 model years needed, separate 1998 registration distributions were calculated for each truck type. This was accomplished by multiplying the total number of trucks in operation in 1998 in a given model year by the fraction of truck sales of the specified truck type in the given model year. Equation 4.6-12 shows how EPA calculated the number of 1990 model year LDGT1s operating in 1995.

$$\begin{matrix}\textbf{1990 } \textit{Model Year LDGT1s} \\ \textit{Operating in } \textbf{1995}\end{matrix} = \begin{matrix}\textit{Total Model Year } \textbf{1990} \\ \textit{Trucks Operating in } \textbf{1995}\end{matrix} \times \frac{\textbf{1990 } \textit{Model Year LDGT1s Sold}}{\textit{Total } \textbf{1990 } \textit{Model Year Trucks Sold}} \qquad \text{(Eq. 4.6-12)}$$

EPA applied this process to all five truck types for model years 1974 through 1998. With the number of trucks in operation 1998 by truck type and model year, the 1998 registration distribution for each truck type was calculated by dividing the number of trucks operating in 1998 from a given model year by the total number of trucks operating in 1998 for that particular truck category.

EPA projected the 1999 truck registration distributions from the calculations made for the 1998 truck registration distributions. EPA multiplied the number of trucks in operation in 1998 by truck survival rates[21] to obtain the corresponding numbers that would have survived to 1999. This is the same as the process used to project the 1998 car registration distribution to 1999. As with the procedure for cars, estimates of the number of 1998 and 1999 model year trucks operating in 1999 were calculated separately. All of the 1998 model year trucks would not have been sold by the end of the 1998 calendar year. Therefore, the number of 1998 model year trucks operating in 1999 should represent an increase over the number of 1998 trucks operating in 1998, and a survival rate of 1998 cars to 1999 should be factored in. Truck sales for 1999 were estimated as 50 percent of the 1998 sales figures for each of the truck categories. (The truck model year is assumed to start in January, so half of the model year trucks would be sold by July 1.) As with the development of the 1998 truck registration distributions, the last step in calculating the 1999 truck registration distribution was to divide the number of trucks in operation in each model year by the total number of estimated trucks in operation in 1999.

Registration distributions input to MOBILE5a should be expressed as a July 1 registration distribution. Internally, the model can then adjust this registration distribution to represent either a January 1 or a July 1 registration distribution, depending on the user selected setting of the month flag. When modeling months from January through June, EPA set the month flag within the MOBILE5a input files to "1" to simulate January registration distributions. For months from July through December, EPA set the month flag to "2" to model July registration distributions.

What Does EPA do with Local Registration Distributions for 1990, 1995, and Later Years? For the 1990, 1995, and later years MOBILE5b modeling, EPA replaced the national registration distributions in some States with State-provided data. The State-provided data were extracted from the registration distributions provided by the States to OTAG. In some States, a single registration distribution applied to the entire State. In other States, different registration distributions applied to different groupings of counties, such as nonattainment areas or MSAs. Since these State-provided registration distributions did not vary by year, EPA applied the same distributions in 1990, 1995, and later

years. All of the State-supplied registration distributions included only a single distribution for HDDVs, since they were all created for use with MOBILE.

The following States supplied their own registration distribution: Delaware, Washington DC, Louisiana, Maryland, Massachusetts, Michigan, Missouri, New Jersey, New York, North Carolina, Pennsylvania, Texas, Virginia, and Wisconsin.

The following counties in Illinois supplied their own distribution: Cook County, Du Page County, Lake County, Grundy County, Kane County, Kendall County, McHenry County, Will County, Madison County, St. Clair County, and Monroe County.

4.6.4.7 Which MONTH Flag(s) Does EPA Use in the MOBILE Model?

Registration distribution inputs to MOBILE5b are expressed as July 1 registration distributions. Internally, the model then adjusts this registration distribution to represent either a January 1 or a July 1 registration distribution, depending on the user selected setting of the MONTH flag. When modeling months from January through June, the MONTH flag within the MOBILE5b input files is set to "1" to simulate January registration distributions. For months from July through December, the flag is set to "2" to model July registration distributions.

4.6.4.8 What Additional Area-Specific Inputs from OTAG are Used?

In addition to the inputs discussed above, States supplied several additional MOBILE5b inputs for the OTAG modeling. This data has been incorporated into the *Trends* MOBILE5b input files. These inputs are listed below followed by the States that provided the inputs:

- trip length distributions (DC, MD, TX, and VA) (see Table 4.6-15)
- alcohol fuel market shares (GA, IL, IN, MI, MO, and WI) (see Table 4.6-16)
- diesel sales shares (DE, MD, and VA)

For all other States, EPA assumed the MOBILE5b model defaults for these variables.

4.6.4.9 How Does EPA Model On-road Control Programs?

The MOBILE model also allows for the modeling of several area-specific on-road control programs, such as inspection and maintenance (I/M) programs, reformulated gasoline (RFG), oxygenated fuels, the national low emission vehicle program (NLEV), heavy-duty diesel engine corrections and controls, and California emission standards.

How Does EPA Model Inspection and Maintenance (I/M) Programs? Modeling an Inspection and Maintenance (I/M) program in MOBILE requires the most complex set of inputs of any highway vehicle control program. The sources used for developing the necessary I/M program inputs include the I/M program inputs supplied by States to the OTAG process, a summary prepared by OTAQ showing the basic characteristics of I/M programs planned by the States,[22] past OTAQ I/M program summaries showing characteristics of historical or current I/M programs in each State, and inputs prepared for previous *Trends* inventories.

For States that had an I/M program in place in one or more counties in the year being modeled, EPA created at least one additional MOBILE input file to model the characteristics of the I/M program in that State. All other inputs (such as temperature, RVP, speeds, etc.) are identical to the input file without I/M modeled for the State in the year being analyzed. The determination of whether or not a county has an I/M program in place in a given year is based on a series of I/M program summaries released by OTAQ. I/M program characteristics are also included in the I/M program summaries. These program characteristics vary by State and in some cases by nonattainment area or county within a particular State. The effectiveness statistics used as MOBILE5 inputs varied by State based on the characteristics of representative I/M programs in that State. For States where I/M programs varied within a given State, a single set of effectiveness statistics, based on a combination of characteristics of all the I/M programs within the State, was used as an I/M input to the model. In some cases, the characteristics of the different programs within a specific State could not be adequately modeled using some average of the I/M program characteristics. In these cases, multiple I/M programs were modeled for these States, with the appropriate I/M programs applied to the corresponding counties. Tables 4.6-17 and 4.6-18 show the counties included in the 1996 through 1999 I/M programs by test type.

A number of States provided data to OTAG that included MOBILE I/M program inputs and the counties that these inputs should be applied to. These State-provided I/M inputs replaced the OTAQ I/M program data for 1996 and 1999. States with I/M programs outside of the OTAG domain were modeled according to the I/M program parameters supplied by OTAQ.

How Does EPA Account for the Reformulated Gasoline Program? Phase I of the federal RFG program began on January 1, 1995. Phase I RFG provides year-round toxic emission reductions and additional VOC emission reductions during the ozone season (May through September). The Clean Air Act Amendments of 1990 (CAAA) mandates that RFG be used in the nine most severe ozone nonattainment areas and allows additional nonattainment areas to opt in to the program. OTAQ provided a list of areas that participated in this program. This list can be found at: http://www.epa.gov/oms/regs/fuels/rfg/rfgarea.pdf. Table 4.6-19 shows the counties modeled with Federal RFG in 1996.

RFG was modeled in the appropriate MOBILE5b input files by setting the RFG flag to “2”, including the appropriate ASTM class of the area being modeled (B for Southern RFG areas or C for Northern RFG areas), and setting WINFLG (a hidden MOBILE5b flag) to “1”. Setting WINFLG to “1” guarantees that the summer RFG reductions are modeled regardless of the setting of the MONTH flag. For all other months, and for areas not included in the RFG program, WINFLG is either set to “2” or not included (in which case the model defaults to a setting of “2”).

How Does EPA Account for Oxygenated Fuels? The oxygenated fuel requirements of the 1990 CAAA began to take effect in late 1992. Therefore, oxygenated fuel was modeled in the areas indicated by OTAQ, using the oxygenated fuel flag and the oxygenated fuel market share and oxygen content inputs in MOBILE. OTAQ provided a listing of areas participating in the oxygenated fuel program,[23] the months that each area used oxygenated fuel, and market share data indicating the percentage of ether blends versus alcohol blends in each oxygenated fuel area. EPA assumed the average oxygen content of ether blend fuels for all areas, except California, to be 2.7 percent while alcohol blend fuels were assumed to have an oxygen content of 3.5 percent. For California, the oxygen content of both ether blends and alcohol blends was modeled as 2 percent, based on documentation from OTAQ on how to model reformulated and oxygenated fuels in the CALI5 model. Table 4.6-20 lists the areas modeled with oxygenated fuels and the corresponding inputs used for these areas.

How Does EPA Account for the National Low Emission Vehicle (NLEV) Program? On March 2, 1998, EPA's voluntary National Low Emission Vehicle (NLEV) program came into effect. This program was modeled as starting in the Northeast Ozone Transport Commission (OTC) States in 1999. States in the OTC that had already adopted a LEV program on their own were modeled with the characteristics of their own program. These States included Massachusetts, New York, Vermont, Maine, and Connecticut. The implementation schedule of the NLEV program is shown below.

Model Year	Federal Tier I Standards	Transitional LEV Standards	LEV Standards
1999	30%	40%	30%
2000		40%	60%
2001 and later			100%

These LEV implementation schedules differ from the MOBILE5b default LEV implementation schedule, which was designed to model the California LEV program. For the model to access the implementation schedule of these other LEV programs, the PROMPT flag in the applicable MOBILE5b input files was set to '5' and the name of the file containing the corresponding LEV implementation schedule was entered when prompted by MOBILE5b. In addition to setting the PROMPT flag, the REGION flag was set to '4' to properly model the LEV program in the MOBILE5b input files. The setting of '4' for the REGION flag indicates that an additional line is being added to the input file to model a LEV program. The necessary inputs for this additional program line include the start year of the LEV program and whether an "appropriate" I/M program will be implemented in conjunction with the LEV program. The start year of the LEV program was set to "95" for input files modeling Massachusetts, "96" for modeling New York, "98" for input files modeling Connecticut, and "99" for input files modeling all other States within the OTC (including the Washington DC nonattainment area portion of Virginia). With an "appropriate" I/M program, maximum benefits of the LEV program are modeled by MOBILE5b, implementing a lower set of deterioration rates.

How Does EPA Account for Heavy-Duty Vehicle Emission Rate Corrections? A correction was made to the basic emission rates (BERs) for HDDVs and HDGVs as specified by OTAQ. This correction modifies the default MOBILE5b zero mile level (ZML) (the ZML is the emission rate at the beginning of a vehicle's life) and DR (the DR reflects how quickly the emission rate of a vehicle increases with time) for NO_x for HDDVs and NO_x and VOC for HDGVs. EPA believes that these default ZMLs and DRs in MOBILE5b are not reflective of actual heavy-duty vehicle emissions.[24] The corrected BERs input to MOBILE5b are shown below. These inputs were included in all of the 1995 and later MOBILE5b input files, for both low and high altitude areas. In addition, the NEWFLG in the MOBILE5b input files was set to "2" to incorporate these additional input lines.

		NO_x		VOC	
Vehicle Category	Model Year	ZML (g/bhp-hr)	DR (g/bhp-hr/10k mi)	ZML (g/bhp-hr)	DR (g/bhp-hr/10k mi)
HDGV	1998 +	3.19	0.045		
HDGV	1994 +			0.364	0.023
HDDV	1994 - 2003			0.283	0.000

Note(s): g/bhp-hr = grams per brake horsepower-hour; k = 1,000

How Does EPA Account for California's Vehicle Program? California's highway vehicle fleet has been subject to different emission standards than the rest of the country. To account for these differences in basic emission rates, EPA used an EPA-modified version of MOBILE5a, referred to as CALI5, for California. Input files used with this model are essentially identical to MOBILE5a input files. The model internally handles the different emission standards. EPA developed temperature, RVP, speed, registration distribution, and operating mode inputs for California in the same manner as for the rest of the nation. The primary difference in inputs is the modeling of the California RFG program. Using CALI5, EPA modeled the RFG program in the summer months for 1995 by setting the RFG flag to "4". Phase II of California's RFG program began on June 1, 1996. EPA modeled this by setting the RFG flag to "5" starting with the June 1996 scenarios in the CALI5 input files. As mentioned earlier, EPA divided California into two temperature regions to account for the differences in climate throughout the State.

California's low emission vehicle (LEV) program began in 1994. This was modeled in the CALI5 input files indicating a start year of 1994 for this program and minimum LEV credits. Because MOBILE5a did not include LDGT2s in the LEV modeling, this was carried forward to CALI5. However, California's LEV program does include LDGT2s. To model the LDGT2s in the LEV program, additional BER input lines were added that model the zero mile level (ZML) and deterioration rate (DR) of the California LEV program standard for LDGT2s. Two sets of basic emission rates (BERs) were developed—one modeling the maximum LEV benefits for LDGT2s and the other modeling the minimum benefits.

How Does EPA Account for the HDDV NO_x Excess Emissions? On October 22, 1998, EPA reached a settlement agreement with seven manufacturers of diesel truck engines. EPA had found that the engines in as many as 1.3 million trucks built over the last 10 years contained devices that defeated pollution controls. Federal officials considered such engine control software to be "defeat devices," which are illegal under the federal laws. These devices allow for excessive NO_x emissions during highway driving but prohibit high emissions during engine certification testing.

Certain engine manufacturers built these devices into heavy-duty diesel vehicles beginning in the 1988 model year. In the late 1980's and early 1990's these devices were being phased into the fleet, mostly confined to the heavy end of the heavy-duty diesels (8a and 8b vehicles). However, by the mid to late 1990's such devices were widespread on virtually all of the heavy end engines and most of the medium and light end heavy-duty diesels.

Because EPA's MOBILE model is designed based on engine certification testing, these excess in-use emissions from heavy-duty diesels caused the emission factors calculated by the MOBILE model to underestimate actual emissions from these vehicles. In order to estimate actual in-use emissions from HDDVs, OTAQ developed a series of spreadsheet models to provide emission factor adjustments to apply to MOBILE5b HDDV emission factors.[25] These spreadsheets contain multiplicative factors representing the ratio of HDDV NO_x emissions with the defeat devices to the HDDV NO_x emissions without the defeat devices. These factors differ by calendar year, roadway type, and vehicle speed. The HDDV NO_x emissions, calculated using the MOBILE5b HDDV NO_x emission factors, were revised by multiplying the appropriate factor at the State/county/roadway type level of detail for the years 1990 through 1999.

4.6.5 How Does EPA Develop PM-10 and SO_2 Emission Factors?

In 1994, EPA released a particulate emission factor model, known as PART5,[26] that calculates particle emission factors in grams per mile from on-road automobiles, trucks, and motorcycles, for particle sizes up to 10 microns. PART5 calculates on-road vehicle PM-10 and PM-2.5 emission factors for vehicle exhaust, brake wear, and tire wear; reentrained road dust from paved and unpaved roads; and SO_2 vehicle exhaust emission factors.

EPA makes the following basic assumptions regarding inputs to PART5 that apply to all PART5 model runs:

- The transient speed cycle is used.
- Any county with an existing I/M program receives I/M credit from PART5, regardless of the details of the I/M program. PART5 gives credit based on the assumption that high emitting vehicles will be forced to make emission reducing repairs and that an existing I/M program will deter tampering. This only affects lead and sulfate emissions from gasoline-powered vehicles.
- Using the input parameter BUSFLG in PART5, EPA used the PART5 transit bus emission factors to model bus emission factors for all rural road types, urban interstates, and other freeways and expressways road types, while the PART5 Central Business District bus emission factors are used to model bus emission factors for all other urban road types.

4.6.5.1 How are Registration Distributions Developed for the PART5 Model?

Registration distributions for PART5 include distributions for 12 vehicle categories. The MOBILE5 HDDV category is subdivided into five subclasses (2BHDDV, LHDDV, MHDDV, HHDDV, and BUSES) in PART5. Table 4.6-21 lists the PART5 HDDV vehicle classes along with the corresponding FHWA class and gross vehicle weight. The national MOBILE5 year-specific vehicle registration distributions were modified to distribute the MOBILE HDDV vehicle class distribution among the five PART5 HDDV subclasses. This was accomplished using HDDV subclass-specific sales, survival rates, and diesel market shares. The table below shows how EPA calculated the sales for each of these five HDDV categories. All of the relevant sales data came from *Facts and Figures.* Once the sales data are extracted for each of these HDDV categories, EPA applies the procedures described above individually to each category to obtain the five separate HDDV registration distributions required by PART5.

Truck Class	Data Used to Calculate Truck Sales
2B HDDVs	0.90 *U.S. Factory Sales of Diesel Trucks 6,001 to 10,000 lb GVWR
Light HDDVs	U.S. Factory Sales of Diesel Trucks 10,001 to 19,500 lb GVWR
Medium HDDVs	U.S. Factory Sales of Diesel Trucks 19,501 to 33,000 lb GVWR
Heavy HDDVs	U.S. Factory Sales of Diesel Trucks 33,001 lb GVWR - Factory Bus Sales
Buses	Factory Bus Sales

For all other vehicle categories, the national MOBILE5b and PART5 registration distributions are identical. For areas that used local registration distributions in the MOBILE5b modeling, the HDDV category was applied to all five of the corresponding PART5 HDDV subcategory registration

distributions since the local data did not contain sufficient information to split the distributions according to HDDV subcategory.

4.6.5.2 How is Speed Modeled in the PART5 Model?

The speed inputs outlined above for use in the MOBILE model are used in the PART5 model as well, except that the maximum allowable speed in PART5 is 55 mph. Therefore, the rural interstate speed was changed from 60 mph to 55 mph for the PART5 modeling (see Table 4.6-22).

4.6.5.3 How Does EPA Develop VMT for the Five PART5 HDDV Vehicle Classes?

The HDDV VMT data developed as described above are broken down into the five PART5 subcategories for use with the PART5 PM and SO_2 emission factors. This is done by multiplying the HDDV VMT by a weighting factor for each of the five subcategories. These weighting factors are based on truck VMT by weight and truck class from the *Truck Inventory and Use Survey*[27] and FHWA's *Highway Statistics.*[2] The fractional weighting factors are shown in Table 4.6-21. After PART5 emission factors are generated, EPA then multiplies the PART5 HDDV subclass emission factors (2BHDDV, LHDDV, MHDDV, HHDDV, and BUSES) by the corresponding subclass VMT value.

4.6.5.4 How Does EPA Calculate Exhaust PM Emissions?

EPA calculates monthly, county-level, SCC-specific PM emissions from on-road vehicle exhaust components by multiplying year specific monthly, county-level, SCC-specific VMT by state-level, SCC-specific exhaust PM emission factors generated using PART5. Since none of the inputs affecting the calculation of the PM exhaust emission factors varies by month, EPA only calculates annual PM exhaust emission factors. PART5 total exhaust emission factors are the sum of lead, soluble organic fraction, remaining carbon portion, and direct SO_4 (sulfates) emission factors.

4.6.5.5 How Does EPA Calculate Exhaust SO_2 Emissions?

EPA uses the PART5 model to calculate national annual SO_2 on-road vehicle exhaust emission factors by vehicle type and speed. These emission factors vary according to fuel density, the weight percent of sulfur in the fuel, and the fuel economy of the vehicle (which varies by speed). None of these parameters varies by month or State. EPA calculates monthly/county/SCC-specific SO_2 emissions by multiplying each county's monthly VMT at the road type and vehicle type level by the SO_2 emission factor (calculated for each vehicle type and speed) that corresponds to the vehicle type and road type.

4.6.5.6 How Does EPA Calculate PM Brake Wear Emissions?

The PART5 model generates PM emission factors for brake wear of 0.013 grams per mile for PM-10 and 0.005 grams per mile for PM-2.5. These values are used to estimate brake wear emissions for all vehicle types.

4.6.5.7 How Does EPA Calculate PM Tire Wear Emissions?

The emission factors for tire wear generated by the PART5 model are proportional to the average number of wheels per vehicle. The emission factor is 0.002 grams per mile per wheel for PM-10 and

0.0005 grams per mile per wheel for PM-2.5. Therefore, EPA calculates separate tire wear emission factors for each vehicle type. Estimates of the average number of wheels per vehicle by vehicle class were developed using information from the *Truck Inventory and Use Survey*.[27] Tire wear PM emissions were then calculated at the monthly/county/SCC level by multiplying the monthly/county/SCC level VMT by the tire wear emission factor for the appropriate vehicle type.

4.6.5.8 How does EPA calculate PM and SO_2 Emissions For 1970 to 1984?

The EPA did not use the PART5 model to calculate PM-10 and SO_2 emission factors from 1970 to 1984. (EPA did not calculate $PM_{2.5}$ emissions for any years prior to 1990.) Instead, it relies on data from AP-42 and other applicable EPA documents to develop PM-10 and SO_2 emission factors. EPA developed emission factors for both PM-10 and SO_2 on a national basis by vehicle type for each year. The procedure followed for developing these emission factors is discussed below.

How Does EPA Calculate PM-10 Emission Factors for 1970 to 1984? EPA relied on the methodology used to develop the Regional Particulate Inventory [RPI] for 1990[28] to calculate on-road vehicle PM-10 emission factors for 1970 to 1984. The Regional Particulate Inventory calculated national annual 1990 PM-10 emission factors by vehicle type. With regard to gasoline PM-10 exhaust emission factors, the RPI based the factors on exhaust particulate emission factors specific to the technology type of the vehicle (i.e., catalyst vs. no catalyst) and model year group.[29] EPA then applied these basic exhaust emission factors to the corresponding portion of the vehicle fleet for each model year from age 1 to 25 comprising the 1990 fleet. Model year specific data indicating the fraction of vehicles with catalysts were obtained from the MOBILE5a source code.[10] After obtaining the model year weighted emission factor for each of the gasoline vehicle types, the model year specific emission factors were then weighted by the model year travel fraction, obtained using the by-model-year option in MOBILE5a that lists VMT fractions for each model year for the calendar year specified. These model year-weighted emission factors were then summed to obtain the fleet average exhaust particulate emission factor for each of the gasoline vehicle types. These particulate emission factors were then multiplied by the PM-10 particle size multiplier from AP-42. The PM-10 emission factors calculated for LDGVs were also applied to motorcycles.

EPA used the RPI procedure to obtain 1970 and 1984 PM-10 exhaust emission factors for gasoline-fueled vehicles, and then used straight line interpolation to calculate the PM-10 exhaust emission factors for the years between 1970 and 1984. Total PM-10 emission factors were then calculated by adding the brake and tire wear PM-10 emission factors from AP-42 (which do not vary by year).

EPA calculated PM-10 emission factors from diesel vehicles using a similar methodology; however, EPA used data by model year and vehicle type for diesel particulate emission factors and diesel travel fractions.[30] Again, EPA multiplied the particulate emission factors by the AP-42 particle size multipliers to obtain PM-10 exhaust emission factors, and PM-10 brake and tire wear emission factors were added to the exhaust emission factors.

The PM-10 emission factors by vehicle type and year used in Emission Trends inventory are shown in Table 4.6-23. These emission factors include the exhaust, brake, and tire wear components of PM-10.

How Does EPA Calculate SO_2 Emission Factors for 1970 to 1984? EPA used Equation 4.6-13 to calculate the on-road vehicle SO_2 emission factors by vehicle type.

$$SO_2EF_{x,y} = SULFCONT_{y,z} \times 0.98 \times FUELDENS_z \times 453.59 \times \frac{2}{FUELECON_{x,y}} \quad \text{(Eq. 4.6-13)}$$

where: $SO_2EF_{x,y}$ = SO_2 emission factor for vehicle type x in year y (grams per mile)
$SULFCONT_{y,z}$ = Sulfur content in year y for fuel type z (fractional value)
$FUELDENS_z$ = Fuel density of fuel type z (pounds per gallon)
$FUELECON_{x,y}$ = Fuel economy for vehicle type x in year y (miles per gallon)

The factor of 0.98 in the above equation represents the fraction of sulfur in the fuel that is converted to SO_2[31] while the 2 represents the weight molecular ratio of sulfur to SO_2. The remaining term (453.59) is the conversion from pounds to grams.

The value used for fuel sulfur content depends on whether a vehicle is gasoline-fueled or diesel-fueled. EPA relied upon a fuel sulfur content of 0.000339 for gasoline-fueled vehicles, which is based on the fuel sulfur content of EPA baseline fuel, while a fuel sulfur content of 0.002[27] was used for diesel-fueled vehicles through September 1993. EPA used fuel density values of 6.17 pounds per gallon for gasoline and 7.05 pounds per gallon for diesel for all years.[32]

Fleet average fuel economy varies slightly from year to year for each vehicle type. The values used for fuel economy from 1982 to 1984 were obtained from output from the draft MOBILE4.1 Fuel Consumption Model[33] for all vehicle types except motorcycles. 1982 was the earliest model year included in this output. EPA estimated fuel economy values for 1970 through 1981 using fuel economy data from Highway Statistics.[2] Because the vehicle classes included in Highway Statistics differ from the MOBILE vehicle classes, EPA needed to make adjustments to the Highway Statistics fuel economy data in order to smooth out the discontinuity in fuel economy estimates between the two sources from 1981 to 1982. This was done using Equation 4.6-14.

$$FE_{x,y} = FE(HS)_{x,y} \times \frac{FE(FCM)_{x,1982}}{FE(HS)_{x,1982}} \quad \text{(Eq. 4.6-14)}$$

where: $FE_{x,y}$ = Fuel economy value for vehicle type x in year y used SO_2 emission factor calculations (mpg)
$FE(HS)_{x,y}$ = Highway Statistics fuel economy for vehicle type x in year y (mpg)
$FE(FCM)_{x,1982}$ = MOBILE4.1 Fuel Consumption Model fuel economy for vehicle type x in 1982
$FE(HS)_{x,1982}$ = Highway Statistics fuel economy for vehicle type x in 1982

Differences in vehicle class definitions used in the MOBILE4.1 Fuel Consumption Model versus those used in Highway Statistics proved difficult when using the above equation. To resolve this, EPA calculated a single light duty vehicle and a single light duty truck fuel economy value for each year. EPA also used the same OTAQ apportionment used in allocating HPMS VMT to the diesel and gasoline categories in weighing gasoline and diesel vehicles. Because the MOBILE4.1 Fuel Consumption Model does not include motorcycles, EPA used a fuel economy value of 50 mpg for motorcycles in all years

from 1970 through 1984 based on AAMA motorcycle fuel economy data.[11] The fuel economy values used for each vehicle type and year are shown in Table 4.6-24.

The resulting SO_2 emission factors by vehicle type and year are shown in Table 4.6-25.

4.6.6 How Does EPA Calculate Pre-1996 Ammonia (NH_3) Emission Factors?

Little research has been done to date on NH_3 emission factors from motor vehicles. The NH3 emission factors used by EPA for years from 1990 through 1995 were calculated from vehicle test data including NH_3 emission factors summarized in a report by Volkswagen AG.[34] In the testing program described in that report, 18 different Volkswagen/Audi vehicles from the 1978 through 1986 model years were tested. These 18 vehicles represented a cross-section of the Volkswagen/Audi passenger car production program. The vehicles all had either 4 or 5 cylinder gasoline or diesel engines. Seven of the gasoline vehicles were equipped with 3-way catalysts with oxygen sensors, seven of the vehicles were diesel-fueled, and the remaining four vehicles were gasoline vehicles with no catalysts.

The Volkswagen test measured emissions from each of these vehicles using a chassis dynamometer over three different test procedures: the U.S. FTP, the U.S. Sulfate Emission Test (SET), and the U.S. Highway Driving Test. The FTP includes both cold and hot engine starts with a cumulative mileage of 11.1 miles over 505 seconds. The SET simulates 13.5 miles of travel on a freeway in Los Angeles with heavy traffic over a time of 1,398 seconds. The Highway Driving Test, also known as the Highway Fuel Economy Test (HFET), results in an average speed of 48.1 mph over 10.2 miles with a maximum speed of 59.9 mph. Both the SET and the HFET are hot start tests (no cold starts are included). The test ran each vehicle on all three test cycles on the same day, with three to five repeated measurements carried out for each vehicle on consecutive days.

The Volkswagen report includes the mean results of the emissions testing program for each of the 18 vehicles tested and for each of the test cycles. The report shows the total mean value over all three tests by engine type (gasoline with catalyst, gasoline without catalyst, and diesel). These total mean values were used in Trends analysis to calculate NH_3 emission factors, given that most types of driving would be included in one of the three test cycles studied (that is., the FTP would represent urban driving; the SET would represent stop and go driving on expressways; and the HFET would represent freeway driving). These mean emission factors are shown below.

Engine Type	Mean NH_3 Emission Factor (grams/mile)
Gasoline Engine without Catalyst	0.00352
Gasoline Engine with 3-Way Catalyst	0.13743
Diesel Engine	0.00188

Using the NH_3 emission factors listed above, EPA calculated emission factors by vehicle type and model year using MOBILE5b data listing the fraction of vehicles with 3-way catalysts by vehicle type and travel fractions from MOBILE5b output by model year and vehicle type. For the Trends analysis, EPA assigned the non-catalyst gasoline engine emission factor to motorcycles and the diesel engine emission factor to all diesel vehicle types.

To calculate the LDGV emission factor for 1995, a MOBILE5b run was made to produce by-model-year output for LDGVs in 1995. The by-model-year travel fractions were extracted from the resulting MOBILE5b output file. Then, for each of the 25 model years included in the by-model-year output, a weighted emission factor was calculated by multiplying the fraction of LDGVs with 3-way catalysts in that model year by the emission factor listed above for gasoline engines with 3-way catalysts (i.e., 0.13743 g/mi) and adding to this the product of the fraction of LDGVs without 3-way catalysts in that model year and the emission factor for gasoline engines without 3-way catalysts (i.e., 0.00352 g/mi). This weighted emission factor was then multiplied by the LDGV travel fraction for that model year, giving a model year-weighted emission factor. This procedure was repeated for each of the 25 model years included in the by-model-year output for 1995 and the 25 model-year weighted emission factors were then summed to give the composite 1995 LDGV NH_3 emission factor.

EPA repeated the above procedure for each calendar year from 1990 through 1994 for LDGVs, LDGT1s, LDGT2s, and HDGVs. Table 4.6-26 summarizes the catalyst fractions used in this analysis by model year and vehicle type.

4.6.7 How Does EPA Calculate 1996 through 1999 Ammonia Emission Factors?

EPA used a different data set to estimate NH_3 emission factors starting in 1996. These emission factors are based on data contained in a report supplied by OTAQ that allows EPA to capture the effect of catalytic converters on vehicles.[35] These numbers are, in general, consistent with more recent studies on motor vehicle emissions. MOBILE5b travel fractions are then generated by model year for each calendar year to weight the emission factors according to the fraction of vehicles with different catalyst types.

4.6.8 References

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Table 4.6-1. Methods for Developing Annual Emission Estimates for On-road Highway Vehicles for the Years 1989-1999

For the category	For the years	For the pollutant(s)	EPA estimated emissions by
Highway Vehicles	1989-1994	VOC, NO_x, CO	Using monthly, area-specific MOBILE5a emission factors except for California. For California, using monthly, area-specific CALI5 emission factors.
	1995-1999	VOC, NO_x, CO	Using monthly, area-specific MOBILE5b emission factors except for California. For California, using monthly, area-specific CALI5 emission factors.
	1989-1999	SO_2, PM_{10}, $PM_{2.5}$	Using annual, area-specific PART5 emission factors.
	1990-1995	NH_3	Using annual Volkswagen-based emission factors by vehicle type.[34]
	1996-1999	NH_3	Using annual OTAQ-based emission factors by vehicle type.[35]
Heavy Duty Diesel Vehicles	1990-1999	NO_x	Applying excess emission adjustment factors to emissions calculated with MOBILE5b or CALI5.[25]
Highway Vehicles	1989	VMT (affects all pollutants)	Using HPMS VMT data by urban area and rest-of-state rural and small urban areas, also by roadway type. Converting HPMS VMT by vehicle classes to MOBILE5 vehicle classes based on OTAQ 1994 mapping scheme.[7] Allocating VMT to county based on population.
	1990	VMT (affects all pollutants)	Using State-supplied VMT from OTAG where available to replace HPMS-based VMT.
	1990-1995	VMT (affects all pollutants)	Adjusting previous VMT (calculated as discussed for 1989) to account for shifts from passenger cars to light-duty trucks; using HMPS to MOBILE5 vehicle category allocation from 1994.
	1996-1999	VMT (affects all pollutants)	Using updated annual HPMS to MOBILE5b vehicle category allocations provided by OTAQ;[9] modifying roadway type allocations to only place VMT in counties with roadway mileage of that type. Local road VMT allocated by population. Rural interstate VMT allocated by interstate mileage.
	1999	VMT (affects all pollutants)	Starting with preliminary FHWA VMT totals by State and roadway type and allocating to county/roadway type by applying 1999 to 1998 ratio of State/roadway type VMT to 1998 VMT data.

Table 4.6-2. Comparison of Methodologies Used to Develop 1996 Base Year Emissions for On-road Sources in Versions 1 through 4 of the NEI

For the Category	For the estimation of	EPA estimated 1996 Base Year emissions for			
		Version 1 by	Version 2 by	Version 3 by	Version 4 by
Light Duty Gasoline Vehicles, Light Duty Gasoline Trucks, Heavy Duty Gasoline Vehicles, Light Duty Diesel Vehicles, Light Duty Diesel Trucks, Heavy Duty Diesel Vehicles	VMT (same VMT data is used in calculating emissions from all pollutants)	Growing 1995 VMT to 1996 based on preliminary 1996 HPMS state/roadway type VMT data. Using MOBILE5b emission factors developed at monthly level of detail by control area, vehicle type, and roadway type.	Calculating 1996 VMT by county, vehicle type, and roadway type based on 1996 final VMT data from HPMS by urban area, and state totals for small urban and rural areas, all by roadway type. Apportioning VMT to county level for all roadway types based on county population. Converting HPMS vehicle type distributions to MOBILE5b vehicle type distributions based on 1994 EPA guidance.[7]	Using same methodology as used in Version 2.	Apportioning Rural Interstate VMT to county level using Rural Interstate mileage as activity surrogate; apportioning local roadway VMT to county level based on county population; and apportioning VMT to county level for remaining roadway types based on county population for counties with mileage from specific roadway type. Reallocating Version 2 VMT by vehicle class, based on OTAQ update of the conversion of HPMS vehicle types to MOBILE5b vehicle types.[9]
Light Duty Gasoline Vehicles, Light Duty Gasoline Trucks, Heavy Duty Gasoline Vehicles, Light Duty Diesel Vehicles, Light Duty Diesel Trucks	VOC, NOx, CO	Calculating emission factors with MOBILE5b using a national registration distribution projected from 1995 to 1996, or locally supplied registration distributions where available, state-level monthly temperature data, monthly RVP data by State and nonattainment area, area-specific I/M inputs, area-specific reformulated gasoline and oxygenated fuel program inputs, and other state-supplied inputs, where provided. Calculating emissions by county, month, vehicle type, and roadway type.	Updating national 1996 registration distribution based on actual 1996 data. Updating control program inputs to MOBILE5b. Recalculating MOBILE5b emission factors with updated inputs and other unchanged inputs from Version 1. Recalculating emissions by county, month, vehicle type, and roadway type.	Using same methodology as used in Version 2.	Applying Version 2 emission factors to updated VMT.
Heavy Duty Diesel Vehicles	VOC, CO				
Heavy Duty Diesel Vehicles	NO_x	Calculating emission factors with MOBILE5b using a national registration distribution projected from 1995 to 1996, or locally supplied registration distributions where available, state-level monthly temperature data, monthly RVP data by State and nonattainment area, area-specific I/M inputs, area-specific reformulated gasoline and oxygenated fuel program inputs, and other state-supplied inputs, where provided. Calculating emissions by county, month, vehicle type, and roadway type.	Updating national 1996 registration distribution based on actual 1996 data. Updating control program inputs to MOBILE5b. Recalculating MOBILE5b emission factors with updated inputs and other unchanged inputs from Version 1. Recalculating emissions by county, month, vehicle type, and roadway type.	Applying excess emission adjustment factors to Version 2 emissions.[25]	Applying Version 2 emission factors and Version 3 excess emission adjustment factors to updated VMT.

Table 4.6-2 (continued)

For the Category	For the estimation of	EPA estimated 1996 Base Year emissions for			
		Version 1 by	Version 2 by	Version 3 by	Version 4 by
Light Duty Gasoline Vehicles, Light Duty Gasoline Trucks, Heavy Duty Gasoline Vehicles, Light Duty Diesel Vehicles, Light Duty Diesel Trucks, Heavy Duty Diesel Vehicles	SO_2, PM_{10}	Calculating emission factors with PART5 using a national registration distribution projected from 1995 to 1996, or locally supplied registration distributions where available, and area-specific I/M and reformulated gasoline inputs. Calculating emissions by county, month, vehicle type, and roadway type.	Updating national 1996 registration distribution based on actual 1996 data and recalculating PART5 emission factors using other unchanged inputs from Version 1. Calculating emissions by county, month, vehicle type, and roadway type.	Using same methodology as used in Version 2.	Applying Version 2 emission factors to updated VMT.
Gasoline Vehicles, Light Duty Gasoline Trucks, Heavy Duty Gasoline Vehicles, Light Duty Diesel Vehicles, Light Duty Diesel Trucks, Heavy Duty Diesel Vehicles	$PM_{2.5}$	Not estimated. $PM_{2.5}$ and NH_3 were not included in the Trends inventories (for any sources) until 1998 (i.e., version 2).	Updating national 1996 registration distribution based on actual 1996 data and recalculating PART5 emission factors using other unchanged inputs from Version 1. Calculating emissions by county, month, vehicle type, and roadway type.	Using same methodology as used in Version 2.	Applying Version 2 emission factors to updated VMT.
Gasoline Vehicles, Light Duty Gasoline Trucks, Heavy Duty Gasoline Vehicles, Light Duty Diesel Vehicles, Light Duty Diesel Trucks, Heavy Duty Diesel Vehicles	NH_3	Not estimated. $PM_{2.5}$ and NH_3 were not included in the Trends inventories (for any sources) until 1998 (i.e., version 2).	Calculating national emission factors by vehicle type.[35] Calculating emissions by county, month, vehicle type, and roadway type.	Using same methodology as used in Version 2.	Applying Version 2 emission factors to updated VMT.

NOTES: Version 1 corresponds to December 1997 Trends report, Version 2 estimates correspond to December 1998 report, Version 3 corresponds to March 2000 report, and Version 4 is for report yet to be published.

Table 4.6-3. Data Components of HPMS

Universe - All Road Mileage	
Identification	Contains State, county, and rural/small urbanized codes and a unique identification of location reference. Optionally, the latitude and longitude coordinates for the beginning and ending points of universe and sample sections are provided.
System	Provides for coding of functional system and federal-aid system.
Jurisdiction	Provides for coding of State or local highway system and special funding category.
Operation	Includes type of facility, truck prohibition, and toll.
Other	Contains length of highway section and fields for the coding of AADT and the number of through lanes.

Sample - Statistical Sample of Universe	
Identification	Contains unique identification for the sample section portion of the record.
Computational Elements	Provides data items used to expand sample information to universe values.
Pavement Attributes	Contains data items used to evaluate the physical characteristics of pavement, pavement performance, and the need for pavement overlays.
Improvements	Describes the improvement type for the year of the improvement completion.
Geometrics/ Configuration	Describes the physical attributes used to evaluate the capacity and operating characteristics of the facility.
Traffic/Capacity	Provides operational data items used to calculate the capacity of a section and the need for improvements.
Environment	Contains items that marginally affect the operation of a facility but are important to its structural integrity.
Supplemental Data	Provides linkage to existing structure and railroad crossing information systems.

Areawide - State Summaries	
Mileage	Road mileage
Travel	Vehicle miles traveled, percent travel by vehicle type
Accidents	Number of accidents
Injuries	Number of injuries
Population	Area population

Table 4.6-4. Apportionment Percentages for Conversion of HPMS Vehicle Type Categories to MOBILE5a Categories (through 1995)

HPMS Vehicle Type Category	MOBILE5a Vehicle Type Category and Apportionment Percentages	
Motorcycle	MC	1.0000
Passenger Car	LDGV	0.9864
	LDDV	0.0136
Other 2-Axle, 4-tire	LDGT1	0.6571
	LDGT2	0.3347
	LDDT	0.0082
Buses	HDGV	0.1028
	HDDV	0.8972
Other Single Unit Trucks	HDGV	0.7994
	HDDV	0.2006
Combination Trucks	HDDV	1.0000

Table 4.6-5. VMT Seasonal and Monthly Temporal Allocation Factors

	Roadway	Seasonal VMT Factors			
Vehicle Type	Type	Winter	Spring	Summer	Fall
LDV, LDT, MC	Rural	0.2160	0.2390	0.2890	0.2560
LDV, LDT, MC	Urban	0.2340	0.2550	0.2650	0.2450
HDV	All	0.2500	0.2500	0.2500	0.2500

	Roadway	Monthly VMT Factors: Non-Leap Years--1995, 1999, 2002, 2005, 2007, 2010											
Vehicle Type	Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
LDV, LDT, MC	Rural	0.0744	0.0672	0.0805	0.0779	0.0805	0.0942	0.0974	0.0974	0.0844	0.0872	0.0844	0.0744
LDV, LDT, MC	Urban	0.0806	0.0728	0.0859	0.0832	0.0859	0.0864	0.0893	0.0893	0.0808	0.0835	0.0808	0.0806
HDV	All	0.0861	0.0778	0.0842	0.0815	0.0842	0.0815	0.0842	0.0842	0.0824	0.0852	0.0824	0.0861

	Roadway	Monthly VMT Factors: Leap Years--1996, 2000, 2008											
Vehicle Type	Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
LDV, LDT, MC	Rural	0.0736	0.0688	0.0805	0.0779	0.0805	0.0942	0.0974	0.0974	0.0844	0.0872	0.0844	0.0736
LDV, LDT, MC	Urban	0.0797	0.0746	0.0859	0.0832	0.0859	0.0864	0.0893	0.0893	0.0808	0.0835	0.0808	0.0797
HDV	All	0.0852	0.0797	0.0842	0.0815	0.0842	0.0815	0.0842	0.0842	0.0824	0.0852	0.0824	0.0852

Table 4.6-6. State-level Daily VMT Totals in the OTAG Inventory

STATE	1990 VMT (VMT/SUMMER DAY)
Alabama	130,293,139
Arkansas	64,893,375
Connecticut	80,795,439
Delaware	21,688,232
District of Columbia	9,512,227
Florida	301,401,066
Georgia	215,733,554
Illinois	254,405,708
Indiana	146,238,700
Iowa	70,914,717
Kansas	70,274,093
Kentucky	103,468,764
Louisiana	85,036,022
Maine	36,687,471
Maryland	124,790,087
Massachusetts	128,906,395
Michigan	244,651,250
Minnesota	119,486,368
Mississippi	75,306,141
Missouri	144,836,950
Nebraska	42,949,068
New Hampshire	30,337,965
New Jersey	177,882,767
New York	327,206,333
North Carolina	159,748,582
North Dakota	18,241,880
Ohio	249,268,477
Oklahoma	101,777,917
Pennsylvania	262,877,528
Rhode Island	22,482,474
South Carolina	106,001,636
South Dakota	21,648,546
Tennessee	143,924,247
Texas	456,338,143
Vermont	18,055,581
Virginia	184,879,090
West Virginia	47,716,623
Wisconsin	116,510,029
TOTAL	**4,917,166,586**

Table 4.6-7. Cities Used for Temperature Data Modeling from 1970 through 1999

State	City
Alabama	Birmingham
Alaska	Anchorage
Arizona	Phoenix
Arkansas	Little Rock
California	Los Angeles
California	San Francisco
Colorado	Denver (1970-1997) Colorado Springs (1998-1999)
Connecticut	Hartford
Delaware	Dover
District of Columbia	Washington
Florida	Orlando
Georgia	Atlanta
Hawaii	Honolulu
Idaho	Boise
Illinois	Springfield
Indiana	Indianapolis
Iowa	Des Moines
Kansas	Topeka
Kentucky	Louisville
Louisiana	Baton Rouge
Maine	Portland
Maryland	Baltimore
Massachusetts	Boston
Michigan	Detroit
Minnesota	Minneapolis
Mississippi	Jackson
Missouri	Springfield
Montana	Billings
Nebraska	Lincoln
Nevada	Las Vegas
New Hampshire	Concord
New Jersey	Newark
New Mexico	Albuquerque
New York	New York City
North Carolina	Greensboro
North Dakota	Bismarck
Ohio	Columbus
Oklahoma	Oklahoma City
Oregon	Eugene
Pennsylvania	Harrisburg (1970-1991), Middletown (1991-1999)
Rhode Island	Providence
South Carolina	Columbia
South Dakota	Pierre
Tennessee	Nashville
Texas	Dallas/Fort Worth
Utah	Salt Lake City
Vermont	Montpelier
Virginia	Richmond
Washington	Seattle
West Virginia	Charleston
Wisconsin	Milwaukee
Wyoming	Casper

Table 4.6-8. Surrogate City Assignment

Nonattainment Area/MSA	State	Survey City
Albany-Schenectady-Troy, NY MSA	NY	New York City
Albuquerque, NM MSA	NM	Albuquerque
Allentown-Bethlehem, PA-NJ MSA	PA-NJ	Philadelphia
Altoona, PA MSA	PA	Philadelphia
Anchorage, AK MSA	AK	Cleveland
Anderson, SC MSA	SC	Atlanta
Appleton-Oshkosh-Neenah, WI MSA	WI	Chicago
Atlanta	GA	Atlanta
Atlantic City, NJ MSA	NJ	Philadelphia
Bakersfield, CA MSA	CA	San Francisco
Baltimore, MD MSA	MD	Washington, DC
Baton Rouge	LA	New Orleans
Beaumont-Port Arthur, TX MSA	TX	Dallas
Bennington Co., VT	VT	Boston
Birmingham, AL MSA	AL	Atlanta
Boston Metropolitan Area	MA	Boston
Boston Metropolitan Area	MA-NH	Boston
Bowling Green, KY	KY	Chicago
Buffalo-Niagara Falls, NY CMSA	NY	New York City
Canton, OH MSA	OH	Cleveland
Charleston, WV MSA	WV	Washington, DC
Charlotte-Gastonia-Rock Hill, NC-SC MSA	NC	Atlanta
Chattanooga, TN-GA MSA	GA-TN	Atlanta
Cherokee Co., SC	SC	Atlanta
Chester Co., SC	SC	Atlanta
Chicago-Gary-Lake County, IL-IN-WI CMSA	IL-IN-WI	Chicago
Chico, CA MSA	CA	San Francisco
Cincinnati-Hamilton, OH-KY-IN CMSA	OH-KY-IN	Cleveland
Cleveland Metropolitan Area	OH	Cleveland
Clinton Co., OH	OH	Cleveland
Colorado Springs, CO MSA	CO	Denver
Columbia, SC MSA	SC	Atlanta
Columbus, OH MSA	OH	Cleveland
Dallas-Ft. Worth, TX CMSA	TX	Dallas
Dayton-Springfield, OH MSA	OH	Cleveland
Denver-Boulder, CO CMSA	CO	Denver
Detroit-Ann Arbor, MI CMSA	MI	Detroit
Door Co., WI	WI	Chicago
Duluth, MN-WI MSA	MN	Minneapolis
Edmonson Co., KY	KY	Chicago
El Paso, TX MSA	TX	Albuquerque
Erie, PA MSA	PA	Cleveland
Essex Co., NY	NY	New York City
Evansville, IN-KY MSA	IN-KY	Chicago
Fairbanks, AK	AK	Cleveland
Fayetteville, NC MSA	NC	Atlanta
Flint, MI MSA	MI	Detroit
Fort Collins-Loveland, CO MSA	CO	Denver

Table 4.6-8 (continued)

Nonattainment Area/MSA	State	Survey City
Fresno, CA MSA	CA	San Francisco
Glens Falls, NY MSA	NY	New York City
Grand Rapids, MI MSA	MI	Chicago
Great Falls, MT MSA	MT	Billings
Greater Connecticut Metropolitan Area	CT	Boston
Greeley, CO MSA	CO	Denver
Greenbrier Co., WV	WV	Washington, DC
Greensboro-Winston-Salem-High Point PMSA	NC	Atlanta
Greenville-Spartanburg, SC MSA	SC	Atlanta
Hancock Co., ME	ME	Boston
Harrisburg-Lebanon-Carlisle, PA MSA	PA	Philadelphia
Hartford-New Britain-Middletown, CT	CT	Boston
Houston-Galveston-Brazoria, TX CMSA	TX	Dallas
Huntington-Ashland, WV-KY-OH MSA	WV-KY-OH	Washington, DC
Huntsville, AL MSA	AL	Chicago
Indianapolis, IN MSA	IN	Chicago
Jacksonville, FL MSA	FL	Miami
Janesville-Beloit, WI MSA	WI	Chicago
Jefferson Co., NY	NY	Philadelphia
Jersey Co., IL	IL	Chicago
Johnson City-Kingsport-Bristol, TN-VA MSA	TN	Atlanta
Johnstown, PA MSA	PA	Philadelphia
Josephine Co., OR	OR	Seattle
Kansas City, MO-KS MSA	MO	Kansas City
Kent and Queen Anne's Cos., MD	MD	Philadelphia
Kewaunee Co., WI	WI	Chicago
Kings Co., CA	CA	San Francisco
Klamath Co., OR	OR	San Francisco
Knox Co., ME	ME	Boston
Knoxville, TN MSA	TN	Atlanta
Lafayette-West Lafayette, IN MSA	IN	Chicago
Lake Charles, LA MSA	LA	New Orleans
Lake Tahoe South Shore, CA	CA	San Francisco
Lancaster, PA MSA	PA	Philadelphia
Las Vegas, NV MSA	NV	Las Vegas
Lawrence Co., PA	PA	Cleveland
Lewiston, ME	ME	Boston
Lexington-Fayette, KY MSA	KY	Chicago
Lincoln Co., ME	ME	Boston
Livingston Co., KY	KY	St. Louis
Longmont, CO	CO	Denver
Longview-Marshall, TX MSA	TX	Dallas
Los Angeles-Anaheim-Riverside, CA CMSA	CA	Los Angeles
Los Angeles-South Coast Air Basin, CA	CA	Los Angeles
Louisville, KY-IN MSA	KY-IN	Chicago
Manchester, NH MSA	NH	Boston
Manitowoc Co., WI	WI	Chicago
Medford, OR MSA	OR	San Francisco

Table 4.6-8 (continued)

Nonattainment Area/MSA	State	Survey City
Memphis, TN-AR-MS MSA	TN-AR-MS	St. Louis
Miami-Fort Lauderdale, FL CMSA	FL	Miami
Milwaukee Metropolitan Area	WI	Chicago
Minneapolis-St. Paul, MN-WI MSA	MN-WI	Minneapolis
Missoula, MT	MT	Billings
Mobile, AL MSA	AL	New Orleans
Modesto, CA MSA	CA	San Francisco
Montgomery, AL MSA	AL	Atlanta
Muskegon, MI MSA	MI	Chicago
Nashville, TN MSA	TN	Atlanta
New Orleans, LA MSA	LA	New Orleans
New York-Northern New Jersey-Long Island CMSA	NY-NJ-CT	New York City
Norfolk-Virginia Beach-Newport News, VA MSA	VA	Washington, DC
Northampton Co., VA	VA	Washington, DC
Oklahoma City, OK MSA	OK	Dallas
Owensboro, KY MSA	KY	Atlanta
Paducah, KY	KY	Chicago
Parkersburg, WV	WV	Cleveland
Parkersburg-Marietta, WV-OH MSA	OH-WV	Cleveland
Philadelphia Metropolitan Area	PA-NJ-DE-MD	Philadelphia
Phoenix, AZ MSA	AZ	Phoenix
Pittsburgh-Beaver Valley, PA CMSA	PA	Philadelphia
Portland, ME	ME	Boston
Portland-Vancouver, OR-WA CMSA	OR-WA	Seattle
Portsmouth-Dover-Rochester, NH-ME MSA	ME-NH	Boston
Poughkeepsie, NY MSA	NY	New York City
Providence-Pawtucket-Fall River, RI-MA CMSA	MA-RI	Boston
Provo-Orem, UT MSA	UT	Denver
Raleigh-Durham, NC MSA	NC	Atlanta
Reading, PA MSA	PA	Philadelphia
Reno, NV MSA	NV	San Francisco
Richmond-Petersburg	VA	Washington, DC
Rochester, NY MSA	NY	Philadelphia
Sacramento, CA MSA	CA	San Francisco
Salt Lake City-Ogden, UT MSA	UT	Denver
San Antonio, TX MSA	TX	San Antonio
San Diego, CA MSA	CA	Los Angeles
San Francisco-Oakland-San Jose, CA CMSA	CA	San Francisco
San Joaquin Valley, CA	CA	San Francisco
Santa Barbara-Santa Maria-Lompoc, CA MSA	CA	Los Angeles
Scranton-Wilkes-Barre, PA MSA	PA	Philadelphia
Seattle-Tacoma, WA	WA	Seattle
Sheboygan, WI MSA	WI	Chicago
Smyth Co., VA	VA	Washington, DC
South Bend-Elkhart, IN	IN	Chicago
South Bend-Mishawaka, IN MSA	IN	Chicago
Southeast Desert Modified AQMA, CA	CA	Los Angeles
Spokane, WA MSA	WA	Seattle

Table 4.6-8 (continued)

Nonattainment Area/MSA	State	Survey City
Springfield, MA MSA	MA	Boston
St. Louis, MO-IL MSA	MO-IL	St. Louis
Steubenville-Weirton, OH-WV MSA	OH-WV	Cleveland
Stockton, CA MSA	CA	San Francisco
Sussex Co., DE	DE	Philadelphia
Syracuse, NY MSA	NY	New York City
Tampa-St. Petersburg-Clearwater, MSA	FL	Miami
Toledo, OH MSA	OH	Detroit
Tulsa, OK MSA	OK	Kansas City
Ventura Co., CA	CA	Los Angeles
Visalia-Tulare-Porterville, CA MSA	CA	San Francisco
Waldo Co., ME	ME	Boston
Walworth Co., WI	WI	Chicago
Washington, DC-MD-VA MSA	DC-MD-VA	Washington, DC
Wheeling, WV-OH MSA	WV-OH	Cleveland
Winnebago Co., WI	WI	Chicago
Winston-Salem, NC	NC	Atlanta
Worcester, MA MSA	MA	Boston
Yakima, WA MSA	WA	Seattle
York, PA MSA	PA	Philadelphia
Youngstown-Warren, OH MSA	OH	Cleveland
Yuba City, CA MSA	CA	San Francisco

Table 4.6-9. Substitute Survey City Assignment

Nonattainment Area/MSA	State	Original Survey City	New Survey City
Albany-Schenectady-Troy, NY MSA	NY	New York City	Cleveland
Allentown-Bethlehem, PA-NJ MSA	PA-NJ	Philadelphia	Cleveland
Altoona, PA MSA	PA	Philadelphia	Cleveland
Appleton-Oshkosh-Neenah, WI MSA	WI	Chicago	Minneapolis
Beaumont-Port Arthur, TX MSA	TX	Dallas	New Orleans
Bennington Co., VT	VT	Boston	Minneapolis
Bowling Green, KY	KY	Chicago	Cleveland
Buffalo-Niagara Falls, NY CMSA	NY	New York City	Cleveland
Charleston, WV MSA	WV	Washington, DC	Cleveland
Door Co., WI	WI	Chicago	Minneapolis
Edmonson Co., KY	KY	Chicago	Cleveland
Essex Co., NY	NY	New York City	Cleveland
Evansville, IN-KY MSA	IN-KY	Chicago	Cleveland
Glens Falls, NY MSA	NY	New York City	Cleveland
Grand Rapids, MI MSA	MI	Chicago	Detroit
Greenbrier Co., WV	WV	Washington, DC	Cleveland
Harrisburg-Lebanon-Carlisle, PA MSA	PA	Philadelphia	Cleveland
Huntington-Ashland, WV-KY-OH MSA	WV-KY-OH	Washington, DC	Cleveland
Huntsville, AL MSA	AL	Chicago	Atlanta
Indianapolis, IN MSA	IN	Chicago	Cleveland
Jefferson Co., NY	NY	Philadelphia	Cleveland
Jersey Co., IL	IL	Chicago	Cleveland
Johnstown, PA MSA	PA	Philadelphia	Cleveland
Kewaunee Co., WI	WI	Chicago	Minneapolis
Lafayette-West Lafayette, IN MSA	IN	Chicago	Cleveland
Lancaster, PA MSA	PA	Philadelphia	Cleveland
Longview-Marshall, TX MSA	TX	Dallas	New Orleans
Louisville, KY-IN MSA	KY-IN	Chicago	Cleveland
Manitowoc Co., WI	WI	Chicago	Minneapolis
Muskegon, MI MSA	MI	Chicago	Detroit
Northampton Co., VA	VA	Washington, DC	Atlanta
Oklahoma City, OK MSA	OK	Dallas	St. Louis
Paducah, KY	KY	Chicago	Cleveland
Pittsburgh-Beaver Valley, PA CMSA	PA	Philadelphia	Cleveland
Reading, PA MSA	PA	Philadelphia	Cleveland
Rochester, NY MSA	NY	Philadelphia	Cleveland
Sheboygan, WI MSA	WI	Chicago	Minneapolis
Smyth Co., VA	VA	Washington, DC	Atlanta
South Bend-Elkhart, IN	IN	Chicago	Cleveland
South Bend-Mishawaka, IN MSA	IN	Chicago	Cleveland
Syracuse, NY MSA	NY	New York City	Cleveland
Waldo Co., ME	ME	Boston	Minneapolis
Walworth Co., WI	WI	Chicago	Minneapolis
York, PA MSA	PA	Philadelphia	Cleveland

Table 4.6-10. Monthly RVP Values Modeled in 1996

State	Applicable Counties	1996 Monthly RVP (psi)											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
AL	Entire State	12.4	12.4	9.5	9.5	7.8	7.8	7.8	7.8	7.8	9.5	9.5	12.4
AK	Entire State	14.1	14.1	14.1	14.1	13.0	13.0	13.0	13.0	13.0	14.1	14.1	14.1
AZ	Entire State	8.7	7.9	7.2	7.2	6.8	6.8	6.8	6.8	6.8	6.8	7.2	7.9
AR	Entire State	13.7	13.7	9.8	9.8	7.1	7.1	7.1	7.1	7.1	9.8	13.7	13.7
CA	Los Angeles Region	11.9	11.9	11.9	9.0	6.9	6.9	6.9	6.9	6.9	6.9	9.0	11.9
CA	San Francisco Region	11.7	11.7	11.7	11.7	9.0	6.9	6.9	6.9	6.9	7.0	9.0	11.7
CO	Entire State	13.2	12.1	10.7	10.7	9.0	7.8	7.8	7.8	7.8	9.6	10.7	12.1
CT	Entire State	13.0	13.0	10.8	10.8	8.6	8.6	8.6	8.6	8.6	10.8	10.8	13.0
DE	Entire State	13.5	13.5	11.1	11.1	8.5	8.5	8.5	8.5	8.5	7.9	11.1	13.5
DC	Entire State	12.8	10.3	10.3	7.0	7.5	7.5	7.5	7.5	7.5	7.0	10.3	12.8
FL	Entire State	11.8	11.8	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	11.8
GA	Entire State	12.4	12.4	9.4	9.4	7.6	7.6	7.6	7.6	7.6	9.4	9.4	12.4
HI	Entire State	10.0	10.0	10.0	10.0	10.0	10.0	9.5	10.0	10.0	10.0	10.0	10.0
ID	Entire State	13.9	12.3	12.3	10.2	8.6	8.6	8.6	8.6	8.6	8.6	10.2	12.3
IL	Madison, Monroe, St. Clair	14.1	14.1	11.4	11.4	7.1	7.1	7.1	7.1	7.1	7.8	11.4	14.1
IL	Rest of State	14.1	14.1	11.4	11.4	8.4	8.4	8.4	8.4	8.4	7.8	11.4	14.1
IN	Entire State	14.5	14.5	12.0	12.0	9.0	9.0	9.0	9.0	9.0	8.7	12.0	14.5
IA	Entire State	14.9	14.9	13.3	11.2	9.0	9.0	9.0	9.0	9.0	11.2	13.3	14.9
KS	Entire State	14.0	12.1	9.5	9.5	7.4	7.4	7.4	7.4	7.4	7.6	9.5	12.1
KY	Boone, Campbell, Kenton	14.2	11.7	11.7	8.4	9.3	9.3	9.3	9.3	9.3	8.4	11.7	14.2
KY	Rest of State	14.2	11.7	11.7	8.4	8.6	8.6	8.6	8.6	8.6	8.4	11.7	14.2
LA	Entire State	12.4	12.4	9.6	9.6	7.3	7.3	7.3	7.3	7.3	9.6	9.6	12.4
ME	Entire State	13.2	13.2	11.0	11.0	8.6	8.6	8.6	8.6	8.6	11.0	11.0	13.2
MD	Entire State	13.2	13.2	10.8	10.8	7.8	7.8	7.8	7.8	7.8	7.5	10.8	13.2
MA	Entire State	12.9	12.9	10.7	10.7	8.6	8.6	8.6	8.6	8.6	10.7	10.7	12.9
MI	Entire State	14.1	14.1	11.2	11.2	8.9	8.9	8.9	8.9	8.9	11.2	11.2	14.1
MN	Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, Washington, Wright	14.9	14.9	12.6	12.6	9.3	9.3	9.3	9.3	9.3	9.6	12.6	14.9
MN	Rest of State	14.9	14.9	12.6	12.6	9.0	9.0	9.0	9.0	9.0	9.6	12.6	14.9
MS	Entire State	13.7	13.7	9.8	9.8	7.1	7.1	7.1	7.1	7.1	9.8	9.8	13.7
MO	Franklin, Jefferson, St. Charles, St. Louis, St. Louis City	13.9	11.9	11.9	9.2	7.1	7.1	7.1	7.1	7.1	9.2	11.9	11.9
MO	Rest of State	13.9	11.9	11.9	9.2	7.3	7.3	7.3	7.3	7.3	9.2	11.9	11.9
MT	Entire State	13.8	13.8	12.3	10.2	8.7	8.7	8.7	8.7	8.7	10.2	12.3	13.8
NE	Entire State	14.5	14.5	12.7	10.4	8.4	8.4	8.4	8.4	8.4	8.6	10.4	12.7
NV	Entire State	10.5	9.2	8.2	8.2	7.6	7.6	7.6	7.6	7.6	7.6	8.2	9.2
NH	Entire State	12.9	12.9	10.7	10.7	8.6	8.6	8.6	8.6	8.6	10.7	10.7	12.9
NJ	Entire State	13.7	13.7	11.3	11.3	8.6	8.6	8.6	8.6	8.6	11.3	11.3	13.7
NM	Entire State	11.7	11.7	10.2	9.1	8.4	7.8	7.8	7.8	7.8	9.1	10.2	11.7
NY	Entire State	14.3	14.3	11.9	11.9	8.7	8.7	8.7	8.7	8.7	11.9	11.9	14.3
NC	Entire State	12.4	12.4	12.4	9.4	7.6	7.6	7.6	7.6	7.6	9.4	12.4	12.4
ND	Entire State	14.9	14.9	13.3	13.3	9.0	9.0	9.0	9.0	9.0	11.2	13.3	14.9
OH	Butler, Cuyahoga, Hamilton, Lake, Lorain	14.6	14.6	12.1	12.1	9.3	9.3	9.3	9.3	9.3	8.7	12.1	14.6

Table 4.6-11. HPMS Average Overall Travel Speeds for 1990 (mph)

	Rural					Urban				
Vehicle Type	Interstate	Principal Arterial	Minor Arterial	Major Collector	Minor Collector	Interstate	Other Freeways Expressways	Principal Arterial	Minor Arterial	Collector
Small Pass. Cars	58.4	46.5	40.1	35.4	30.3	46.3	42.4	18.7	19.3	19.5
Large Pass. Cars	58.4	46.5	40.1	35.4	30.3	46.3	42.4	18.7	19.3	19.5
Pickups & Vans	56.7	45.6	39.7	35.3	30.5	45.4	41.9	19.5	20.1	20.3
Single 2 Axle	55.7	44.5	38.8	32.6	24.1	47.1	42.9	18.1	18.2	18.0
Single 3+ Axle	53.3	43.0	37.6	33.1	29.8	45.4	41.5	18.0	18.1	18.1
Multi 4+ Axle	43.0	34.0	30.7	27.9	25.7	37.2	34.4	14.7	14.6	14.5
Multi 5+ Axle	41.8	33.4	30.2	26.9	22.5	36.4	33.8	14.6	14.5	14.3

Table 4.6-10 (continued)

State	Applicable Counties	1996 Monthly RVP (psi)											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
OH	Rest of State	14.6	14.6	12.1	12.1	9.0	9.0	9.0	9.0	9.0	8.7	12.1	14.6
OK	Entire State	13.9	13.9	10.1	10.1	7.4	7.4	7.4	7.4	7.4	7.2	10.1	13.9
OR	Entire State	13.1	10.8	10.8	10.8	7.7	7.7	7.7	7.7	7.7	7.7	10.8	13.1
PA	Clarion, Crawford, Elk, Erie, Forest, Jefferson, Lawrence, McKean, Mercer, Venango, Warren	14.4	14.4	12.0	12.0	9.3	9.3	9.3	9.3	9.3	12.0	12.0	14.4
PA	Rest of State	14.4	14.4	12.0	12.0	8.5	8.5	8.5	8.5	8.5	12.0	12.0	14.4
RI	Entire State	12.9	12.9	10.7	10.7	8.6	8.6	8.6	8.6	8.6	10.7	10.7	12.9
SC	Entire State	12.4	12.4	12.4	9.4	7.6	7.6	7.6	7.6	7.6	9.4	12.4	12.4
SD	Entire State	14.9	14.9	13.3	11.2	9.0	9.0	9.0	9.0	9.0	9.6	11.2	13.3
TN	Entire State	12.7	12.7	12.7	9.5	7.5	7.5	7.5	7.5	7.5	9.5	12.7	12.7
TX	El Paso	12.2	12.2	10.0	10.0	8.2	8.2	8.2	8.2	8.2	8.3	10.0	12.2
TX	Hardin, Harris, Jefferson, Orange	12.2	12.2	10.0	10.0	7.4	7.4	7.4	7.4	7.4	8.3	10.0	12.2
TX	Rest of State	12.2	12.2	10.0	10.0	7.7	7.7	7.7	7.7	7.7	8.3	10.0	12.2
UT	Entire State	13.2	12.1	12.1	10.7	9.0	7.8	7.8	7.8	7.8	9.6	10.7	12.1
VT	Entire State	14.9	14.9	12.6	12.6	9.0	9.0	9.0	9.0	9.0	12.6	12.6	14.9
VA	Entire State	12.6	10.2	10.2	7.1	7.5	7.5	7.5	7.5	7.5	7.1	10.2	12.6
WA	Entire State	14.0	14.0	11.6	11.6	8.5	8.5	8.5	8.5	8.5	8.5	11.6	14.0
WV	Entire State	14.6	14.6	12.1	12.1	8.8	8.8	8.8	8.8	8.8	8.8	12.1	14.6
WI	Entire State	14.6	14.6	12.2	12.2	9.0	9.0	9.0	9.0	9.0	9.0	12.2	14.6
WY	Entire State	13.5	13.5	12.1	10.2	8.8	8.8	8.8	8.8	8.8	8.8	10.2	12.1

Note: May through September RVP values modeled for areas receiving reformulated gasoline are set within MOBILE5b and are not reflected here.

Table 4.6-12. Average Speeds by Road Type and Vehicle Type (mph)

Rural

	Interstate	Principal Arterial	Minor Arterial	Major Collector	Minor Collector	Local
LDV	60	45	40	35	30	30
LDT	55	45	40	35	30	30
HDV	40	35	30	25	25	25

Urban

	Interstate	Other Freeways & Expressways	Principal Arterial	Minor Arterial	Collector	Local
LDV	45	45	20	20	20	20
LDT	45	45	20	20	20	20
HDV	35	35	15	15	15	15

Table 4.6-13. State-Supplied Operating Mode Inputs

		Percent of VMT Accumulated by:		
State	County	Non-catalyst Vehicles in Cold Start Mode	Catalyst Equipped Vehicles in Hot Start Mode	Catalyst Equipped Vehicles in Cold Start Mode
Texas	Brazoria Co	16.0	14.3	23.3
	Chambers Co			
	Fort Bend Co			
	Galveston Co			
	Harris Co			
	Liberty Co			
	Montgomery Co			
	Waller Co			
Texas	Collin Co	16.5	14.6	24.9
	Dallas Co			
	Denton Co			
	Tarrant Co			
Maryland	Allegany Co	22.3	14.6	22.3
	Anne Arundel Co			
	Baltimore Co			
	Caroline Co			
	Carroll Co			
	Cecil Co			
	Dorchester Co			
	Garrett Co			
	Harford Co			
	Howard Co			
	Kent Co			
	Queen Annes Co			
	St. Mary's Co			
	Somerset Co			
	Talbot Co			
	Washington Co			
	Wicomico Co			
	Worcester Co			
	Baltimore			

Table 4.6-14. Default Values for the 1998 National Registration Distribution

AGE	LDV	LDT	LDGT2	HDGV	HDDV	MC
1	0.044	0.062	0.062	0.018	0.076	0.133
2	0.064	0.089	0.074	0.036	0.084	0.152
3	0.06	0.075	0.064	0.033	0.072	0.149
4	0.071	0.082	0.071	0.026	0.102	0.115
5	0.063	0.076	0.062	0.049	0.069	0.083
6	0.063	0.065	0.048	0.04	0.055	0.08
7	0.058	0.055	0.037	0.031	0.044	0.065
8	0.06	0.054	0.035	0.036	0.04	0.049
9	0.061	0.05	0.038	0.037	0.043	0.033
10	0.065	0.054	0.051	0.052	0.052	0.029
11	0.064	0.051	0.048	0.056	0.049	0.022
12	0.059	0.046	0.036	0.04	0.04	0.09
13	0.055	0.046	0.039	0.038	0.039	0
14	0.046	0.037	0.035	0.027	0.041	0
15	0.037	0.029	0.031	0.024	0.039	0
16	0.031	0.02	0.034	0.023	0.027	0
17	0.021	0.016	0.026	0.021	0.022	0
18	0.018	0.014	0.023	0.026	0.019	0
19	0.014	0.012	0.022	0.03	0.014	0
20	0.015	0.017	0.043	0.091	0.023	0
21	0.011	0.012	0.043	0.081	0.016	0
22	0.008	0.011	0.032	0.064	0.013	0
23	0.005	0.009	0.021	0.047	0.007	0
24	0.005	0.009	0.018	0.052	0.006	0
25	0.003	0.008	0.009	0.021	0.008	0

Table 4.6-15. State-Supplied Trip Length Distribution Inputs

Nonattainment Area	Percentage of Total VMT Accumulated in Trips of: < 10 Minutes	11 to 20 Minutes	21 to 30 Minutes	31 to 40 Minutes	41 to 50 Minutes	> 50 Minutes
Washington, DC/MD/VA	16.6	33.9	23.4	13.3	6.1	6.7
Baltimore	15.1	31.7	26	13.3	6.5	7.4
Houston	14.8	27.9	22.4	14.3	8.5	12.1
Dallas	9.8	19	23.8	19.4	13.6	14.4

Table 4.6-16. State-Supplied Alcohol Fuels Data

State	Applicable Area	Ether Blends Market Share (%)	Alcohol Blends Market Share (%)	Oxygen Content of Ether Blends (%)	Oxygen Content of Alcohol Blends (%)	1.0 psi RVP Waiver
Georgia	Entire State	0.0	2.5		3.5	No
Illinois	Chicago Nonattainment Area	17.0	83.0	2.1	3.5	Yes
Illinois	Rest of State	0.0	33.0		3.5	Yes
Indiana	Entire State excluding RFG Counties	0.0	19.0		3.5	Yes
Michigan	Entire State	0.0	12.7		3.5	Yes
Missouri	Entire State	0.0	33.0		3.5	Yes
Wisconsin	Milwaukee Nonattainment Area	17.0	83.0	2.1	3.5	Yes
Wisconsin	Rest of State excluding St. Croix County	0.0	10.0		3.5	Yes

Table 4.6-17. Counties Included in 1996 and 1997 I/M Programs

(P) Indicates a Pressure and/or Purge test was also included.

I/M Program Name	Included Counties
COUNTIES WITH IDLE/2 SPEED IDLE TESTING	
ALASKA	Anchorage Ed, Fairbanks Ed
ARIZONA	Pima Co
CALIFORNIA	Butte Co, El Dorado Co, Madera Co, Merced Co, Orange Co, Placer Co, Riverside Co, San Bernardino Co, San Joaquin Co, Santa Clara Co, Stanislaus Co, Tulare Co, Ventura Co, Yolo Co, Monterey Co, San Luis Obispo Co, Santa Barbara Co, Santa Cruz Co, Sonoma Co, Fresno Co, Kern Co, Los Angeles Co, Sacramento Co, San Diego Co, Alameda Co, Contra Costa Co, Solano Co, Marin Co, San Mateo Co, Napa Co, San Francisco Co The following CA counties were added in 1997 - Colusa Co, Glenn Co, Kings Co, Nevada Co, San Benito Co, Shasta Co, Sutter Co, Tehama Co, Yuba Co
COLORADO	Pitkin Co, Larimer Co, Weld Co
CONNECTICUT	Fairfield Co, Hartford Co, Litchfield Co, Middlesex Co, New Haven Co, New London, Tolland Co, Windham Co
DELAWARE	New Castle Co, Kent Co, Sussex Co
FLORIDA	Broward Co, Dade Co, Duval Co, Hillsborough Co, Palm Beach Co, Pinellas Co
GEORGIA	Cobb Co, De Kalb Co, Fulton Co, Gwinnett Co
IDAHO	Ada Co
ILLINOIS	Cook Co, Du Page Co, Lake Co, Madison Co, St. Clair Co, Grundy Co, Kane Co, Kendall Co, McHenry Co, Will Co
INDIANA	Clark Co, Floyd Co
KENTUCKY (P)	Boone Co, Campbell Co, Kenton Co, Jefferson Co
LOUISIANA	Ascension Par, Calcasieu Par, East Baton Rouge Par, Iberville Par, Livingston Par, Pointe Coupee Par, West Baton Rouge Par
MASSACHUSETTS	Barnstable Co, Berkshire Co, Bristol Co, Dukes Co, Essex Co, Franklin Co, Hampden Co, Hampshire Co, Middlesex Co, Nantucket Co, Norfolk Co, Plymouth Co, Suffolk Co, Worcester Co
MARYLAND	Anne Arundel Co, Baltimore Co, Carroll Co, Harford Co, Howard Co, Baltimore City, Montgomery Co, Prince Georges Co, Washington Co, Calvert Co, Cecil Co, Queen Annes Co, Charles Co, Frederick Co
MINNESOTA	Anoka Co, Carver Co, Dakota Co, Hennepin Co, Ramsey Co, Scott Co, Washington Co, Wright Co,
MISSOURI	Franklin Co, Jefferson Co, St. Charles Co, St. Louis Co, St. Louis
NEVADA	Clark Co, Washoe Co
NEW JERSEY	Atlantic Co, Cape May Co, Warren Co, Bergen Co, Essex Co, Hudson Co, Hunterdon Co, Mercer Co, Middlesex Co, Monmouth Co, Morris Co, Ocean Co, Passaic Co, Somerset Co, Sussex Co, Union Co, Burlington Co, Camden Co, Cumberland Co, Gloucester Co, Salem Co
NEW MEXICO	Bernalillo Co

Table 4.6-17 (continued)

(P) Indicates a Pressure and/or Purge test was also included.

I/M Program Name	Included Counties
COUNTIES WITH IDLE/2 SPEED IDLE TESTING (cont'd.)	
NEW YORK	Bronx Co, Kings Co, Nassau Co, New York Co, Queens Co, Richmond Co, Rockland Co, Suffolk Co, Westchester Co
NORTH CAROLINA	Mecklenburg Co, Wake Co, Davidson Co, Davie Co, Forsyth Co, Guilford Co, Durham Co, Granville Co, Gaston Co
OKLAHOMA	Canadian Co, Cleveland Co, Kingfisher Co, Lincoln Co, Logan Co, McClain Co, Oklahoma Co, Pottawatomie Co, Creek Co, Osage Co, Rogers Co, Tulsa Co, Wagoner Co
OREGON (P)	Jackson Co, Clackamas Co, Multnomah Co, Washington Co
PENNSYLVANIA	Lehigh Co, Northampton Co, Allegheny Co, Beaver Co, Washington Co, Westmoreland Co
RHODE ISLAND	Bristol Co, Kent Co, Newport Co, Providence Co, Washington Co
TENNESSEE	Shelby Co, Davidson Co, Rutherford Co, Sumner Co, Williamson Co, Wilson Co
TEXAS	Dallas Co, Tarrant Co, El Paso Co, Harris Co
UTAH	Weber Co, Utah Co
VERMONT	Addison Co, Bennington Co, Caledonia Co, Chittenden Co, Essex Co, Franklin Co, Grand Isle Co, Lamoille Co, Orange Co, Orleans Co, Rutland Co, Washington Co, Windham Co, Windsor Co
VIRGINIA	Arlington Co, Fairfax Co, Fairfax, Prince William Co, Alexandria, Manassas, Manassas Park, Falls Church
COUNTIES WITH ASM TESTING	
PENNSYLVANIA (P)	Bucks Co, Chester Co, Delaware Co, Montgomery Co, Philadelphia Co
UTAH	Salt Lake Co
WASHINGTON	King Co, Snohomish Co, Spokane Co, Clark Co, Pierce Co
COUNTIES WITH IM240 TESTING	
ARIZONA (P)	Maricopa Co
COLORADO	Adams Co, Arapahoe Co, Boulder Co, Douglas Co, Jefferson Co, Denver Co, El Paso Co
DC	Washington
INDIANA	Lake Co, Porter Co
OHIO (P)	Clark Co, Greene Co, Montgomery Co, Clermont Co, Geauga Co, Medina Co, Portage Co, Summit Co, Warren Co, Butler Co, Hamilton Co, Lake Co, Lorain Co, Cuyahoga Co
UTAH	Davis Co
WISCONSIN	Kenosha Co, Milwaukee Co, Ozaukee Co, Racine Co, Washington Co, Waukesha Co, Sheboygan Co

Table 4.6-18. Counties Included in 1998 and 1999 I/M Programs

(P) indicates a Pressure and/or Purge test was also included.
*** Indicates the state was added in 1999**

I/M Program Name	Included Counties
COUNTIES WITH IDLE/2 SPEED IDLE TESTING	
ALASKA	Anchorage Ed, Fairbanks Ed
ARIZONA (P)	Pima Co
CALIFORNIA (P)	Butte Co, Colusa Co, El Dorado Co, Glenn Co, Kings Co, Madera Co, Merced Co, Nevada Co, Orange Co, Placer Co, Riverside Co, San Benito Co, San Bernardino Co, San Joaquin Co, Santa Clara Co, Shasta Co, Stanislaus Co, Sutter Co, Tehama Co, Tulare Co, Ventura Co, Yolo Co, Yuba Co, Monterey Co, San Luis Obispo Co, Santa Barbara Co, Santa Cruz Co, Sonoma Co, Fresno Co, Kern Co, Los Angeles Co, Sacramento Co, San Diego Co, Alameda Co, Contra Costa Co, Solano Co, Marin Co, San Mateo Co, Napa Co, San Francisco Co
COLORADO (P)	Pitkin Co, Larimer Co, Weld Co
DC	Washington
DELAWARE (P)	New Castle Co, Kent Co, Sussex Co
FLORIDA	Broward Co, Dade Co, Duval Co, Hillsborough Co, Palm Beach Co, Pinellas Co
GEORGIA	Cobb Co, De Kalb Co, Fulton Co, Gwinnett Co
IDAHO7	Ada Co
ILLINOIS	Cook Co, Du Page Co, Lake Co, Madison Co, St. Clair Co, Grundy Co, Kane Co, Kendall Co, McHenry Co, Will Co
KENTUCKY (P)	Boone Co, Campbell Co, Kenton Co, Jefferson Co
LOUISIANA	Ascension Par, Calcasieu Par, East Baton Rouge Par, Iberville Par, Livingston Par, Pointe Coupee Par, West Baton Rouge Par
MASSACHUSETTS	Barnstable Co, Berkshire Co, Bristol Co, Dukes Co, Essex Co, Franklin Co, Hampden Co, Hampshire Co, Middlesex Co, Nantucket Co, Norfolk Co, Plymouth Co, Suffolk Co, Worcester Co
MARYLAND	Anne Arundel Co, Baltimore Co, Carroll Co, Harford Co, Howard Co, Baltimore, Montgomery Co, Prince Georges Co, Washington Co, Calvert Co, Cecil Co, Queen Annes Co, Charles Co, Frederick Co
*MAINE (P)	Cumberland Co
MINNESOTA	Anoka Co, Carver Co, Dakota Co, Hennepin Co, Ramsey Co, Scott Co, Washington Co, Wright Co
MISSOURI	Franklin Co, Jefferson Co, St. Charles Co, St. Louis Co, St. Louis
NORTH CAROLINA	Mecklenburg Co, Wake Co, Davidson Co, Davie Co, Forsyth Co, Guilford Co, Durham Co, Granville Co, Gaston Co
*NEW HAMPSHIRE	Hillsborough Co, Rockingham Co
NEW JERSEY	Atlantic Co, Cape May Co, Warren Co, Bergen Co, Essex Co, Hudson Co, Hunterdon Co, Mercer Co, Middlesex Co, Monmouth Co, Morris Co, Ocean Co, Passaic Co, Somerset Co, Sussex Co, Union Co, Burlington Co, Camden Co, Cumberland Co, Gloucester Co, Salem Co
NEW MEXICO (P)	Bernalillo Co

Table 4.6-18 (continued)

(P) indicates a Pressure and/or Purge test was also included.
*** Indicates the state was added in 1999**

I/M Program Name	Included Counties
COUNTIES WITH IDLE/2 SPEED IDLE TESTING (cont'd.)	
NEVADA	Clark Co, Washoe Co
NEW YORK	Bronx Co, Kings Co, Nassau Co, New York Co, Queens Co, Richmond Co, Rockland Co, Suffolk Co, Westchester Co
OKLAHOMA	Canadian Co, Cleveland Co, Kingfisher Co, Lincoln Co, Logan Co, McClain Co, Oklahoma Co, Pottawatomie Co, Creek Co, Osage Co, Rogers Co, Tulsa Co, Wagoner Co
PENNSYLVANIA	Lehigh Co, Northampton Co, Allegheny Co, Beaver Co, Washington Co, Westmoreland Co
RHODE ISLAND	Bristol Co, Kent Co, Newport Co, Providence Co, Washington Co
TENNESSEE	Shelby Co, Davidson Co, Rutherford Co, Sumner Co, Williamson Co, Wilson Co
TEXAS (P)	Dallas Co, Tarrant Co, El Paso Co, Harris Co
UTAH (P)	Davis Co, Weber Co, Utah Co
VERMONT (P)	Addison Co, Bennington Co, Caledonia Co, Chittenden Co, Essex Co, Franklin Co, Grand Isle Co, Lamoille Co, Orange Co, Orleans Co, Rutland Co, Washington Co, Windham Co, Windsor Co
COUNTIES WITH ASM TESTING	
CONNECTICUT (P)	Fairfield Co, Hartford Co, Litchfield Co, Middlesex Co, New Haven Co, New London Co, Tolland Co, Windham Co
OHIO (P)	Clark Co, Greene Co, Montgomery Co
PENNSYLVANIA (P)	Bucks Co, Chester Co, Delaware Co, Montgomery Co, Philadelphia Co
UTAH (P)	Salt Lake Co
VIRGINIA (P)	Arlington Co, Fairfax Co, Fairfax, Prince William Co, Alexandria, Manassas, Manassas Park, Falls Church
WASHINGTON (P)	King Co, Snohomish Co, Spokane Co, Clark Co, Pierce Co
COUNTIES WITH IM240 TESTING	
ARIZONA (P)	Maricopa Co
COLORADO (P)	Adams Co, Arapahoe Co, Boulder Co, Douglas Co, Jefferson Co, Denver Co, El Paso Co
INDIANA (P)	Clark Co, Floyd Co, Lake Co, Porter Co
OHIO (P)	Clermont Co, Geauga Co, Medina Co, Portage Co, Summit Co, Warren Co, Butler Co, Hamilton Co, Lake Co, Lorain Co, Cuyahoga Co
OREGON (P)	Jackson Co, Clackamas Co, Multnomah Co, Washington Co
WISCONSIN (P)	Kenosha Co, Milwaukee Co, Ozaukee Co, Racine Co, Washington Co, Waukesha Co, Sheboygan Co

Table 4.6-19. Counties Modeled with Federal Reformulated Gasoline

State (ASTM Class)/ Nonattainment Area	County
Arizona (B)	
Phoenix	
	Maricopa Co
Connecticut (C)	
Greater Connecticut	
	Hartford Co
	Litchfield Co
	Middlesex Co
	New Haven Co
	New London Co
	Tolland Co
	Windham Co
New York-Northern New Jersey-Long Island	
	Fairfield Co
District of Columbia (B)	
Washington DC	
	Washington
Delaware (C)	
Philadelphia-Wilmington-Trenton	
	Kent Co
	New Castle Co
Sussex County	
	Sussex Co
Illinois (C)	
Chicago-Gary-Lake County	
	Cook Co
	Du Page Co
	Grundy Co
	Kane Co
	Kendall Co
	Lake Co
	McHenry Co
	Will Co
Indiana (C)	
Chicago-Gary-Lake County	
	Lake Co
	Porter Co
Kentucky (C)	
Cincinnati-Hamilton	
	Boone Co
	Campbell Co
	Kenton Co
Maine (C)	
Knox & Lincoln Counties	
	Knox Co
	Lincoln Co
Lewiston-Auburn	
	Androscoggin Co
	Kennebec Co
Portland	
	Cumberland Co
	Sagadahoc Co
	York Co
Maryland (B)	
Baltimore	
	Anne Arundel Co
	Baltimore
	Baltimore Co
	Carroll Co
	Harford Co
	Howard Co
Kent & Queen Annes Counties	
	Kent Co
	Queen Annes Co
Philadelphia-Wilmington-Trenton	
	Cecil Co
Washington DC	
	Calvert Co
	Charles Co
	Frederick Co
	Montgomery Co
	Prince Georges Co
Massachusetts (C)	
Boston-Lawrence-Worcester-Eastern MA	
	Barnstable Co
	Bristol Co
	Dukes Co
	Essex Co
	Middlesex Co
	Nantucket Co
	Norfolk Co
	Plymouth Co
	Suffolk Co
	Worcester Co

Table 4.6-19 (continued)

State (ASTM Class)/ Nonattainment Area	County
Louisville	
	Bullitt Co
	Jefferson Co
	Oldham Co
New Hampshire (C)	
Manchester	
	Hillsborough Co
	Merrimack Co
Portsmouth-Dover-Rochester	
	Rockingham Co
	Strafford Co
New Jersey (C)	
Allentown-Bethlehem-Easton	
	Warren Co
Atlantic City	
	Atlantic Co
	Cape May Co
New York-Northern New Jersey-Long Island	
	Bergen Co
	Essex Co
	Hudson Co
	Hunterdon Co
	Middlesex Co
	Monmouth Co
	Morris Co
	Ocean Co
	Passaic Co
	Somerset Co
	Sussex Co
	Union Co
Philadelphia-Wilmington-Trenton	
	Burlington Co
	Camden Co
	Cumberland Co
	Gloucester Co
	Mercer Co
	Salem Co
New York (C)	
New York-Northern New Jersey-Long Island	
	Bronx Co
	Kings Co
	Nassau Co
	New York Co
	Orange Co
Springfield/Pittsfield-Western MA	
	Berkshire Co
	Franklin Co
	Hampden Co
	Hampshire Co
New York (C)	
Poughkeepsie	
	Dutchess Co
	Putnam Co
Pennsylvania (C)	
Philadelphia-Wilmington-Trenton	
	Bucks Co
	Chester Co
	Delaware Co
	Montgomery Co
	Philadelphia Co
Rhode Island (C)	
Providence	
	Bristol Co
	Kent Co
	Newport Co
	Providence Co
	Washington Co
Texas (B)	
Dallas-Fort Worth	
	Collin Co
	Dallas Co
	Denton Co
	Tarrant Co
Houston-Galveston-Brazoria	
	Brazoria Co
	Chambers Co
	Fort Bend Co
	Galveston Co
	Harris Co
	Liberty Co
	Montgomery Co
	Waller Co
Virginia (B)	
Norfolk-Virginia Beach-Newport News	
	Chesapeake
	Hampton
	James City Co
	Newport News
	Norfolk

Table 4.6-19 (continued)

State (ASTM Class)/ Nonattainment Area	County
	Queens Co
	Richmond Co
	Rockland Co
	Suffolk Co
	Westchester Co
Virginia (B)	
Richmond-Petersburg	
	Charles City Co
	Chesterfield Co
	Colonial Heights
	Hanover Co
	Henrico Co
	Hopewell
	Richmond
Washington DC	
	Alexandria
	Arlington Co
	Fairfax
	Fairfax Co
	Falls Church
	Loudoun Co
	Manassas
	Manassas Park
	Prince William Co
	Stafford Co
	Poquoson
	Portsmouth
	Suffolk
	Virginia Beach
	Williamsburg
	York Co
Wisconsin (C)	
Milwaukee-Racine	
	Kenosha Co
	Milwaukee Co
	Ozaukee Co
	Racine Co
	Washington Co
	Waukesha Co

Notes: Reformulated gasoline was only modeled in Phoenix during 1997 and 1998. California reformulated gasoline was modeled statewide in California.

Table 4.6-20. Oxygenated Fuel Modeling Parameters

State	County	Market Shares (%)		Oxygen Content (%)		Oxygenated
		MTBE	Alcohol Blends	MTBE	Alcohol Blends	Fuel Season
Alaska	Anchorage Ed	0	100	2.7	2.0	NOV - FEB
Arizona	Maricopa Co	80	20	2.7	2.0	OCT - FEB
Colorado	Adams Co	75	25	2.7	2.0	NOV - FEB
Colorado	Arapahoe Co	75	25	2.7	2.0	NOV - FEB
Colorado	Boulder Co	75	25	2.7	2.0	NOV - FEB
Colorado	Douglas Co	75	25	2.7	2.0	NOV - FEB
Colorado	Jefferson Co	75	25	2.7	2.0	NOV - FEB
Colorado	Denver Co	75	25	2.7	2.0	NOV - FEB
Colorado	El Paso Co	75	25	2.7	2.0	NOV - FEB
Colorado	Larimer Co	75	25	2.7	2.0	NOV - FEB
Connecticut	Fairfield Co	90	10	2.7	2.0	NOV - FEB
Minnesota	Anoka Co	10	90	2.7	2.0	OCT - JAN
Minnesota	Carver Co	10	90	2.7	2.0	OCT - JAN
Minnesota	Dakota Co	10	90	2.7	2.0	OCT - JAN
Minnesota	Hennepin Co	10	90	2.7	2.0	OCT - JAN
Minnesota	Ramsey Co	10	90	2.7	2.0	OCT - JAN
Minnesota	Scott Co	10	90	2.7	2.0	OCT - JAN
Minnesota	Washington Co	10	90	2.7	2.0	OCT - JAN
Minnesota	Wright Co	10	90	2.7	2.0	OCT - JAN
Minnesota	Chisago Co	10	90	2.7	2.0	OCT - JAN
Minnesota	Isanti Co	10	90	2.7	2.0	OCT - JAN
Montana	Missoula Co	0	100	2.7	2.0	NOV - FEB
Nevada	Clark Co	0	100	2.7	2.0	OCT - MAR
Nevada	Washoe Co	95	5	2.7	2.0	OCT - JAN
New Jersey	Bergen Co	95	5	2.7	2.0	NOV - FEB
New Jersey	Essex Co	95	5	2.7	2.0	NOV - FEB
New Jersey	Hudson Co	95	5	2.7	2.0	NOV - FEB
New Jersey	Hunterdon Co	95	5	2.7	2.0	NOV - FEB
New Jersey	Middlesex Co	95	5	2.7	2.0	NOV - FEB
New Jersey	Monmouth Co	95	5	2.7	2.0	NOV - FEB
New Jersey	Morris Co	95	5	2.7	2.0	NOV - FEB
New Jersey	Ocean Co	95	5	2.7	2.0	NOV - FEB
New Jersey	Passaic Co	95	5	2.7	2.0	NOV - FEB
New Jersey	Somerset Co	95	5	2.7	2.0	NOV - FEB
New Jersey	Sussex Co	95	5	2.7	2.0	NOV - FEB
New Jersey	Union Co	95	5	2.7	2.0	NOV - FEB
New York	Bronx Co	95	5	2.7	2.0	NOV - FEB
New York	Kings Co	95	5	2.7	2.0	NOV - FEB
New York	Nassau Co	95	5	2.7	2.0	NOV - FEB
New York	New York Co	95	5	2.7	2.0	NOV - FEB
New York	Queens Co	95	5	2.7	2.0	NOV - FEB
New York	Richmond Co	95	5	2.7	2.0	NOV - FEB
New York	Rockland Co	95	5	2.7	2.0	NOV - FEB
New York	Suffolk Co	95	5	2.7	2.0	NOV - FEB
New York	Westchester Co	95	5	2.7	2.0	NOV - FEB
New York	Orange Co	95	5	2.7	2.0	NOV - FEB
New York	Putnam Co	95	5	2.7	2.0	NOV - FEB
Oregon	Clackamas Co	1	99	2.7	2.0	NOV - FEB
Oregon	Jackson Co	1	99	2.7	2.0	NOV - FEB
Oregon	Multnomah Co	1	99	2.7	2.0	NOV - FEB
Oregon	Washington Co	1	99	2.7	2.0	NOV - FEB
Oregon	Josephine Co	1	99	2.7	2.0	NOV - FEB
Oregon	Klamath Co	1	99	2.7	2.0	NOV - FEB
Oregon	Yamhill Co	1	99	2.7	2.0	NOV - FEB
Texas	El Paso Co	15	85	2.7	2.0	NOV - FEB
Utah	Utah Co	20	80	2.7	2.0	NOV - FEB
Washington	Clark Co	1	99	2.7	2.0	NOV - FEB
Washington	Spokane Co	1	99	2.7	2.0	SEP - FEB
Wisconsin	St. Croix Co	10	90	2.7	2.0	OCT - JAN

Table 4.6-21. PART5 HDDV Vehicle Classes

Vehicle Class		FHWA Class	Gross Vehicle Weight (lbs)	Fraction of Total HDDV VMT
2BHDDV	class 2B heavy-duty diesel vehicles	2B	8,501-10,000	0.001
LHDDV	light heavy-duty diesel vehicles	3,4,5	10,001-19,500	0.026
MHDDV	medium heavy-duty diesel vehicles	6,7,8A	19,501-33,000	0.102
HHDDV	heavy heavy-duty diesel vehicles	8B	33,000+	0.820
BUSES	buses			0.051

Table 4.6-22. Average Speeds by Road Type and Vehicle Type

	Rural Road Speeds (mph)					
Vehicle Type	Interstate	Principal Arterial	Minor Arterial	Major Collector	Minor Collector	Local
LDV	60	45	40	35	30	30
LDT	55	45	40	35	30	30
HDV	40	35	30	25	25	25

	Urban Road Speeds (mph)					
Vehicle Type	Interstate	Other Freeways & Expressways	Principal Arterial	Minor Arterial	Collector	Local
LDV	45	45	20	20	20	20
LDT	45	45	20	20	20	20
HDV	35	35	15	15	15	15

Table 4.6-23. PM-10 Emission Factors used in the Emission Trends Inventory

	Emission Factor (grams per mile)							
Year	**LDGV**	**LDGT1**	**LDGT2**	**HDGV**	**LDDV**	**LDDT**	**HDDV**	**MC**
1970	0.070	0.069	0.070	0.062	0.615	0.615	2.367	0.070
1971	0.066	0.066	0.067	0.062	0.615	0.615	2.367	0.066
1972	0.063	0.063	0.064	0.062	0.615	0.615	2.367	0.063
1973	0.060	0.060	0.062	0.062	0.615	0.615	2.367	0.060
1974	0.057	0.057	0.059	0.062	0.615	0.615	2.351	0.057
1975	0.054	0.054	0.057	0.062	0.615	0.615	2.335	0.054
1976	0.051	0.051	0.054	0.062	0.615	0.615	2.319	0.051
1977	0.048	0.049	0.052	0.062	0.585	0.583	2.303	0.048
1978	0.045	0.046	0.049	0.062	0.555	0.552	2.287	0.045
1979	0.042	0.043	0.047	0.062	0.525	0.520	2.271	0.042
1980	0.039	0.040	0.044	0.062	0.495	0.489	2.255	0.039
1981	0.036	0.037	0.042	0.062	0.465	0.457	2.239	0.036
1982	0.033	0.034	0.039	0.062	0.435	0.426	2.223	0.033
1983	0.030	0.032	0.037	0.062	0.405	0.395	2.207	0.030
1984	0.026	0.029	0.034	0.062	0.375	0.363	2.191	0.026

Table 4.6-24. Fuel Economy Values Used in Calculation of SO_2 Emission Factors for the Emission Trends Inventory

	Fuel Economy (miles/gallon)						
Year	**LDGV**	**LDGT**	**HDGV**	**LDDV**	**LDDT**	**HDDV**	**MC**
1970	12.68	10.18	6.79	12.68	10.18	5.05	50.00
1971	12.70	10.39	6.85	12.70	10.39	5.17	50.00
1972	12.57	10.51	6.86	12.57	10.51	5.27	50.00
1973	12.48	10.69	6.90	12.48	10.69	5.32	50.00
1974	12.59	11.15	7.11	12.59	11.15	5.47	50.00
1975	12.68	11.40	7.16	12.68	11.40	5.62	50.00
1976	12.69	11.39	7.05	12.69	11.39	5.47	50.00
1977	12.94	11.63	7.05	12.94	11.63	5.47	50.00
1978	13.17	11.81	6.97	13.17	11.81	5.45	50.00
1979	13.52	12.00	6.94	13.52	12.00	5.45	50.00
1980	14.50	12.54	7.13	14.50	12.54	5.64	50.00
1981	14.95	12.72	7.07	14.95	12.72	5.56	50.00
1982	15.49	12.96	7.65	24.90	24.59	5.30	50.00
1983	16.13	13.42	7.96	25.10	24.85	5.44	50.00
1984	16.78	13.90	8.15	25.21	24.96	5.57	50.00

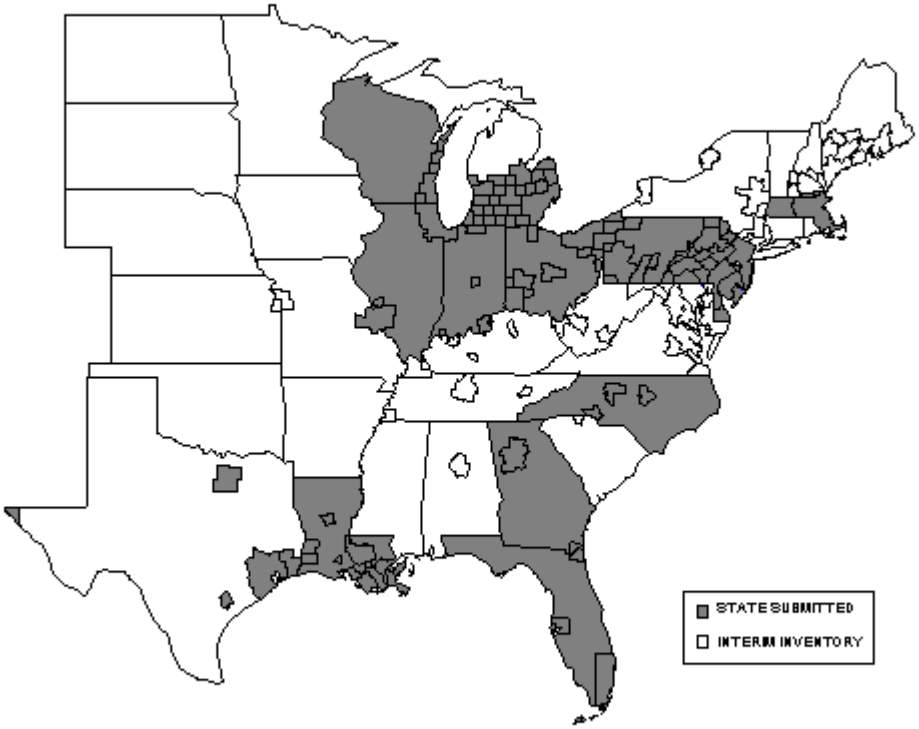
Table 4.6-25. SO_2 Emission Factors used in the Emission Trends Inventory

	Emission Factor (grams per mile)							
Year	**LDGV**	**LDGT1**	**LDGT2**	**HDGV**	**LDDV**	**LDDT**	**HDDV**	**MC**
1970	0.147	0.183	0.183	0.274	0.989	1.231	2.482	0.037
1971	0.146	0.179	0.179	0.272	0.987	1.207	2.425	0.037
1972	0.148	0.177	0.177	0.271	0.997	1.193	2.379	0.037
1973	0.149	0.174	0.174	0.270	1.004	1.173	2.356	0.037
1974	0.148	0.167	0.167	0.262	0.996	1.124	2.292	0.037
1975	0.147	0.163	0.163	0.260	0.989	1.100	2.231	0.037
1976	0.147	0.163	0.163	0.264	0.988	1.101	2.292	0.037
1977	0.144	0.160	0.160	0.264	0.969	1.078	2.292	0.037
1978	0.141	0.158	0.158	0.267	0.952	1.061	2.300	0.037
1979	0.138	0.155	0.155	0.268	0.927	1.045	2.300	0.037
1980	0.128	0.148	0.148	0.261	0.865	1.000	2.223	0.037
1981	0.124	0.146	0.146	0.263	0.839	0.986	2.255	0.037
1982	0.120	0.144	0.144	0.243	0.503	0.510	2.365	0.037
1983	0.115	0.139	0.139	0.234	0.499	0.504	2.304	0.037
1984	0.111	0.134	0.134	0.228	0.497	0.502	2.251	0.037

Table 4.6-26. Fractions of Vehicles Equipped with 3-Way Catalysts by Vehicle Type and Model Year

	LDGVs		**LDGT1**		**LDGT2**		**HDGVs**	
Model Year	**With Catalyst**	**Without Catalyst**	**With Catalyst**	**Without Catalyst**	**With Catalyst**	**Without Catalyst**	**With Catalyst**	**Without Catalyst**
1990 and later	1.00	0.00	0.95	0.05	0.85	0.15	0.25	0.75
1989	1.00	0.00	0.95	0.05	0.85	0.15	0.15	0.85
1988	1.00	0.00	0.95	0.05	0.85	0.15	0.15	0.85
1987	1.00	0.00	0.95	0.05	0.85	0.15	0.15	0.85
1986	1.00	0.00	0.50	0.50	0.50	0.50	0.00	1.00
1985	1.00	0.00	0.40	0.60	0.40	0.60	0.00	1.00
1984	1.00	0.00	0.30	0.70	0.30	0.70	0.00	1.00
1983	0.88	0.12	0.20	0.80	0.10	0.90	0.00	1.00
1982	0.86	0.14	0.10	0.90	0.00	1.00	0.00	1.00
1981	0.07	0.93	0.05	0.95	0.00	1.00	0.00	1.00
1980	0.07	0.93	0.00	1.00	0.00	1.00	0.00	1.00
1979 and earlier	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00

Figure 4.6-1. OTAG Inventory Source of Data - VMT



4.7 NONROAD ENGINES AND VEHICLES

4.7.1 What Sources Do We Include in the Nonroad Engines and Vehicles Category?

"Nonroad engines and vehicles" includes the following Tier I and Tier II categories:

Tier I Category	Tier II Category
(09) STORAGE AND TRANSPORT	(02) Petroleum and Petroleum Product Storage
(12) NONROAD ENGINES AND VEHICLES	All
(14) MISCELLANEOUS	(07) Fugitive Dust

The "nonroad engines and vehicles" category includes motorized vehicles and equipment that provide transportation but are not usually operated on public roadways. This includes aircraft, commercial marine vessels, railroads, and all other nonroad vehicles and equipment. In addition, although not technically nonroad engines or vehicles, unpaved airstrips and aircraft refueling categories are included in this category.

4.7.2 What Information Does This Section Provide?

This section describes the methods used to estimate nonroad emissions for 1985 through 1999. Table 4.7-1 summarizes the methods applied and the pollutants for which emissions were estimated for each year. Section 4.7.3 provides an overview of recent updates made to nonroad estimates. Section 4.7.4 explains how EPA's draft NONROAD model was used for those nonroad equipment categories included in the model. Finally, sections 4.7.5, 4.7.6, and 4.7.7 provide a description of the emission estimation methodologies for aircraft, commercial marine, and locomotive categories. Finally, section 4.7.8 discusses the methods used to estimate NH_3 emissions for nonroad engines.

4.7.3 What Methodologies Did We Use to Develop Nonroad Emission Estimates?

For several years OTAQ has been developing an emissions model (NONROAD) to estimate emissions from nonroad sources. In large part, we used the draft version of the NONROAD model to generate emission inventories for volatile organic compounds (VOCs), oxides of nitrogen (NO_x), carbon monoxide (CO), sulfur dioxide (SO_2), primary particulate matter with an aerodynamic diameter less than or equal to 10 micrometers (PM-10), and primary particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers (PM-2.5) for all gasoline, diesel, compressed natural gas (CNG), and liquefied petroleum gas (LPG) nonroad equipment types at the 10-digit Source Classification Code (SCC) level.

We did not use the NONROAD model to calculate emissions for aircraft, commercial marine vessels, and locomotives. For these sources, the draft version of the NONROAD model does not currently include estimation methods for these categories.

The NONROAD model does not contain emission factors to calculate NH_3 emissions; therefore, we used fuel consumption estimates generated by the NONROAD model and applied NH_3 emission factors for diesel and noncatalyst gasoline vehicles as appropriate. NH_3 estimates for aircraft, commercial marine, and locomotives are also calculated based on fuel consumption estimates for these categories.

For the NET Version 4, we generally updated nonroad emission estimates for most nonroad categories for the years 1996-1999. For previous years' Trends estimates, we have made adjustments to years prior to 1996, every year back to 1985, and for 1970, 1975, 1980, and 1985. Table 4.7-1 presents a summary of how nonroad emission estimates have been developed over the most recent 10-year period (i.e., 1989-1999). Table 4.7-2 summarizes the methods applied to prepare the 1996 base year inventory from 1996 through 1999 for each of the general nonroad categories.

4.7.4 How Was the Nonroad Model Used to Develop Emission Estimates?

The majority of nonroad mobile source emission estimates in the NET inventory are based on the NONROAD model. For the latest version of the NONROAD model, the reader is referenced to http://www.epa.gov/oms/nonrdmdl.htm. Criteria pollutant emission estimates in the NET Version 3 were based on the NONROAD model all categories included in the model, with the exception of recreational gasoline-fueled equipment. For the NET Version 4, the nonroad emission estimates are based on estimates for all categories in NONROAD, including recreational gasoline.

4.7.4.1 What Emissions Does the NONROAD Model Measure?

The NONROAD model provides emission estimates for hydrocarbon (HC), NO_x, CO, SO_2, PM-10, and PM-2.5. The model reports various hydrocarbon species, including VOC, and breaks out the hydrocarbon emissions according to exhaust and evaporative components. PM-10 is assumed to be equivalent to total PM, and PM-2.5 is assumed to 92 percent of PM-10 for gasoline and diesel-fueled engines, and 100 percent of PM-10 for LPG and CNG-fueled engines.

4.7.4.2 What Equipment Categories Are Included in the NONROAD Model?

The NONROAD model includes the following general equipment categories:

- agricultural;
- airport support;
- light commercial;
- construction and mining;
- industrial;
- lawn and garden;
- logging;
- pleasure craft;
- railroad; and
- recreational equipment.

The model generates emissions at subcategory levels lower than the general categories listed above. The subcategories are equivalent to 10-digit SCCs, and correspond to specific nonroad applications within a category.

4.7.4.3 Do We Use Different Methods to Calculate Nonroad Emissions for Different Years?

Yes. We describe the different methods used for various years below.

4.7.4.3.1 How Did We Develop 1996 Base Year Emissions? —

We estimated 1996 nonroad emissions from two emission inventories including: 1) a 1996 county-level inventory, developed using EPA's April 1999 draft NONROAD model; and 2) an updated national inventory, based on EPA's June 2000 draft version of the NONROAD model. The recreational gasoline equipment category was an exception, since estimates for this category in EPA's NET Version 3 were not based on the April 1999 model, but were based on NEVES (Nonroad Engine and Vehicle Emission Study). Emission estimates for recreational gasoline developed for the NET Version 4 series, as well as all other categories, are based on the June 2000 draft NONROAD model.

To develop the original 1996 county-level inventory, we used the April 1999 draft NONROAD model adapted to run on a DEC Alpha UNIX workstation. We prepared NONROAD model input files for each State to account for the average statewide temperatures and Reid vapor pressure (RVP) for four seasons, including summer, fall, winter, and spring. We used these default state input files to calculate emissions for all counties in the United States. Estimates for particular counties were replaced with county-specific estimates, if those counties had significant differences in their RVP, fuel characteristics due to reformulated gasoline and oxygenated fuel requirements, and Stage II controls. Typical summer season daily (SSD) emissions were estimated by dividing total summer season emissions by 92 days.

Table 4.7-3 presents the statewide seasonal default RVP values used as input to the NONROAD model. For areas subject to Phase 1 of the Federal reformulated gasoline (RFG) program, separate RVP values were modeled in the 1996 NONROAD inputs for May through September (values not shown). Table 4.7-4 presents the areas and counties modeled with RFG. Oxygenated fuel was modeled in the areas participating in this program in 1996, as presented in Table 4.7-5. Emissions calculated for counties with fuel characteristic data that varied from statewide average values replaced emissions for these same counties generated by running the default input files. Four seasonal emissions files for each run were then added together to estimate annual emissions.

We then updated this 1996 county-level emissions inventory to reflect revisions made to the NONROAD model since the April 1999 version. Using the June 2000 draft NONROAD model, OTAQ generated national, seasonal emissions at the SCC level for the following pollutants: VOC, NO_x, SO_2, CO, PM-10, and PM-2.5. The results for three seasonal runs (i.e., summer, winter, fall/spring combined) were summed to calculate annual emissions. Additional NONROAD model runs were performed to estimate typical summer weekday emissions as well. Table 4.7-6 presents a summary of the input values used for the national NONROAD model runs.

We calculated SCC-specific ratios by dividing the updated national, annual emission estimates by the previous 1996 national values (i.e., based on the April 1999 version of NONROAD). We then calculated county-level emissions by multiplying each record in the 1996 inventory by the appropriate ratio for each SCC. In this manner, we normalized the county-level distribution of the 1996 estimates in Version 3 of the NET inventory to the updated national, SCC-level totals for 1996.

Similar to annual emission ratios, SSD ratios were first developed by dividing updated SSD emissions by previous SSD emissions. However, when SSD ratios were applied to certain records, new SSD emission values were calculated that were larger than the corresponding annual emissions. This was occurring because SSD values had been calculated differently in the April 1999 data base (i.e., they had previously been calculated by dividing summer season emissions by 92, as opposed to performing separate runs for a typical summer day). To adjust this result, and to ensure that the total national SSD

emissions were equivalent to what OTAQ had originally provided, county-level SSD emissions were calculated by multiplying national SSD emissions by the ratio of county level annual emissions to national level annual emissions. This is shown in the formula below:

$$SSD_{county} = SSD_{national} \times (Annual_{county} \div Annual_{national})$$

The most recent version of NONROAD includes emission estimates for new SCCs. Since the April 1999 county-level data base did not include these SCCs, we assigned surrogate SCCs to the new SCCs to use in allocating national emissions to the county-level. The additional SCCs and each corresponding surrogate SCC are shown in Table 4.7-7.

4.7.4.3.2 How Did We Calculate 1997, 1998, 1999 Inventories? —

For NONROAD model categories, we used similar procedures to update 1997, 1998, and 1999 emission estimates that were used to develop the most recently updated 1996 nonroad estimates. The steps we took included:

1. Perform three seasonal (i.e., summer, winter, and fall/spring combined) NONROAD model runs at the national level, to account for differences in average seasonal temperature, as well as RVP.

2. Calculate year-specific ratios by dividing national SCC-level emission estimates for 1997, 1998, and 1999 by the 1996 national values.

3. Calculate county-level estimates for 1997, 1998, and 1999 by multiplying each ratio times the 1996 county-level emissions inventory.

By following these steps, the county-level distribution assumed for the 1996 inventory is normalized to the updated national, SCC-level totals for each alternative year. This approach ensures that the sum of all county-level emissions for any year are equivalent to the national-level estimates and are distributed to the counties according to the 1996 distribution.

Because the NONROAD model estimates growth in local equipment populations using one national average growth rate, the effects of growth should be reflected in the national-level runs for each alternate year aside from the base year 1996. The effects of federal nonroad emission standards in future years (e.g., years beyond 1996) would also be accounted for. Because the model uses one average growth rate for the whole nation, the approach of using the 1996 county-level inventory as a basis for geographically allocating national inventories for other years was assumed to be reasonable. However, temperature and fuel inputs to reflect local conditions cannot be accounted for when doing a national-level run for a specified year. We used this approach due to time and resource constraints.

4.7.4.3.3 How Did We Calculate Historic Year Inventories? —

For the inventory years 1985-1996, we ran the April 1999 draft NONROAD model at the national level for all relevant inventory years. Each national run included three seasonal NONROAD model runs per year to estimate annual criteria pollutant emissions. The seasonal runs help to account for differences in average seasonal temperature, as well as RVP. Tables 4.7-8 and 4.7-9 present the RVP and temperature inputs used for each inventory year, respectively.

4.7.4.4 Were Nonroad Model Runs Performed for Any Specific States?

Yes, we performed separate runs for California for the years 1996, 1997, 1998, and 1999 using the June 2000 draft model. We generated new results for diesel-fueled equipment SCCs to account for lower diesel fuel sulfur levels in California. Based on the results of the separate California NONROAD model runs, we calculated SCC emission ratios by dividing the updated California diesel emission estimates by the previous 1996 California values. We applied these ratios to county-level records for California, and incorporated the resulting emissions into the 1996 emissions inventory.

4.7.5 How Did We Update Aircraft Emissions for 1997, 1998, and 1999?

The following discusses the procedures we used to grow aircraft emissions for the 1997, 1998, and 1999 year NET inventories. We based all aircraft emissions for 1996 on Version 3 of the NET inventory. In addition, we made no changes to any historical year NET estimates for aircraft prior to 1996 (i.e., the estimates are consistent with Version 1 of the NET).

4.7.5.1 How Did We Update Commercial Aircraft and General Aviation Emissions?

We revised commercial aircraft and general aviation emission estimates for 1997, 1998, and 1999 using updated landing-takeoff operations (LTO) data from the Federal Aviation Administration (FAA). We developed growth factors using 1996 operations data and operations data for the year in question.

4.7.5.2 How Did We Update Emissions for Military Aircraft, Unpaved Airstrips, and Aircraft Refueling?

We grew military aircraft, unpaved airstrips, and aircraft refueling emissions from 1996 to 1997, 1998, and 1999 using growth factors consistent with the current draft version of the Economic Growth Analysis System (EGAS). See Table 4.7-10 for a list of growth indicators used for aircraft categories.

4.7.6 How Did We Update Commercial Marine Emissions?

4.7.6.1 How Did We Develop Commercial Marine Diesel Vessel Emission Estimates for 1996 Through 1999?

We obtained revised 1996 HC, NO_x, CO, and total PM national emission estimates for commercial marine engines from OTAQ. These national estimates were those used in EPA rulemaking documents, and reflect the effect of Federal emission standards promulgated for new diesel-fueled commercial marine vessels. We calculated VOC by multiplying HC by a factor of 1.053. We assumed PM-10 to be equivalent to PM, and PM-2.5 was estimated by multiplying PM-10 emissions by a factor of 0.92. We developed new pollutant-specific ratios by dividing new/old emissions at a national level. This ratio was applied to the county level emissions using the geographic distribution for 1996 estimates in Version 2 of the NET so that the sum of the county-level emissions now equaled the new national total. We established the distribution based on emissions for SCC 2280002000. Revised emissions for SO_2 were not developed by OTAQ; therefore, SO_2 estimates from the current NET inventory were used.

In addition, records for several states contained emissions data for some pollutants, such as SO_2 and PM-10, but contained no data on VOC, NO_x, or CO emissions. To estimate emissions for these

pollutants, we calculated national average ratios of VOC/PM-10, NO_x/PM-10, and CO/PM-10 from the available inventory data. These ratios were then applied to the PM-10 emissions to estimate the missing VOC, NO_x, and CO emissions.

For 1997, 1998, and 1999, we developed diesel commercial marine estimates similar to the 1996 base year estimates. We distributed national commercial marine diesel emissions provided by OTAQ to counties according to the 1996 county level distribution. For 1997 through 1999, we grew the 1996 SO_2 annual emissions using the BEA GSP growth factors (since revised national SO_2 emissions were not available).

4.7.6.2 How Did We Develop Historic Year Estimates for Commercial Marine Diesel Vessels?

For Version 3 of the NET, OTAQ provided revised commercial marine diesel emissions back to the year 1995, consistent with estimates presented in EPA rulemaking documents. We used the following methodology to adjust historic year emissions for this category, to avoid a large disconnect in previous Trends estimates and revised OTAQ estimates. For each pollutant, we calculated the ratio of the 1995 revised OTAQ commercial marine emissions to the 1995 emissions in Version 3 of the NET. This ratio was then applied to emission estimates for the following SCCs: commercial marine diesel (2280002), commercial marine residual (2280003), and commercial marine unspecified fuel (2280000). We did not perform any additional data augmentation for these years. For the NET Version 4, no further adjustments were made prior to 1996 to reflect revised national commercial marine diesel emissions.

4.7.6.3 How Did We Update Emission Estimates for Non-Diesel Commercial Marine Vessels and Military Marine?

We estimated commercial gasoline, commercial coal, and military marine emissions for the years 1997 through 1999 by applying EGAS growth factors to 1996 emission estimates for these same categories. See Table 4.7-10 for a list of the growth indicators used for each category.

4.7.7 How Did We Update Locomotive Emissions for 1996 Through 1999?

As a first step, we developed 1999 county-level emission estimates for all pollutants using 1996 as a base year and applying 1999 growth factors from EGAS. We then adjusted the 1999 grown emissions using national locomotive emissions for 1999 as reported in the "Locomotive Emission Standards-Regulatory Support Document (RSD)."[1] This report included emission projections for all criteria pollutants except for SO_2; therefore, SO_2 estimates from Version 2 of the NET inventory were used. We developed new/old pollutant specific ratios for 1999, and for each record we added emissions for three SCCs (2285002000, 2285002005, 2285002010). We applied these ratios to county-level emission estimates for the same SCCs for 1996, 1997, 1998, and for 1999 as well.

4.7.8 How Did We Develop NH_3 Emission Estimates?

4.7.8.1 How Did We Calculate NH_3 Emissions for NONROAD Model Categories for 1996 Through 1999?

We estimated NH_3 emissions based on updated national, SCC-level fuel consumption estimates for diesel and gasoline engines, as reported by the June 2000 draft version of NONROAD. Fuel

consumption estimates were not available for LPG- and CNG-fueled equipment (however, fuel consumption can be estimated from the CO_2 emissions provided by NONROAD for these engines). As with the criteria pollutant emission estimates, we developed SCC-specific ratios by dividing updated fuel consumption values (i.e., from June 2000 draft NONROAD) by previous fuel consumption values (i.e., from April 1999 draft NONROAD). NH_3 emissions for California were also recalculated using updated diesel fuel consumption values generated for California-specific runs. Once a county-level data base of fuel consumption was developed, we multiplied these activity data by emission factors provided by OTAQ to estimate NH_3 emissions. OTAQ derived the emission factors primarily from light-duty onroad vehicle emission measurements,[2] and extrapolated to nonroad engines on a fuel consumption basis. For diesel engines, we applied an emission factor of 165.86 milligrams (mg)/gallon. For gasoline engines (without catalysts) we applied an emission factor of 153.47 milligrams/gallon. These emission factor values are, in general, consistent with more recent studies on motor vehicle NH_3 emissions.

4.7.8.2 How Did We Calculate NH_3 Emissions for Aircraft, Commercial Marine, and Aircraft Categories?

Similar to the NONROAD categories, we calculated NH_3 emissions for aircraft, commercial marine, and locomotives based on fuel consumption estimates for these categories. We obtained 1996 national fuel consumption estimates for aircraft, commercial marine, and locomotive categories from various sources. Jet fuel and aviation gasoline consumption for general aviation and commercial aircraft come from the "FAA Aviation Forecasts Fiscal Years, 1998-2009."[3] For aircraft categories, we applied NH_3 emission factors developed for diesel engines to all fuel consumption estimates, since aviation gasoline consumption was determined to be relatively small compared to jet fuel, and the aircraft SCCs are not defined by fuel type. We obtained diesel consumption estimates for locomotives from "Locomotive Emission Standards - Regulatory Support Document (RSD)".[1] For commercial marine, data for distillate and residual fuel oil were reported in "Fuel Oil and Kerosene Sales."[4]

To develop 1997, 1998, and 1999 NH_3 emissions for aircraft, commercial marine, and locomotives, we projected 1996 base year NH_3 emissions for these categories using the growth indicators listed in Table 4.7-10. NH_3 emissions were reported in the NET database for commercial marine and locomotive categories for historic years (i.e., 1990-1995); no changes were made to these historic estimates. Historic NH_3 emissions were not available for aircraft, so a disconnect occurs between 1995 and 1996 for NH_3 emissions for this category.

4.7.9 References

1. "Locomotive Emission Standards - Regulatory Support Document (RSD)," U.S. Environmental Protection Agency, Office of Mobile Sources, Ann Arbor, MI, April 1997.

2. Craig Harvey, Robert Garbe, Thomas Baines, Joseph Somers, Karl Hellman, and Penny Carey, "A Study of the Potential Impact of Some Unregulated Motor Vehicle Emissions," SAE Paper 830987, June 1983.

3. "FAA Aviation Forecasts Fiscal Years, 1998-2009," Federal Aviation Administration, Office of Aviation Policy and Plans. March 1998.

4. "Fuel Oil and Kerosene Sales," U.S. Department of Energy, Energy Information Administration, DOE/EIA-0380, Washington, DC. 1996.

Table 4.7-1. Methods for Developing Annual Emission Estimates for Nonroad Sources for the Years 1989-1999

For the category	For the years	For the pollutant(s)	EPA estimated emissions by
NONROAD Model Categories			
Nonroad Gasoline, Nonroad Diesel, Nonroad LPG, Nonroad CNG	1997-1999	VOC, NO_x, CO, SO_2, PM-10, PM-2.5	Running the June 2000 draft NONROAD model at a national level for each year, and distributing to counties based on 1996 inventory
	1996	VOC, NO_x, CO, SO_2, PM-10, PM-2.5	Calculating SCC-specific ratios by dividing the updated national, annual emission estimates (based on the June 2000 draft NONROAD model) by the previous 1996 national values (based on the April 1999 draft NONROAD model), and applying these ratios to the 1996 county-level emissions (i.e., as reported in EPA, 1998)[1]
	1989-1995	VOC, NO_x, CO, SO_2, PM-10, PM-2.5	Running the April 1999 draft NONROAD model at a national level, and distributing to counties based on 1996 inventory
Nonroad Gasoline, Nonroad Diesel	1997-1999	NH_3	Obtaining national fuel consumption estimates from the June 2000 draft NONROAD model, multiplying by NH_3 emission factors, and distributing to counties based on 1996 inventory
	1996	NH_3	Obtaining county fuel consumption estimates from the April 1999 draft NONROAD model, normalizing to new national fuel consumption values from June 2000 draft NONROAD model, and multiplying by NH_3 emission factors
	1990-1995	NH_3	Running the April 1999 draft NONROAD model at a national level, and distributing to counties based on 1996 inventory
Aircraft			
All Aircraft Categories	1989-1996	VOC, NO_x, CO, SO_2, PM-10, PM-2.5	Using emissions from NET (i.e., as reported in EPA, 2000)
Commercial Aircraft, General Aviation	1997-1999	VOC, NO_x, CO, SO_2, PM-10, PM-2.5, NH_3	Growing 1996 emissions using landing-takeoff operations (LTO) data from the FAA
	1996	NH_3	Applying NH_3 emissions factors to 1996 national jet fuel and aviation gasoline consumption estimates
Military Aircraft	1997-1999	VOC, NO_x, CO, SO_2, PM-10, PM-2.5	Growing emissions each year using SIC 992-Federal, Military growth factors consistent with the current draft version of Economic Growth Analysis System (EGAS)
Unpaved Airstrips	1997-1999	PM-10, PM-2.5	Growing emissions each year using SIC 45-Air Transportation growth factors consistent with the current draft version of EGAS
Aircraft Refueling	1997-1999	VOC	Growing emissions for each year using SIC 45-Air Transportation growth factors consistent with the current draft version of EGAS

Table 4.7-1 (continued)

For the category	For the years	For the pollutant(s)	EPA estimated emissions by
Commercial Marine (CM)			
CM Diesel	1996-1999	VOC, NO_x, CO, PM-10, PM-2.5	Distributing national commercial marine diesel emissions provided by OTAG to counties according to the 1996 county level distribution
	1997-1999	SO_2, NH_3	Growing the 1996 SO_2 and NH_3 emissions using Bureau of Economic Analysis (BEA) Gross State Product (GSP) growth factors
	1996	NH_3	Applying NH_3 emissions factors to 1996 distillate and residual fuel oil estimates (i.e., as reported in EIA, 1996)
	1989-1995	VOC, NO_x, CO, SO_2, PM-10, PM-2.5	Calculating the ratio of the 1995 revised national OTAQ commercial marine emissions to 1995 Trends emissions (as reported in EPA, 1998) and applying the ratio to emissions estimates for the specified SCC.
	1990-1995	NH_3	Using emissions from NET (i.e., as reported in EPA, 2000)
CM Coal, CM Residual Oil, CM Gasoline, Military Marine	1997-1999	VOC, NO_x, CO, SO_2, PM-10, PM-2.5	Applying EGAS growth factors to 1996 emissions estimates for this category
CM Coal, CM Residual Oil, CM Gasoline, Military Marine	1989-1996	VOC, NO_x, CO, SO_2, PM-10, PM-2.5	Using emissions from NET (i.e., as reported in EPA, 2000)
Locomotives			
	1996-1999	VOC, NO_x, CO, PM-10, PM-2.5	Developing 1999 county-level emissions estimates for all pollutants using 1996 as a base year and applying 1999 growth factors from EGAS and adjusting the 1999 grown emissions using national locomotive emissions for 1999, then developing pollutant specific ratios for 1999 and applying these ratios to county-level emissions estimates for each year
	1989-1995	VOC, NO_x, CO, SO_2, PM-10, PM-2.5	Using emissions from NET (i.e., as reported in EPA, 2000)
	1996	SO_2	Using emissions from NET (i.e., as reported in EPA, 2000)
	1997-1999	SO_2, NH_3	Growing 1996 base year emissions using EGAS growth indicators
	1996	NH_3	Applying NH_3 emissions factors to diesel consumption estimates for 1996
	1990-1995	NH_3	Using emissions from NET (i.e., as reported in EPA, 2000)

Notes:
[1]Exception for recreation gasoline equipment; recreational gasoline estimates from the April 1999 version of NONROAD were not incorporated into the NET Version 3 Data Base. Estimates for the NET Version 4 were based on June 2000 draft NONROAD.

References: EIA, 1996: "Fuel Oil and Kerosene Sales," U.S. Department of Energy, Energy Information Administration, DOE/EIA-0380, Washington, DC, 1996.
EPA, 1998: "National Air Pollutant Emission Trends Update, 1970-1997," EPA-454/E-98-007, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, December, 1998.
EPA, 2000: "National Air Pollutant Emission Trends, 1900-1998," EPA-454/R-00-002, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2000.

Table 4.7-2. Comparison of Methodologies Used to Develop 1996 Base Year Emissions for Nonroad Sources in Versions 1 through 4 of the NET

For the Category	For the Pollutant(s)	EPA estimated 1996 Base Year emissions for Version 1 by	EPA estimated 1996 Base Year emissions for Version 2 by	Version 3 by	Version 4 by
Nonroad Gasoline	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Growing from 1995 NET using appropriate surrogates. Updating NO_x, and VOC emission estimates for recreational marine only using national estimates from OTAQ so that the sum of the county/SCC level NET estimates equal the new national estimates.	Using same methodology as used in Version 1.	Running the April 1999 NONROAD model at the county level for all categories except recreational gasoline. Recreational gasoline emissions were based on Version 1 estimates.	Calculating SCC-specific ratios by dividing the updated national, annual emission estimates (based on June 2000 draft NONROAD model) by the previous 1996 national values (based on the April 1999 draft NONROAD model). Applying these ratios to 1996 county level emissions.
Nonroad Diesel	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Growing from 1995 NET using appropriate surrogates. Updating emission estimates for CO, NO_x, VOC, and PM_{10} using national estimates from OTAQ so that the sum of the county/SCC level NET estimates equal the new national estimates.	Obtaining national level emission estimates from OTAQ's draft NONROAD model for all categories except airport service. Distributing to counties based on 1996 estimates in Version 1 of NET.	Running the April 1999 NONROAD model at the county level for all categories.	Calculating SCC-specific ratios by dividing the updated national, annual emission estimates (based on June 2000 draft NONROAD model) by the previous 1996 national values (based on the April 1999 draft NONROAD model). Applying these ratios to 1996 county level emissions.
Nonroad Gasoline, Nonroad Diesel	NH_3	Not estimated.	Not estimated.	Obtaining county-level fuel consumption estimates from the April 1999 NONROAD model. Multiplying by NH_3 emissions factors.	Obtaining county fuel estimates from the April 1999 draft NONROAD model. Normalizing to new national fuel consumption values from June 2000 draft NONROAD model. Multiplying by NH_3 emissions factors.
Nonroad LPG, Nonroad CNG	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Not estimated.	Not estimated.	Running the April 1999 NONROAD model at the county level for all categories.	Calculating SCC-specific ratios by dividing the updated national, annual emission estimates (based on June 2000 draft NONROAD model) by the previous 1996 national values (based on the April 1999 draft NONROAD model). Applying these ratios to 1996 county level emissions.
Commercial Aircraft, General Aviation	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Growing 1995 emissions using landing-takeoff operations (LTOs) data obtained from the FAA.	Using same methodology as used in Version 1.	Using same methodology as used in Version 1, but using updated LTO data.	Using same methodology as used for Version 3.
	NH_3	Growing 1995 emissions using landing-takeoff operations (LTOs) data obtained from the FAA instead of BEA data.	Using same methodology as used in Version 1.	Applying NH_3 emission factors to 1996 national jet fuel and aviation gasoline consumption estimates. Allocating to counties based on PM-10 emissions distribution.	Applying NH_3 emission factors to 1996 national jet fuel and aviation gasoline consumption estimates.
Military Aircraft	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Estimating 1996 BEA and SEDS data using linear interpolation of 1988 to 1995 data and growing from 1995 NET.	Using same methodology as used in Version 1, but using actual 1996 BEA and SEDS data.	Using same methodology as used for Version 2.	Using same methodology as used for Version 2.

Table 4.7-2 (continued)

For the Category	For the Pollutant(s)	EPA estimated 1996 Base Year emissions for Version 1 by	EPA estimated 1996 Base Year emissions for Version 2 by	Version 3 by	Version 4 by
Unpaved Airstrips	PM_{10}, $PM_{2.5}$	Estimating 1996 BEA and SEDS data using linear interpolation of 1988 to 1995 data and growing from 1995 NET.	Using same methodology as used in Version 1, but using actual 1996 BEA and SEDS data.	Using same methodology as used for Version 2.	Using same methodology as used for Version 2.
Aircraft Refueling	VOC	Estimating 1996 BEA and SEDS data using linear interpolation of 1988 to 1995 data and growing from 1995 NET.	Using same methodology as used in Version 1, but using actual 1996 BEA and SEDS data.	Using same methodology as used for Version 2.	Using same methodology as used for Version 2.
Commercial Marine (CM) Diesel	VOC, NO_x, CO, SO_2 PM_{10}, $PM_{2.5}$	Estimating 1996 BEA and SEDS data using linear interpolation of 1988 to 1995 data and growing from 1995 NET.	Using same methodology as used for Version 1, but using actual 1996 BEA and SEDS data.	Distributing updated national commercial marine diesel emissions (with exception of SO2) provided by OTAQ to counties using 1996 county level distribution in Version 1 of NET.	Using same methodology as used for Version 3, but with revised national emission estimates provided by OTAQ.
	NH_3	Estimating 1996 BEA and SEDS data using linear interpolation of 1988 to 1995 data and growing from 1995 NET.	Using same methodology as used for Version 1, but using actual 1996 BEA and SEDS data.	Applying NH_3 emissions factors to 1996 distillate and residual fuel estimates. Allocating to counties based on PM-10 emissions distribution.	Using same methodology as used for Version 3.
CM Coal, CM Residual Oil, CM Gasoline, Military Marine	VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$	Estimating 1996 BEA and SEDS data using linear interpolation of 1988 to 1995 data and growing from 1995 NET.	Using same methodology as used for Version 1, but using actual 1996 BEA and SEDS data.	Using same methodology as used for Version 2.	Using same methodology as used for Version 2.
Locomotives	VOC, NO_x, CO, PM_{10}, $PM_{2.5}$	Estimating 1996 BEA and SEDS data using linear interpolation of 1988 to 1995 data and growing from 1995 NET. Updating PM_{10} and $PM_{2.5}$ emissions estimates using national estimates from OTAQ so that the sum of the county/SCC level NET estimates equal the new national estimates.	Using same methodology as used for Version 1, but using actual 1996 BEA and SEDS data.	Applying E-GAS growth factors to 1996 emissions to estimate 1999 county-level emissions.	Applying E-GAS growth factors to 1996 emissions to estimate 1999 county-level emissions. Adjusting 1999 grown emissions using national locomotive emissions for 1999. Developing pollutant-specific ratios for 1999/1996, and applying ratios to county-level 1996 emissions.
	SO_2	Estimating 1996 BEA and SEDS data using linear interpolation of 1988 to 1995 data and growing from 1995 NET.	Using same methodology as used for Version 1, but using actual 1996 BEA and SEDS data.	Using same methodology as used for Version 2.	Using same methodology as used for Version 2.
	NH_3	Estimating 1996 BEA and SEDS data using linear interpolation of 1988 to 1995 data and growing from 1995 NET.	Using same methodology as used for Version 1, but using actual 1996 BEA and SEDS data.	Applying NH_3 emissions factors to 1996 diesel consumption estimates. Allocating to counties based on PM-10 emissions distribution.	Using same methodology as used for Version 3.

NOTES: Version 1 corresponds to December 1997 Trends report, Version 2 estimates correspond to December 1998 report, Version 3 corresponds to March 2000 report, and Version 4 series is for report yet to be published.

Table 4.7-3. Seasonal RVP Values Modeled for 1996 NONROAD Model Runs

State	FIPS State Code	Seasonal RVP (psi)			
		Winter	Spring	Summer	Autumn
AL	01	12.4	9.3	7.5	8.8
AK	02	14.1	13.7	13.0	13.7
AZ	04	8.2	7.1	6.8	6.9
AR	05	13.7	9.5	6.8	10.1
CA	06	11.9	9.3	6.9	7.6
CO	08	12.5	10.1	7.8	9.4
CT	09	13.0	9.8	7.9	9.8
DE	10	13.5	10.0	7.9	9.0
DC	11	12.0	8.1	7.0	8.1
FL	12	11.8	7.4	7.4	7.4
GA	13	12.4	9.3	7.4	8.7
HI	15	10.0	10.0	9.8	10.0
ID	16	12.8	10.4	8.6	9.1
IL	17	14.1	10.2	7.8	9.0
IN	18	14.5	10.9	8.8	9.8
IA	19	14.9	11.2	9.0	11.2
KS	20	12.7	8.9	7.6	8.2
KY	21	13.4	9.5	8.4	9.5
LA	22	12.4	9.4	7.6	8.9
ME	23	13.2	10.3	9.0	10.3
MD	24	13.2	9.7	7.5	8.6
MA	25	12.9	9.7	7.8	9.7
MI	26	14.1	9.9	7.4	9.9
MN	27	14.9	11.4	9.0	10.4
MS	28	13.7	9.5	7.1	8.8
MO	29	12.6	10.0	7.2	9.4
MT	30	13.8	10.4	8.7	10.4
NE	31	13.9	10.6	8.6	9.2
NV	32	9.6	8.0	7.6	7.8
NH	33	12.9	9.7	7.8	9.7
NJ	34	13.7	10.5	8.8	10.5
NM	35	11.7	9.2	7.8	9.0
NY	36	14.3	10.9	8.8	10.9
NC	37	12.4	10.3	7.4	9.7
ND	38	14.9	11.9	9.0	11.2
OH	39	14.6	11.0	8.7	9.8
OK	40	13.9	9.1	7.2	8.2

Table 4.7-3 (continued)

State	FIPS State Code	Seasonal RVP (psi)			
		Winter	Spring	Summer	Autumn
OR	41	12.3	9.8	7.7	8.7
PA	42	14.4	10.9	8.8	10.9
RI	44	12.9	9.7	7.8	9.7
SC	45	12.4	10.3	7.4	9.7
SD	46	14.4	11.2	9.0	9.9
TN	47	12.7	10.4	7.3	9.8
TX	48	12.2	9.7	7.8	8.7
UT	49	12.5	10.6	7.8	9.4
VT	50	14.9	11.4	9.0	11.4
VA	51	11.8	8.2	7.2	8.2
WA	53	14.0	10.6	8.5	9.5
WV	54	14.6	11.0	8.8	9.9
WI	55	14.6	11.1	9.0	10.1
WY	56	13.0	10.4	8.8	9.3
CA	57	11.7	10.8	6.9	7.6

Note: For areas receiving reformulated gasoline May through September, RVP values were modeled in place of the values shown here.

Table 4.7-4. Counties Modeled with Federal Reformulated Gasoline

State (American Society for Testing and Materials (ASTM) Class)/ Nonattainment Area	County
Arizona (B)	
Phoenix	
	Maricopa Co
Connecticut (C)	
Greater Connecticut	
	Hartford Co
	Litchfield Co
	Middlesex Co
	New Haven Co
	New London Co
	Tolland Co
	Windham Co
New York-Northern New Jersey-Long Island	
	Fairfield Co
District of Columbia (B)	
Washington DC	
	Washington
Delaware (C)	
Philadelphia-Wilmington-Trenton	
	Kent Co
	New Castle Co
Sussex County	
	Sussex Co
Illinois (C)	
Chicago-Gary-Lake County	
	Cook Co
	Du Page Co
	Grundy Co
	Kane Co
	Kendall Co
	Lake Co
	McHenry Co
	Will Co
Indiana (C)	
Chicago-Gary-Lake County	
	Lake Co
	Porter Co
Kentucky (C)	
Cincinnati-Hamilton	
	Boone Co
	Campbell Co
	Kenton Co
Louisville	
	Bullitt Co
	Jefferson Co
	Oldham Co

State (ASTM Class)/ Nonattainment Area	County
Maine (C)	
Knox & Lincoln Counties	
	Knox Co
	Lincoln Co
Lewiston-Auburn	
	Androscoggin Co
	Kennebec Co
Portland	
	Cumberland Co
	Sagadahoc Co
	York Co
Maryland (B)	
Baltimore	
	Anne Arundel Co
	Baltimore
	Baltimore Co
	Carroll Co
	Harford Co
	Howard Co
Kent & Queen Annes Counties	
	Kent Co
	Queen Annes Co
Philadelphia-Wilmington-Trenton	
	Cecil Co
Washington DC	
	Calvert Co
	Charles Co
	Frederick Co
	Montgomery Co
	Prince Georges Co
Massachusetts (C)	
Boston-Lawrence-Worcester-Eastern MA	
	Barnstable Co
	Bristol Co
	Dukes Co
	Essex Co
	Middlesex Co
	Nantucket Co
	Norfolk Co
	Plymouth Co
	Suffolk Co
	Worcester Co
Springfield/Pittsfield-Western MA	
	Berkshire Co
	Franklin Co
	Hampden Co
	Hampshire Co

Table 4.7-4 (continued)

State (American Society for Testing and Materials (ASTM) Class)/ Nonattainment Area	County
New Hampshire (C)	
Manchester	
	Hillsborough Co
	Merrimack Co
Portsmouth-Dover-Rochester	
	Rockingham Co
	Strafford Co
New Jersey (C)	
Allentown-Bethlehem-Easton	
	Warren Co
Atlantic City	
	Atlantic Co
	Cape May Co
New York-Northern New Jersey-Long Island	
	Bergen Co
	Essex Co
	Hudson Co
	Hunterdon Co
	Middlesex Co
	Monmouth Co
	Morris Co
	Ocean Co
	Passaic Co
	Somerset Co
	Sussex Co
	Union Co
Philadelphia-Wilmington-Trenton	
	Burlington Co
	Camden Co
	Cumberland Co
	Gloucester Co
	Mercer Co
	Salem Co
New York (C)	
New York-Northern New Jersey-Long Island	
	Bronx Co
	Kings Co
	Nassau Co
	New York Co
	Orange Co
	Queens Co
	Richmond Co
	Rockland Co
	Suffolk Co
	Westchester Co

State (ASTM Class)/ Nonattainment Area	County
New York (C)	
Poughkeepsie	
	Dutchess Co
	Putnam Co
Pennsylvania (C)	
Philadelphia-Wilmington-Trenton	
	Bucks Co
	Chester Co
	Delaware Co
	Montgomery Co
	Philadelphia Co
Rhode Island (C)	
Providence	
	Bristol Co
	Kent Co
	Newport Co
	Providence Co
	Washington Co
Texas (B)	
Dallas-Fort Worth	
	Collin Co
	Dallas Co
	Denton Co
	Tarrant Co
Houston-Galveston-Brazoria	
	Brazoria Co
	Chambers Co
	Fort Bend Co
	Galveston Co
	Harris Co
	Liberty Co
	Montgomery Co
	Waller Co
Virginia (B)	
Norfolk-Virginia Beach-Newport News	
	Chesapeake
	Hampton
	James City Co
	Newport News
	Norfolk
	Poquoson
	Portsmouth
	Suffolk
	Virginia Beach
	Williamsburg
	York Co

Table 4.7-4 (continued)

State (American Society for Testing and Materials (ASTM) Class)/ Nonattainment Area	County	State (ASTM Class)/ Nonattainment Area	County
Virginia (B)		Wisconsin (C)	
Richmond-Petersburg		Milwaukee-Racine	
	Charles City Co		Kenosha Co
	Chesterfield Co		Milwaukee Co
	Colonial Heights		Ozaukee Co
	Hanover Co		Racine Co
	Henrico Co		Washington Co
	Hopewell		Waukesha Co
	Richmond		
Washington DC			
	Alexandria		
	Arlington Co		
	Fairfax		
	Fairfax Co		
	Falls Church		
	Loudoun Co		
	Manassas		
	Manassas Park		
	Prince William Co		
	Stafford Co		

NOTE: California reformulated gasoline was modeled statewide in California.

Table 4.7-5. Oxygenated Fuel Modeling Parameters

		Market Shares (%)		Oxygen Content (%)		Oxygenated
State	County	MTBE	Alcohol Blends	MTBE	Alcohol Blends	Fuel Season
Alaska	Anchorage Ed	0	100	2.7	2.0	NOV-FEB (2007 & 2030)
Alaska	Anchorage Ed	0	100	2.7	2.0	NOV-DEC (1996 only)
Arizona	Maricopa Co	80	20	2.7	2.0	OCT-FEB
Colorado	Adams Co	75	25	2.7	2.0	NOV-FEB
Colorado	Arapahoe Co	75	25	2.7	2.0	NOV-FEB
Colorado	Boulder Co	75	25	2.7	2.0	NOV-FEB
Colorado	Douglas Co	75	25	2.7	2.0	NOV-FEB
Colorado	Jefferson Co	75	25	2.7	2.0	NOV-FEB
Colorado	Denver Co	75	25	2.7	2.0	NOV-FEB
Colorado	El Paso Co	75	25	2.7	2.0	NOV-FEB
Colorado	Larimer Co	75	25	2.7	2.0	NOV-FEB
Connecticut	Fairfield Co	90	10	2.7	2.0	NOV-FEB
Minnesota	Anoka Co	10	90	2.7	2.0	OCT-JAN
Minnesota	Carver Co	10	90	2.7	2.0	OCT-JAN
Minnesota	Dakota Co	10	90	2.7	2.0	OCT-JAN
Minnesota	Hennepin Co	10	90	2.7	2.0	OCT-JAN
Minnesota	Ramsey Co	10	90	2.7	2.0	OCT-JAN
Minnesota	Scott Co	10	90	2.7	2.0	OCT-JAN
Minnesota	Washington Co	10	90	2.7	2.0	OCT-JAN
Minnesota	Wright Co	10	90	2.7	2.0	OCT-JAN
Minnesota	Chisago Co	10	90	2.7	2.0	OCT-JAN
Minnesota	Isanti Co	10	90	2.7	2.0	OCT-JAN
Montana	Missoula Co	0	100	2.7	2.0	NOV-FEB
Nevada	Clark Co	0	100	2.7	2.0	OCT-MAR
Nevada	Washoe Co	95	5	2.7	2.0	OCT-JAN
New Jersey	Bergen Co	95	5	2.7	2.0	NOV-FEB
New Jersey	Essex Co	95	5	2.7	2.0	NOV-FEB
New Jersey	Hudson Co	95	5	2.7	2.0	NOV-FEB
New Jersey	Hunterdon Co	95	5	2.7	2.0	NOV-FEB
New Jersey	Mercer Co	95	5	2.7	2.0	JAN-FEB (1996 only)
New Jersey	Middlesex Co	95	5	2.7	2.0	NOV-FEB
New Jersey	Monmouth Co	95	5	2.7	2.0	NOV-FEB
New Jersey	Morris Co	95	5	2.7	2.0	NOV-FEB
New Jersey	Ocean Co	95	5	2.7	2.0	NOV-FEB
New Jersey	Passaic Co	95	5	2.7	2.0	NOV-FEB
New Jersey	Somerset Co	95	5	2.7	2.0	NOV-FEB
New Jersey	Sussex Co	95	5	2.7	2.0	NOV-FEB
New Jersey	Union Co	95	5	2.7	2.0	NOV-FEB
New Mexico	Bernalillo Co	15	85	2.7	2.0	JAN-FEB (1996 only)
New York	Bronx Co	95	5	2.7	2.0	NOV-FEB
New York	Kings Co	95	5	2.7	2.0	NOV-FEB
New York	Nassau Co	95	5	2.7	2.0	NOV-FEB

Table 4.7-5 (continued)

		Market Shares (%)		Oxygen Content (%)		Oxygenated
State	County	MTBE	Alcohol Blends	MTBE	Alcohol Blends	Fuel Season
New York	New York Co	95	5	2.7	2.0	NOV-FEB
New York	Queens Co	95	5	2.7	2.0	NOV-FEB
New York	Richmond Co	95	5	2.7	2.0	NOV-FEB
New York	Rockland Co	95	5	2.7	2.0	NOV-FEB
New York	Suffolk Co	95	5	2.7	2.0	NOV-FEB
New York	Westchester Co	95	5	2.7	2.0	NOV-FEB
New York	Orange Co	95	5	2.7	2.0	NOV-FEB
New York	Putnam Co	95	5	2.7	2.0	NOV-FEB
Oregon	Clackamas Co	1	99	2.7	2.0	NOV-FEB
Oregon	Jackson Co	1	99	2.7	2.0	NOV-FEB
Oregon	Multnomah Co	1	99	2.7	2.0	NOV-FEB
Oregon	Washington Co	1	99	2.7	2.0	NOV-FEB
Oregon	Josephine Co	1	99	2.7	2.0	NOV-FEB
Oregon	Klamath Co	1	99	2.7	2.0	NOV-FEB
Oregon	Yamhill Co	1	99	2.7	2.0	NOV-FEB
Texas	El Paso Co	15	85	2.7	2.0	NOV-FEB
Utah	Utah Co	20	80	2.7	2.0	NOV-FEB
Washington	Clark Co	1	99	2.7	2.0	NOV-FEB
Washington	King Co	1	99	2.7	2.0	JAN-FEB (1996 only)
Washington	Snohomish Co	1	99	2.7	2.0	JAN-FEB (1996 only)
Washington	Spokane Co	1	99	2.7	2.0	SEP-FEB
Wisconsin	St. Croix Co	10	90	2.7	2.0	OCT-JAN

Table 4.7-6. Summary of Input Values for National NONROAD Model Runs[1]

Season	Input[2]	Value[3]
Summer		
	RVP (psi)	8.1
	Min Temp	62
	Max Temp	82
	Average Temp	72
Fall/Spring		
	RVP (psi)	9.7
	Min Temp	43
	Max Temp	63
	Average Temp	53
Winter		
	RVP (psi)	13.1
	Min Temp	24
	Max Temp	44
	Average Temp	34
Typical Summer Weekday		
	RVP (psi)	8.1
	Min Temp	62
	Max Temp	82
	Average Temp	72

[1] The base case input values presented were the same for 1996, 1997, 1998, and 1999. The control case input values were the same for all three projection years (no control case was developed for 1996).
[2] Values for minimum, maximum, and average temperature are expressed in degrees Fahrenheit (°F).
[3] For California runs, a diesel fuel sulfur content of 120 ppm was used for all seasons.

Table 4.7-7. Surrogate SCC Assignments for New SCCs in June 2000 NONROAD Model

Additional SCCs	Description	Surrogate SCC	Description
2260002054	Gasoline, 2-Stroke Construction Equipment Crushing/Processing Equipment	2265002054	Gasoline, 4-Stroke Construction Equipment Crushing/Processing Equipment
2260005050	Gasoline, 2-Stroke Farm Equipment Hydro Power Units	2265005050	Gasoline, 4-Stroke Farm Equipment Hydro Power Units
2265001020	Gasoline, 4-Stroke Recreational Vehicles Snowmobiles	2260001020	Gasoline, 2-Stroke Recreational Vehicles Snowmobiles
2265007015	Gasoline, 4-Stroke Logging Equipment Skidders	2270007015	Diesel Logging Equipment Skidders
2267005055	LPG Farm Equipment Other Agricultural Equipment	2265005055	Gasoline, 4-Stroke Farm Equipment Other Agricultural Equipment
2268002081	CNG Construction Equipment Other Construction Equipment	2265002081	Gasoline, 4-Stroke Construction Equipment Other Construction Equipment
2268003020	CNG Industrial Equipment Forklifts	2265003020	Gasoline, 4-Stroke Industrial Equipment Forklifts
2268003040	CNG Industrial Equipment Other General Industrial Equipment	2265003040	Gasoline, 4-Stroke Industrial Equipment Other General Industrial Equipment
2268003070	CNG Industrial Equipment Terminal Tractors	2265003070	Gasoline, 4-Stroke Industrial Equipment Terminal Tractors
2268005050	CNG Farm Equipment Hydro Power Units	2265005050	Gasoline, 4-Stroke Farm Equipment Hydro Power Units
2268005055	CNG Farm Equipment Other Agricultural Equipment	2265005055	Gasoline, 4-Stroke Farm Equipment Other Agricultural Equipment
2268006015	CNG Light Commercial Air Compressors	2265006015	Gasoline, 4-Stroke Light Commercial Air Compressors

Table 4.7-8. National Seasonal RVP Averages for NONROAD Model Runs, in psi

Year	Winter	Spring/Fall	Summer
1985	13.7	11.9	11.0
1986	13.4	11.6	10.8
1987	13.5	11.5	10.5
1988	13.6	11.4	10.4
1989	12.8	10.3	9.2
1990	12.8	10.1	8.8
1991	12.7	10.1	8.9
1992	12.8	9.6	8.1
1993	12.8	9.7	8.1
1994	13.0	9.8	8.3
1995	12.8	9.8	8.2

Table 4.7-9. National Seasonal Temperatures for NONROAD Model Runs*

	Min (°C)	Max (°C)	Average (°C)
Summer	62	82	72
Winter	24	44	34
Spring/Fall	43	63	53

*Assumed same temperature inputs for all inventory years, except for 1996

Table 4.7-10. Growth Indicators for Nonroad Sources

Nonroad SCC	SCC Description	Growth Indicator
2275050000, 2275060000 2275020000, 2275070000	General Aviation and Air Taxis Commercial Aircraft and Auxiliary Power Units	Landing-Takeoff Operations (LTOs) for total aircraft operations
2275001000	Military Aircraft	992 - Federal, Military
2275085000	Unpaved Airstrips	SIC 45 - Air Transportation
2275900xxx	Aircraft Refueling	SIC 45 - Air Transportation
2280002xxx	Commercial Marine - Diesel Vessels	SIC 44 - Water Transportation[1]
2280001xxx, 2280003xxx, 2280004xxx	Commercial Marine - Coal, Residual Oil, and Gas-fired Vessels	SIC 44 - Water Transportation
2283xxxxxx	Military Marine Vessels	992 - Federal, Military
2285002xxx	Locomotives	SIC - Rail Transportation

[1] SO_2 and NH_3 emissions were estimated using growth factors; estimates for all other pollutants provided by OTAQ.

4.8 MISCELLANEOUS SOURCES (FUGITIVE DUST AND AMMONIA)

4.8.1 What Source Categories Does the Miscellaneous Sector Include?

The point and area source categories under the "Miscellaneous Sources" heading include the following Tier I and Tier II categories:

Tier I Category	Tier II Category
(14) Miscellaneous	(01) Agriculture and Forestry
	(07) Fugitive Dust

The methodologies discussed in Section 4.8.1 for the Miscellaneous Sources sector cover PM-10 and PM2.5 emissions associated with the following fugitive dust categories: agricultural crops, agricultural livestock, paved road resuspension, unpaved roads, construction activities, and mining and quarrying. Methodologies are also discussed for estimating ammonia (NH_3) emissions for agricultural livestock operations and the application of fertilizer to agricultural lands. The methodologies discussed in sections 4.8.2 through 4.8.7 for these categories are for area sources. There are a few point sources associated with the Tier 14/07 categories. The methodologies for the point sources are discussed in section 4.8.1.8.

For the fugitive dust categories, PM-10 emissions are estimated for 1985 through 1999. However, PM-2.5 emissions are calculated only for the years 1990 through 1999. Although several of the source categories listed above have information concerning the PM-2.5 particle size multiplier that should be applied to the AP-42 emission factor to calculate PM-2.5 emissions, much of that data is fairly old. As a consequence, EPA, Pechan, and Midwest Research Institute (MRI) performed an evaluation of more recent particle size distribution information.[1] That review indicated that the PM-2.5/PM-10 ratio for several of the fugitive dust source categories should be reduced. Table 4.8-1 shows the particle size ratios used to calculate PM-2.5 particle size multipliers from the PM-10 particle size multipliers used to develop PM-10 emissions for each fugitive dust category in this section.

Table 4.8-2 summarizes the methods applied and the pollutants for which emissions were estimated for 1989 through 1999. Table 4.8-3 summarizes the methods applied to prepare Versions 1 through 4 of the 1996 base year inventory for each of the categories discussed in sections 4.8.2 through 4.8.7. Table 4.8-4 identifies the State/local agencies that submitted 1996 base year emissions for these categories. The State/local agency emissions replaced the EPA estimates in Versions 3 and 4 of the 1996 NET inventory. Inventories submitted in 1999 were incorporated into Version 3.0 of the 1996 NET, and inventories submitted in 2000 were incorporated into Version 4.0 of the 1996 NET.

4.8.1.1 Agricultural Crops (1985-1989)

Agricultural crops are classified under Source Classification Code (SCC) 2801000003.

EPA estimated PM-10 emissions for the years 1985 through 1989 by using an equation for agricultural tilling.[2,3] The activity data for this calculation is the acres of land planted. The emission factor, developed to estimate the mass of total suspended particulate (TSP) emissions produced per acre-

tilled, is adjusted to estimate PM-10 using the following constant parameters: the silt content of the surface soil, a particle size multiplier, and the number of tillings per year.

EPA used the following equation (Equation 4.8-1) to determine State PM-10 emissions from agricultural tilling for 1985 through 1989:

$$E = c \times k \times s^{0.6} \times p \times a \qquad \text{(Eq. 4.8-1)}$$

where:

E	=	PM-10 emissions
c	=	constant 4.8 lbs/acre-pass
k	=	dimensionless particle size multiplier (PM-10=0.21)
s	=	silt content of surface soil, defined as the mass fraction of particles smaller than 75 µm diameter found in soil to a depth of 10 cm (%)
p	=	number of passes or tillings in a year
a	=	acres of land planted

4.8.1.1.1 Determination of Correction Parameters —

4.8.1.1.1.1 Silt content(s). By comparing the USDA[4] surface soil map with the USDA[5] county map, soil types are assigned to all counties of the continental United States. Silt percentages are determined by using a soil texture classification triangle.[6] For those counties with organic material as its soil type, EPA used the silt percentages presented by Cowherd et al.[7] The weighted mean State silt values are determined by weighing the county value by the number of hectares within the county and summing across the entire State. Table 4.8-5 shows the silt percentages used for 1985 through 1989. These silt values are assumed constant for the 5-year period examined.

4.8.1.1.1.2 Number of Tillings per year (p). Cowherd et al.[7] reported that crops are tilled three times each year, on average, and this value is used for p.

4.8.1.1.2 Activity Data —

The acres of crops planted (a) in each State is obtained for each of the 5 years from the USDA.[8]

4.8.1.1.3 County Distribution —

State-level PM-10 estimates are distributed to the county-level using county estimates of cropland harvested from the 1987 Census of Agriculture.[9] Equation 4.8-2 is used.

$$\textit{County Emissions} = \left(\frac{\textit{County Cropland Harvested}}{\textit{State Croplant Harvested}} \right) \times \textit{State Emissions} \qquad \text{(Eq. 4.8-2)}$$

4.8.1.2 Agricultural Crops (1990-1999)

The methodology to determine agricultural crop emissions for the years 1990 through 1998 is similar to the methodology for the years 1985 through 1989, with several exceptions. The PM-10 and PM-2.5 emissions for the years 1990 through 1998 are also estimated using the equation for agricultural tilling.[2, 3]

The activity data for this calculation is the acres of land tilled. The emission factor, developed to estimate the mass of TSP produced per acre-tilled, is adjusted to estimate PM-10 and PM-2.5 using the following constant parameters: the silt content of the surface soil, a particle size multiplier, and the number of tillings per year.

The following equation (Equation 4.8-3) is used to determine regional PM-10 emissions from agricultural tilling for 1990 through 1998:

$$E = c \times k \times s^{0.6} \times p \times a \qquad \text{(Eq. 4.8-3)}$$

where:

E	=	PM emissions
c	=	constant 4.8 lbs/acre-pass
k	=	dimensionless particle size multiplier (PM-10=0.21; PM-2.5=0.042)
s	=	silt content of surface soil, defined as the mass fraction of particles smaller than 75 µm diameter found in soil to a depth of 10 cm (%)
p	=	number of passes or tillings in a year
a	=	acres of land tilled

Emissions ere estimated for the year 1999 by using a trend analysis of national level tillage type data for the years 1990, 1992, 1994, 1996 and 1998 to project estimates by tillage type for 1999. Then, national level estimates by tillage type for 1999 are divided by the national level estimates by tillage type for 1998 to get national growth factors by tillage type for 1999. These growth factors are then applied to county level data for 1998 to estimate county level emissions for 1999.

4.8.1.2.1 Determination of Correction Parameters —

4.8.1.2.1.1 Silt content(s). By comparing the USDA[4] surface soil map with the USDA[5] county map, soil types are assigned to all counties of the continental U.S. Silt percentages are determined by using a soil texture classification triangle.[6] For those counties with organic material as its soil type, EPA uses the silt percentages presented by Cowherd et al.[7] These silt factors are then corrected using information from Spatial Distribution of PM-10 emissions from Agricultural Tilling in the San Joaquin Valley.[10] Information in that report indicates that silt contents determined from the classification triangle are typically based on wet sieving techniques. Wet sieving tends to desegregate finer materials thus leading to a higher than expected silt content based on the soil triangle estimates. The overestimation is dependent upon the soil type. As a consequence, the values for silt loam and loam were reduced by a factor of 1.5. The values for clay loam and clay were reduced by a factor of 2.6. The values for sand, loamy sand, sandy loam and organic material remained the same. Table 4.8-6 shows the percent silt used for each soil type for 1990 through 1998. These silt values were assumed constant for the 8-year period examined. This differs from the 1989 through 1985 methodology in that the silt factors are applied on the county level, and are corrected values.

4.8.1.2.1.2 Number of Tillings per year (p). The number of tillings for 1990 through 1998 were determined for each crop type, and for conservation and conventional use using information from Agricultural Activities Influencing Fine Particulate Matter Emissions.[11] The tillage emission factor ratio column in the tables in that report are totaled by crop type when the agricultural implement code is not

blank. Harvesting is not included in this total. When the tilling instrument is felt to deeply disturb the soil, the value of the tillage emission factor ratio is equal to one. However, other field instruments are not felt to disturb the soil to the extent of the instruments used to develop the original emission factor and thus have an emission factor ratio of less than one. Discussions with the organization that developed the original emission factor and the report referenced above indicated that these values should be used to calculate the number of tillings rather than a single value for each implement usage.[12] Where there is data from more than one region for a single crop, an average value is used. Information for both conservation and convention tillage methods are developed. The tallies are rounded to the nearest whole number, since it is not physically possible to have a partial tillage event.

These totals are tallied for corn, cotton, rice, sorghum, soybeans, spring wheat, and winter wheat. Table 4.8-7 shows the number of tilling used for each crop type, and for conservation and conventional use included in the database provided by the Conservation Information Technology Center (CTIC).[13] The number of tillings for categories not included in Agricultural Activities Influencing Fine Particulate Matter Emissions were determined by contact with the CTIC.[14]

Rice and spring wheat are included in the category "spring-seeded small grain" in the database provided by the CTIC.[13] Winter wheat is assumed to prevail in all States except Arkansas, Louisiana, Mississippi, and Texas. Rice is assumed to prevail in these four States, and the number of tillings for rice are applied to the acres harvested in these States. Both rice and winter wheat are grown in California. A ratio of rice to winter wheat acres harvested for 1990 through 1998 is obtained from the U.S. Land Use Summary.[8] This ratio is used to calculate a modified number of tillings for spring-seeded small grain in California for each year.

Acres reported in the CTIC database for no till, mulch till, and ridge till are considered conservation tillage. Those with 0 to 15 percent residue, and 15 to 30 percent residue were considered conventional tillage.

4.8.1.2.2 Activity Data —

The acres of crops tilled (a) in each county for each crop type and tilling method is obtained for each of the 6 years from the CTIC.[13]

4.8.1.2.3 County Distribution —

All emissions for agricultural crops for 1990-1998 are calculated on a county basis.

4.8.1.3 Agricultural Livestock and Fertilizer Application

This subsection discusses the methodologies applied to estimate PM-10 and PM-2.5 emissions for beef cattle feedlots, and NH_3 emissions for livestock operations and fertilizer application.

4.8.1.3.1 Beef Cattle Feedlots —

Emissions for beef cattle feedlots are classified under SCC 2805001000. This subsection discusses the methodology applied to estimate PM-10 and PM-2.5 emissions for 1990-1999. EPA estimated emissions for the years 1985 through 1989 using the methodology described in section 4.8.1.8.3.

The 1990-1999 PM-10 emissions from beef cattle feedlots are estimated using the number of head of beef cows published by the Census of Agriculture and a national PM-10 emission factor.[15, 16] The activity

data reported for the beef cow category is believed to provide the best indicator of feedlot activity. Other categories include animals not kept in feedlots and, if used, could result in overestimating emissions for this category. The PM-2.5 emissions for the years 1990 through 1999 are determined by multiplying the PM-10 emission for each year by the size adjustment factor of 0.15, shown in Table 4.8-1. Equation 4.8-4 is used to estimate county level emissions.

$$County\ Emissions = \left(\frac{County\ Head\ of\ Beef\ Cows}{1{,}000} \right) \times 17 \qquad \text{(Eq. 4.8-4)}$$

4.8.1.3.2 Livestock Operations —

The SCCs for which NH_3 emissions are estimated for livestock operations are as follows:

Category	SCC
Cattle	2805020000
Goats	2805045001
Hogs and Pigs	2805025000
Horses and Ponies	2710020030
Poultry	2805030000
Sheep	2805040000

The NH_3 emissions are estimated using activity data published by the Census of Agriculture and NH_3 emission factors. The Census of Agriculture publishes county-level estimates of number of head for the following livestock: cattle and calves, goats, hogs and pigs, horses and ponies, poultry, and sheep. The activity data used to determine NH_3 emissions from poultry includes activity data for broilers, ducks, geese, layers and pullets, turkeys, and other poultry. The activity data used to determine NH_3 emissions from sheep include activity data for sheep and lambs. The activity data used to determine NH_3 emissions from cattle used in animal husbandry (SCC 2805020000) correspond to the inventory of all cattle and calves, which includes beef and milk cows, heifer and heifer calves, and steer and bulls and their calves. This differs from the activity data used to calculate PM-10 emissions for beef cattle feedlots, which is discussed in section 4.8.1.3.1.

The emission factors used to calculate emissions are taken from a study of NH_3 emissions conducted in the Netherlands,[17] and are listed in Table 4.8-8. Before applying the emission factors, activity data for livestock operations is divided by 2000, since the emission factors are in units of pounds per head (lb/head).

Two SCCs each are available for reporting total emissions for dairy, hog, and poultry operations. To avoid the potential for double counting of emissions for these categories, the following SCCs have been deleted from the NET: 2805010000 (Dairy Operations: Total), 2805015000 (Hog Operations: Total), and 2805005000 (Poultry Operations: Total).

In 1999, EPA changed the method for estimating beef cattle feedlots and agricultural livestock operations emissions as a result of additional activity data published by the Census of Agriculture. The current methods, previously described, are used to revise and update previous estimates back to 1990. As a result of this method change, emissions for total livestock operations for SCC 2805000000 (Agriculture - Livestock: Total) have been removed from the NET because the newly calculated emissions are thought to include any emissions that may have previously been reported under this SCC. This SCC also had no specific emission factor associated with it, and was simply grown from 1985 NAPAP estimates.

4.8.1.3.3 Activity Data for Beef Cattle Feedlots and Livestock Operations —

The activity data used to estimate emissions for 1990 through 1999 for beef cattle feedlots and livestock operations are county-level activity data (head of livestock) published by the USDA National Agricultural Statistics Service (NASS) 1997 Census of Agriculture,[16] which contains activity data for the years 1987, 1992 and 1997. In some States, county activity data are not reported or were withheld, but the State total is reported. To accurately reflect the total activity for a specific category and State, such data are apportioned to each county equally within a State that had withheld or not reported data. Further, there are also cases where the data is reported under a general county code designation of *all other counties*. Data reported under this county code are added to the withheld totals for the State before distributing the State totals to counties.

However, there are several States that withheld state-level activity data. In these cases, State totals are first estimated by calculating the total activity corresponding to all States combined that withheld data. This value is calculated by subtracting the category-specific totals from all States that reported data from the national total. The remaining activity data is then equally distributed to the States that had withheld data, and then evenly distributed to each county in that State based upon the number of counties in the State.

Once county-level activity data are estimated for 1987, 1992 and 1997, activity data for the interim years (1988-1991 and 1993-1996) are estimated using linear interpolation. To estimate activity data for 1998 and 1999, linear interpolation is also used using activity estimates for the years 1992 through 1997, and applying a fraction as a multiplier for each of these two years. For 1998, (6/5) is the multiplier used, and for 1999, (7/5) is the multiplier used. For example, the equation to estimate 1998 activity data is [Activity data (1992) + (Activity data (1997) - Activity Data (1992)) *(6/5)]. To estimate activity for 1999, the fraction (7/5) is substituted for (6/5). In certain cases, this method returned a negative result. This is usually due to either activity data being reported in 1992 but not in 1997, or declining activity from 1992 to 1997. In these cases, an average of the 1996 and 1997 activity data is used to estimate 1998 activity data, and an average of the 1997 and 1998 activity data is used to estimate 1999 activity data (i.e., 1998 activity data = [1997+(1997-1996)/2]). In a few cases, this equation also produced a negative result. In these cases, a default value of zero is assigned.

4.8.1.3.4 Fertilizer Application —

The activity data used to estimate NH_3 emissions were obtained from the Commercial Fertilizers Data Base compiled by the Tennessee Valley Authority (TVA) which is now maintained by Association of American Plant Food Control Officials.[18] This data base includes county-level usage of over 100 different types of fertilizers, including those that emit NH_3.

The emission factors used for fertilizer application are also obtained from the Netherlands NH_3 study.[17] This source lists emission factors for the following 10 different types of fertilizers:

Fertilizer Type	SCC
Anhydrous Ammonia	2801700001
Aqua Ammonia	2801700002
Nitrogen Solutions	2801700003
Urea	2801700004
Ammonium Nitrate	2801700005
Ammonium Sulfate	2801700006
Ammonium Thiosulfate	2801700007
Other Straight Nitrogen	2801700008
Ammonium Phosphates	2801700009
N-P-K	2801700010

Emissions for 1999 are estimated by using a linear trend analysis on national level emissions by SCC for 1990, 1996, 1997 and 1998 to project national level emissions by SCC for 1999. Then, county to national ratios for 1998 are calculated. These ratios are then applied to the 1999 national estimates to obtain county level emissions estimates for 1999.

4.8.1.4 PM Emissions from Reentrained Road Dust from Unpaved Roads

Estimates of PM emissions from reentrained road dust on unpaved roads are developed for each county. An updated AP-42 emission factor equation replaced PART5 reentrained road dust emission factors for the years 1996 through 1999 (http://www.epa.gov/ttn/chief/ap42pdf/c13s02-2.pdf). This emission factor equation depends upon the surface material silt content, the mean weight of vehicles traveling on the unpaved roads, the surface material moisture content, and the number of days with measurable precipitation. Emissions are calculated by month at the State/road type level for the average vehicle fleet and then allocated to the county/road type level. The activity factor for calculating reentrained road dust emissions on unpaved roads is the VMT accumulated on these roads. The specifics of the emission estimates for reentrained road dust from unpaved roads are discussed in more detail below.

4.8.1.4.1 PM Emission Factor Calculation —

Equation 4.8-5, is the AP-42 equation that is used to calculate PM-10 emission factors from reentrained road dust on unpaved roads, adapted to calculate a monthly rather than an annual emission factor.

$$E_{ext} = \frac{k/2000 * (s/12)^a * (W/3)^b}{(M_{dry}/0.2)^c} * [(365 - p * 12)/365] \qquad \text{(Eq. 4.8-5)}$$

where: E_{ext} = monthly PM-10 emission factor extrapolated for natural mitigation (tons per mile)
k = empirical constant (2.6 lb/mile)
2000 = conversion factor, number of pounds per ton
s = surface material silt content (%)
a = empirical constant (0.8)
W = mean vehicle weight (tons)
b = empirical constant (0.4)
M_{dry} = surface material moisture content under dry, uncontrolled conditions (%)
c = empirical constant (0.3)
p = number of days in a given month with greater than 0.01 inches of precipitation

The above equation is representative of a fleet average emission factor rather than a vehicle-specific emission factor. A default value of 2.2 tons is used nationally as the mean vehicle weight, as recommended in the AP-42 documentation for travel on publicly accessible unpaved roads. The value of 1 percent for "M_{dry}" was chosen to be representative of national conditions.

4.8.1.4.1.1 Silt Content Inputs. Average state-level, unpaved road silt content values developed as part of the 1985 NAPAP Inventory, are obtained from the Illinois State Water Survey.[19a] Silt contents of over 200 unpaved roads from over 30 States are obtained. Average silt contents of unpaved roads are calculated for each State that had three or more samples for that State. For States that did not have three or more samples, the average for all samples from all States is substituted.

4.8.1.4.1.2 Precipitation Inputs. Rain data input to the original AP-42 emission factor equation is in the form of the total number of rain days in the year. However, the equation uses the number of days simply to calculate a percentage of rain days. Equation 4.8-5 above modifies the original equation to calculate a monthly emission factor for each State. Data from the National Climatic Data Center[19b,19c] showing the number of days per month with more than 0.01 inches of rain were used. Precipitation event accumulation data were collected from a meteorological station selected to be representative of rural areas within that state.

4.8.1.4.2 Unpaved Road VMT —

The unpaved road VMT calculation methodology starting in 1993 is performed in two parts. Separate calculations are performed for county and noncounty (State or federally) maintained roadways.

Equation 4.8-6 is used to calculate unpaved road VMT.

$$VMTUP = ADTV * FSRM * DPY \qquad \text{(Eq. 4.8-6)}$$

where: VMTUP = VMT on unpaved roads (miles/year)
ADTV = average daily traffic volume (vehicles/day/mile)
FSRM = functional system roadway mileage (miles)
DPY = number of days in a year

4.8.1.4.2.1 Estimating Local Unpaved VMT. Unpaved roadway mileage estimates are retrieved from the FHWA's annual *Highway Statistics*[20] report. State-level, county-maintained roadway mileage

estimates are organized by surface type, traffic volume, and population category. From these data, state-level unpaved roadway mileage estimates are derived for the volume and population categories listed in Table 4.8-9. This is done by first assigning an average daily traffic volume (ADTV) to each volume category, as shown in Table 4.8-9.

The above equation is then used to calculate state-level unpaved road VMT estimates for the volume and population categories listed in Table 4.8-9. These detailed VMT data are then summed to develop state-level, county-maintained unpaved roadway VMT.

4.8.1.4.2.2 Estimation of Federal and State-Maintained Unpaved Roadway VMT. The calculation of noncounty (State or federally) maintained unpaved road VMT differed from the calculation of county-maintained unpaved road VMT. This is required since noncounty unpaved road mileage is categorized by arterial classification, not roadway traffic volume.

To calculate noncounty, unpaved road VMT, state-level ADTV values for urban and rural roads are multiplied by state-level, rural and urban roadway mileage estimates. Assuming the ADTV does not vary by roadway maintenance responsibility, the county-maintained ADTV values are assumed to apply to noncounty-maintained roadways as well. To develop noncounty unpaved road ADTV estimates, county-maintained roadway VMT is divided by county-maintained roadway mileage estimates, as shown in Equation 4.8-7.

$$ADTV = VMT / MILEAGE \qquad \text{(Eq. 4.8-7)}$$

where: ADTV = average daily traffic volume for State and federally maintained roadways
VMT = VMT on county-maintained roadways (miles/year)
MILEAGE = state-level roadway mileage of county-maintained roadways (miles)

Federal and state-maintained roadway VMT is calculated by multiplying the state-level roadway mileage of federal and state-maintained unpaved roads[20] by the state-level ADTV values calculated as discussed above for locally-maintained roadways. Equation 4.8-8 illustrates.

$$VMT = ADTV * RM * 365 \qquad \text{(Eq. 4.8-8)}$$

where: VMT = VMT at the state level for federally and state-maintained unpaved roadways (miles/year)
ADTV = average daily traffic volume derived from local roadway data
RM = state-level federally and state-maintained roadway mileage (mi)

4.8.1.4.2.3 Unpaved VMT For 1993 and Later Years. The unpaved road VMT calculation methodology starting in 1993 differs from the procedure discussed above due to a difference in the data reported in the annual Highway Statistics.

Unpaved VMT for 1993 and later years is calculated by multiplying the total number of miles of unpaved road by State and functional class by the annualized traffic volume, where the annualized traffic

volume is calculated as the average daily traffic volume multiplied by the total number of days per year. This calculation is illustrated in Equation 4.8-9.

$$UnpavedVMT_{Roadtype} = Mileage_{Roadtype} * ADTV * DPY \qquad \text{(Eq. 4.8-9)}$$

where:	Unpaved VMT	=	road type specific unpaved Vehicle Miles Traveled (miles/year)
	Mileage	=	total number of miles of unpaved roads by functional class (miles)
	ADTV	=	Average daily traffic volume (vehicle/day)
	DPY	=	number of days per year

The total number of unpaved road miles by State and functional class is retrieved from the federal Highway Administrations Highway Statistics.[20] In Highway Statistics, state-level local functional class unpaved mileage is broken out by ADTV category. The ADTV categories differed for urban and rural areas. Table HM-67 of Highway Statistics shows unpaved road mileage by ADTV categories for rural and urban local functional classes and the assumed traffic volume for each category. Local functional class unpaved VMT is calculated for each of these ADTV categories using the equation illustrated above.

Unpaved road mileage for functional classes other than Local (rural minor collector, rural major collector, rural minor arterial, rural other principal arterial, urban collector, urban minor arterial, urban other principal arterial) are not broken out by ADTV in Highway Statistics. An average ADTV is calculated for these functional classes by dividing state level unpaved Local VMT by the total number of miles of Local unpaved road. Separate calculations are preformed for urban and rural areas. The resulting state level urban and rural ADTV is then multiplied by the total number of unpaved miles in each of the non-local functional classes.

EPA made one modification to the local functional class mileage reported in Highway Statistics. The distribution of mileage between the ADTV categories for Mississippi resulted in unrealistic emissions. Total unpaved road mileage in Mississippi is redistributed within the ADTV categories based on the average distributions found in Alabama, Georgia, and Louisiana.

Starting with the 1997 version of Highway Statistics, the table that shows state-level unpaved road mileage by ADTV categories (Table HM-67) was no longer published. Therefore, for 1997 and later years, the 1996 state-level distribution of unpaved roadway mileage by ADTV category and functional class was substituted. The remainder of the unpaved road VMT calculation methodology for 1997 and later years is the same as that described above for 1993 through 1996.

4.8.1.4.3 Calculation of State-Level Emissions —

The State and federally maintained unpaved road VMT were added to the county- maintained VMT for each State and road type to determine each State's total unpaved road VMT by road type. The state-level unpaved road VMT by road type are then temporally allocated by month using the same NAPAP temporal allocation factors used to allocate total VMT. These monthly state-level, road type-specific VMT are then multiplied by the corresponding monthly, state-level, road type-specific emission factors developed as discussed above. These state-level emission values are then allocated to the county level using the procedure discussed below.

4.8.1.4.4 Allocation of State-Level Emissions to Counties —

The State/road type-level unpaved road PM emission estimates are then allocated to each county in the State using estimates of county rural and urban land area from the U.S. Census Bureau[21] for the years 1985 through 1989. Equation 4.8-10 is used for this allocation.

$$PM_{X,Y} = (CNTYLAND_{URB,X}/STATLAND_{URB}) * PM_{ST,URB,Y} + (CNTYLAND_{RUR,X}/STATLAND_{RUR}) * PM_{ST,RUR,Y} \quad \text{(Eq. 4.8-10)}$$

where:
- $PM_{x,y}$ = unpaved road PM emissions (tons) for county x and road type y
- $CNTYLAND_{URB,X}$ = urban land area in county x
- $STATLAND_{URB}$ = urban land area in entire State
- $PM_{ST,URB,Y}$ = unpaved road PM emissions in entire State for urban road type y
- $CNTYLAND_{RUR,X}$ = rural land area in county x
- $STATLAND_{RUR}$ = rural land area in entire State
- $PM_{ST,RUR,Y}$ = unpaved road PM emissions in entire State for rural road type y

For the years 1990 through 1999, 1990 county-level rural population is used to distribute the state-level emissions instead of land area.

4.8.1.4.5 Nonattainment Area 1995 and Later Unpaved Road Controls —

PM control measures are applied to the unpaved road emission estimates for 1995 and later years. The level of control assumed varied by PM nonattainment area classification and by rural and urban areas. On urban unpaved roads in moderate PM nonattainment areas, the assumed control was paving the unpaved roads. This control is applied with a 96 percent control efficiency and a 50 percent penetration rate. On rural roads in serious PM nonattainment areas, chemical stabilization is the assumed control. This control is applied with a 75 percent control efficiency and a 50 percent penetration rate. On urban unpaved roads in serious PM nonattainment areas, paving and chemical stabilization are the controls assumed to be applied. This combination of controls is applied with an overall control efficiency of 90 percent and a penetration rate of 75 percent.

4.8.1.5 PM Emissions from Reentrained Road Dust from Paved Roads

Estimates of PM emissions from reentrained road dust on paved roads are developed at the county level in a manner similar to that for unpaved roads. PM10 emission factors for reentrained road dust from paved roads were calculated using EPA's PART5 model.[22] PART5 reentrained road dust emission factors for paved roads depend on the road surface silt loading and the average weight of all of the vehicles traveling on the paved roadways. The equation used in PART5 to calculate PM emission factors from reentrained road dust on paved roads is a generic paved road dust calculation formula from AP-42, shown in Equation 4.8-11.[22]

$$PAVED = PSDPVD * (PVSILT/2)^{0.65} * (WEIGHT/3)^{1.5} \quad \text{(Eq. 4.8-11)}$$

where: PAVED = paved road dust emission factor for all vehicle classes combined (grams per mile)

PSDPVD	=	base emission factor for particles of less than 10 microns in diameter from paved road dust (7.3 g/mi for PM-10)
PVSILT	=	road surface silt loading (g/m^2)
WEIGHT	=	average weight of all vehicle types combined (tons)

Paved road silt loadings are assigned to each of the twelve functional roadway classifications (six urban and six rural) based on the average annual traffic volume of each functional system by State. One of three values are assigned to each of these road classes: 1 (gm/m^2) is assigned local functional class roads, and either 0.20 (gm/m^2) or 0.04 (gm/m^2) are assigned to each of the other functional roadway classes. A silt loading of 0.20 (gm/m^2) is assigned to a road types that had an ADTV less than 5,000 vehicles per day and 0.04 (gm/m^2) is assigned to road types that had an ADTV greater than or equal to 5,000 vehicles per day. ADTV is calculated by dividing annual VMT by State and functional class (from Highway Statistics, Table VM-2[20])by State specific functional class roadway mileage (from Highway Statistics, Table HM-20[20]).

As with the PART5 emission factor equation for unpaved roads, the above PM emission factor equation for paved roads is representative of a fleet average emission factor rather than a vehicle-specific emission factor and it includes particulate matter from tailpipe exhaust, brake wear, tire wear, and ambient background particulate concentrations. Therefore, the PART5 fleet average PM emission factors for the tailpipe, tire wear, and brake wear components are subtracted from the paved road fugitive dust emission factors before calculating emissions from reentrained road dust on paved roads. Estimates of average vehicle weight over the entire vehicle fleet on paved road are based on data provided in the *Truck Inventory and Use Survey*,[23] *MVMA Motor Vehicle Facts and Figures '91*,[24] and the *1991 Market Data Book*.[25] Using these data sources, a fleet average vehicle weight of 6,360 pounds is modeled

The emission factors obtained from PART5 are modified to account for the number of days with a sufficient amount of precipitation to prevent road dust resuspension. The PART5 emission factors are multiplied by the fraction of days in a month with less than 0.01 inches of precipitation. This is done by subtracting data from the National Climatic Data Center showing the number of days per month with more than 0.01 inches of precipitation from the number of days in each month and dividing by the total number of days in the month. These emission factors are developed by month at the State and road type level for the average vehicle fleet.

For the years 1990 to 1999 the rain correction factor applied to the paved road fugitive dust emission factors is reduced by 50 percent (i.e., the rain correction factor is calculated as: $(365 - p * 12 * 0.5) / 365$, where p represents the number of days in a given month with greater than 0.01 inches of precipitation). It should be noted that the precipitation data used in the paved road emission factor calculations were taken from stations representative of urban areas in each state, and as such, the precipitation data used for the paved road emission factor calculations differ in most cases from the data used in the unpaved road emission factor calculations.

VMT from paved roads is calculated at the State/road type level by subtracting the State/road type-level unpaved road VMT from total State/road type-level VMT. Because there are differences in methodology between the calculation of total and unpaved VMT there are instances where unpaved VMT is higher than total VMT. For these instances, unpaved VMT is reduced to total VMT and paved road VMT is assigned a value of zero. The paved road VMT are then temporally allocated by month

using the NAPAP temporal allocation factors for VMT. These monthly/State/road type-level VMT are then multiplied by the corresponding paved road emission factors developed at the same level.

These paved road emissions are allocated to the county level according to the fraction of total VMT in each county for the specific road type. Equation 4.8-12 illustrates this allocation.

$$PVDEMIS_{X,Y} = PVDEMIS_{ST,Y} * VMT_{X,Y}/VMT_{ST,Y} \quad \text{(Eq. 4.8-12)}$$

where: $PVDEMIS_{X,Y}$ = paved road PM emissions (tons) for county x and road type y
$PVDEMIS_{ST,Y}$ = paved road PM emissions (tons) for the entire State for road type y
$VMT_{X,Y}$ = total VMT (million miles) in county x and road type y
$VMT_{ST,Y}$ = total VMT (million miles) in entire State for road type y

PM control measures are applied to the paved road emission estimates for the years 1995 and later. The control assumed is vacuum sweeping on paved roads twice per month to achieve an control level of 79 percent. This control is applied to urban and rural roads in serious PM nonattainment areas and to urban roads in moderate PM nonattainment areas. The penetration factor used varies by road type and NAA classification (serious or moderate).

4.8.1.6 Calculation of PM-2.5 Emissions from Paved and Unpaved Roads

EPA, Pechan, and MRI performed an evaluation of more recent particle size distribution information.[1] That review indicated that the PM-2.5/PM-10 ratio for reentrained road dust from paved and unpaved roads should be reduced from the older AP-42 particle size multipliers. Table 4.8-10 shows the particle size ratios used to calculate PM-2.5 emissions from the PM-10 emissions for these sources.

Thus, all PM-2.5 emissions from paved and unpaved roads are calculated by multiplying the final PM-10 emissions at the county/road type/month level by 0.25 for paved roads and by 0.15 for unpaved roads.

4.8.1.7 Other Fugitive Dust Sources

The other fugitive dust sources are from construction and mining and quarrying activities. Methods for estimating construction emissions for the years 1985 through 1998 are explained in section 4.8.1.7.1, and a revised procedure for estimating 1999 construction emissions is described in section 4.8.1.7.2. Mining and quarrying methodology is detailed in section 4.8.1.7.3.

4.8.1.7.1 Construction Activities (1985-1998) —

Area source emissions for construction activities are classified under SCC 2311000100. PM-10 emissions for the years 1985 through 1995, and the PM-2.5 emission for the years 1990 through 1995 are calculated from an emission factor, an estimate of the acres of land under construction, and the average duration of construction activity.[26] The acres of land under construction are estimated from the dollars spent on construction.[27] The PM-10 emission factor for the years 1985 through 1989 is calculated from the TSP emission factor for construction obtained from AP-42 and data on the PM-10/TSP ratio for various construction activities.[15] The PM-10 emission factor for the years 1990 through 1995 is obtained from Improvement of Specific Emission Factors.[28]

EPA extrapolated 1996 emissions from the 1995 emissions using the ratio between the number of residential construction permits issued in 1996 and the number issued in 1995.[27] PM-10 emissions for the years 1997 and 1998 are estimated from state-level annual permit data published annually by the U.S. Census Bureau for "New Privately Owned Housing Units Authorized Unadjusted Units for Regions, Divisions, and States." These data are obtained from the U.S. Census web site at www.census.gov/const/www/C40/Table2.html#annual. State-level growth factors are calculated for the 1997 and 1998 using 1996 permit data as the base year. The growth factors are then applied to the 1996 county level estimates to estimate county-level emissions for the years 1997 and 1998. EPA then applied a control efficiency to emissions for 1995 through 1998 for counties classified as PM nonattainment areas.[29]

4.8.1.7.1.1 1985- 1989 Emission Factor Equation. The following AP-42 particulate emission factor equation (Equation 4.8-13) for heavy construction is used to determine regional PM-10 emissions from construction activities for 1985 through 1989.

$$E = T \times \$ \times f \times m \times P \qquad \text{(Eq. 4.8-13)}$$

where:
- E = PM-10 emissions
- T = TSP emission factor (1.2 ton/acre of construction/month of activity)
- $ = dollars spent on construction ($ million)
- f = factor for converting dollars spent on construction to acres of construction (varies by type of construction, acres/$ million)
- m = months of activity (varies by type of construction)
- P = dimensionless PM-10/TSP ratio (0.22).

4.8.1.7.1.2 1990 through 1995 Emission Factor Equation . Equation 4.8-14 is a variation of the AP-42 particulate emission factor equation for heavy construction and was used to determine regional PM-10 and PM-2.5 emissions from construction activities for 1990 through 1995. The PM-2.5 emission factor used for the years 1990 through 1995 is the PM-10 emission factor multiplied by the particle size adjustment factor of 0.2, shown in Table 4.8-1. A control efficiency is applied to PM nonattainment areas for 1995 and 1996.

$$E = P \times \$ \times f \times m \times \left(1 - \frac{CE}{100}\right) \qquad \text{(Eq. 4.8-14)}$$

where:
- E = PM emissions
- P = PM emission factor (ton/acre of construction/month of activity) (PM-10 = 0.11; PM-2.5 = 0.022)
- $ = dollars spent on construction ($ million)
- f = factor for converting dollars spent on construction to acres of construction (varies by type of construction, acres/$ million)
- m = months of activity (varies by type of construction)
- CE = control efficiency (percent)

4.8.1.7.1.2.1 Dollars spent on construction ($). Estimates of the dollars spent on the various types of construction by EPA region for 1987 are obtained from the Census Bureau.[30] The fraction of total U.S. dollars spent in 1987 for each region for each construction type is calculated. Since values from the Census Bureau are only available every five years, the Census dollars spent for the United States for construction are normalized using estimates of the dollars spent on construction for the United States as estimated by the F.W. Dodge[27] corporation for the other years. This normalized Census value is distributed by region and construction type using the above calculated fractions. An example of how this procedure is applied for SIC 1521 (general contractor, residential building: single family) is shown in Equation 4.8-15.

$$\$_{1988,Region\,I,\,1521}^{SIC} = \frac{\$_{1987,Nation,Census}}{\$_{1987,Nation,Dodge}} \times \$_{1988,Nation,Dodge} \times \frac{\$_{1987,Region\,1,Census,\,1521}^{SIC}}{\$_{1987,Nation,Census,\,1521}^{SIC}} \qquad \text{(Eq. 4.8-15)}$$

where:	$	=	dollar amount of construction spent
	1988	=	year 1988
	1987	=	year 1987
	Region I	=	U.S. EPA Region I
	SIC 1521	=	Standard Industrial Code for general contractor, residential building; single family
	Nation	=	United States
	Census	=	Census Bureau
	Dodge	=	F.W. Dodge

4.8.1.7.1.2.2 Determination of construction acres (f). Information developed by Cowherd et al.[26] determined that for different types of construction, the number of acres is proportional to dollars spent on that type construction. This information (proportioned to constant dollars using the method developed by Heisler[31]) is utilized along with total construction receipts to determine the total number of acres of each construction type.

4.8.1.7.1.2.3 Months of construction (m). Estimates of the duration (in months) for each type construction are derived from Cowherd et al.[26]

4.8.1.7.1.2.4 PM-10/TSP Ratio (P) (1985-1989). The PM-10/TSP ratio for construction activities is derived from MRI.[15] In MRI's report, the data in Table 9, "Net Particulate Concentrations and Ratios" is cited from Kinsey et al.[32] That table included the ratios of PM-10/TSP for 19 test sites for three different construction activities. MRI suggests averaging the ratios for the construction activity of interest. Since EPA was looking at total construction emissions from all sources, EPA averaged the PM-10/TSP ratios for all test sites and construction activities.

4.8.1.7.1.2.5 PM-10 and PM-2.5 Ratio (P) (1990-1998). The PM-10 emission factor used for the years 1990 through 1995 for construction activities is obtained from Improvement of Specific Emission Factors.[28] This study reports an emission factor of 0.11 ton PM-10/acre-month. This value is the geometric mean of emission factors for 7 different sites considered in the study. Emission inventories for the sites are prepared for the construction activities observed at each site. The PM-2.5 emission factor

used for the years 1990-1995 is the PM-10 emission factor (0.11 ton PM-10/acre-month) multiplied by the particle size adjustment factor of 0.2, shown in Table 4.8-1.

4.8.1.7.1.2.6 Control Efficiency (1990-1998). The control efficiency for the years 1990 through 1994 is zero for all counties. However, starting in 1995, a control efficiency is applied to emissions for counties classified as PM nonattainment areas.[29] The PM-10 control efficiency used for 1995 through 1998 for PM nonattainment areas is 62.5. The PM-2.5 control efficiency for these years and areas is 37.5.

4.8.1.7.1.2.7 County Distribution. Regional-level PM-10 estimates are distributed to the county-level using county estimates of payroll for construction (SICs 15, 16, 17) from County Business Patterns.[33] Equation 4.8-16 is used.

$$\textit{County Emissions} = \frac{\textit{County Construction Payroll}}{\textit{Regional Construction Payroll}} \times \textit{Regional Emissions} \qquad \text{(Eq. 4.8-16)}$$

4.8.1.7.2 How Did We Update Construction Emission Estimates for the Year 1999? —

We updated 1999 fugitive dust emission estimates from construction by obtaining more recent activity data corresponding to various subcategories of construction, and applying category-specific emission factors. The final emission estimates are adjusted to account for variations in soil silt and moisture content, as well as control efficiency. The construction categories for which updated emission estimates are developed include:

Construction Category	SCC	SCC Name
Residential	2311010000	Industrial Processes Construction: SIC codes 15 - 17 General Building Construction Total
Commercial	2311020000	Industrial Processes Construction: SIC codes 15 - 17 Heavy Construction Total
Roadway	2311030000	Industrial Processes Construction: SIC codes 15 - 17 Road Construction Total

Construction emissions are estimated using two basic construction parameters, the acres of land disturbed by the construction activity and the duration of the activity. The actual acres disturbed by the various types of construction are generally not available, and must be estimated using surrogate data, which must be converted to acres using the appropriate conversion factor. The methodology is based upon procedures documented in the U.S. EPA report, "Estimating Particulate Matter Emissions from Construction Operations,"[34] with some adjustments.

4.8.1.7.2.1 How Did We Estimate Emissions for Residential Construction? For residential construction, housing permit data for single-family units, two-family units, and apartments were obtained at the county level from the U.S. Department of Commerce's (DOC) Bureau of the Census.[35] We then adjusted county permit data to equal regional housing start data, which would more accurately reflect actual construction, also available from the Bureau of the Census.[36] Once the number of buildings in each

category is estimated, the total acres disturbed by construction is estimated by applying conversion factors to the housing start data for each category as follows:

- Single family - 1/4 acre/building
- Two-family - 1/3 acre/building
- Apartment - 1/2 acre/building

Housing construction emissions are calculated using an emission factor of 0.032 tons PM-10/acre/month, the number of housing units created, a units-to-acres conversion factor, and the duration of construction activity. The duration of construction activity for houses is assumed to be 6 months. The formula for calculating emissions from residential construction is:

$$Emissions = (0.032\ tons\ PM\text{-}10/acre/month) \times B \times f \times m$$

where: B = the number of single or two-family houses constructed
f = buildings-to-acres conversion factor
m = the duration of construction activity in months

Apartment construction emissions are calculated separately using an emission factor that is more representative of emissions due to construction of apartment buildings (0.11 tons PM-10/acre/month). A duration of 12 months was assumed for apartment construction.

Basement Adjustment

For areas in which basements are constructed or the amount of dirt moved at a residential construction site is known, an alternative formula is used. An average value of 2000 square feet is assumed for both single-family and two-family homes. This value is used to estimate the cubic yards of dirt moved per house. Multiplying the average total square feet by an average basement depth of 8 feet and adding in 10 percent of the cubic feet calculated for peripheral dirt removed produces an estimate of the cubic yards of earth moved during residential construction. The added 10 percent accounts for the footings, space around the footings, and other backfilled areas adjacent to the basement.

The cubic yards of earth moved per house along with the number of houses constructed is used with the best available control measures (BACM) Level 2 equation (emission factor of 0.011 tons PM-10/acre/month plus 0.059 tons PM-10/1000 cubic yards of on-site cut/fill) to calculate emissions for regions in which basements are constructed or a large amount of dirt is moved during most residential construction. The percentage of one-family houses with basements was obtained from the DOC report, *Characteristics of New Houses*.[37] The percentage of houses per Census region (Northeast, Midwest, South, and West) that contain full or partial basements is applied to the housing start estimates for each of these respective regions. The BACM Level 2 equation is applied once the number of acres disturbed due to the estimated number of houses built with basements was determined.

4.8.1.7.2.2 How Did We Estimate Emissions for Non-Residential Construction? The emissions produced from the construction of nonresidential buildings is calculated using the value of construction put in place. The national value of construction put in place is obtained from the Bureau of the Census,[38] and is allocated to counties using construction employment data for SIC 154.[39] A conversion factor of 1.6 acres/10^6 dollars ($) is applied to the construction valuation data. This conversion factor is developed

by adjusting the 1992 value of 2 acres/10^6 to 1999 constant dollars using the Price and Cost Indices for Construction.

The duration of construction activity for nonresidential construction is estimated to be 11 months. The formula for calculating the emissions from nonresidential construction is:

$$Emissions = (0.19\ tons\ PM_{10}/acre/month) \times \$ \times f \times m$$

where: $ = dollars spent on nonresidential construction in millions
f = dollars-to-acres conversion factor
m = duration of construction activity in months

4.8.1.7.2.3 How Did We Estimate Emissions for Road Construction? The PM-10 emissions produced by road construction are estimated using an emission factor for heavy construction and the State capital outlay for new road construction. To estimate the acres disturbed by road construction, we obtained FHWA State expenditure data for capital outlay according to the following six classifications:[40]

- Interstate, urban
- Interstate, rural;
- Other arterial, urban;
- Other arterial, rural;
- Collectors, urban; and
- Collectors, rural

We obtained data from the North Carolina Department of Transportation (NCDOT) on the $/mile spent on various road construction projects.[41] For interstate expenditures, we used an average of $4 million/mile corresponding to freeways and interstate projects listed for: 1) new location; 2) widen existing 2-lane shoulder section; and 3) widen existing 4-lane w/ median. For expenditures on other arterial and collectors, we used an average of $1.9 million/mile corresponding to all other projects (excluding freeways and interstate projects) listed for: 1) new location; 2) widen existing 2-lane shoulder section; and 3) widen existing 4-lane w/ median.

After new miles of road constructed are estimated using the above $/mile conversions, miles are converted to acres for each of the 6 road types using the following estimates of acres disturbed per mile:

- Interstate, urban and rural; Other arterial, urban - 15.2 acres/mile
- Other arterial, rural - 12.7 acres/mile
- Collectors, urban - 9.8 acres/mile
- Collectors, rural - 7.9 acres/mile

State-level estimates of acres disturbed are distributed to counties according to the housing starts per county (similar to residential construction).

An emission factor of 0.42 tons/acre/month is used to account for the large amount of dirt moved during the construction of roadways. Since most road construction consists of grading and leveling the land, the higher emission factor more accurately reflects the high level of cut and fill activity that occurs

at road construction sites. The duration of construction activity for road construction is estimated to be 12 months. The formula for calculating roadway construction emissions is:

$$Emissions = (0.42\ tons\ PM_{10}/acre/month) \times \$ \times f1 \times f2 \times d$$

where: $ = State expenditures for capital outlay on road construction
f1 = $-to-miles conversion factor
f2 = miles-to-acres conversion factor
m = duration of roadway construction activity in months

Regional variances in construction activity are accounted for by using correction parameters including soil moisture level, silt content, and control efficiency. The recommended emission factors are representative of uncontrolled emissions.

4.8.1.7.2.3.1 Soil Moisture Level. To account for the soil moisture level, the following equation is used:

$$Moisture\ Level\ Corrected\ Emissions = Base\ Emissions \times (24/PE)$$

where: PE = Precipitation-Evaporation value for county

Precipitation-Evaporation (PE) values are obtained from Thornthwaite's PE Index. We determined the average Thornethwaite PE value for each State based on a map presenting PE values for specific climatic divisions within a State.[34] Alaska and Hawaii were assigned default average PE values by examining rainfall data, and using PE values from those States whose 30-year average statewide rainfall was most comparable to Alaska and Hawaii.

4.8.1.7.2.3.2 Silt Content. To account for the silt content, the following equation is used:

$$Silt\ Content\ Corrected\ Emissions = Base\ Emissions \times (s/9\%)$$

where: s = % dry silt content in soil for area being inventoried

County-level dry silt values are applied to PM-10 emissions for each county. The development of the dry silt content values applied to construction emissions is discussed in section 4.8.1.2.1.1, under the procedures for estimating agricultural tilling emissions.

4.8.1.7.2.3.3 Control Efficiency. For 1999 construction emissions, a control efficiency of 50 percent is used for both PM-10 and PM-2.5 for PM nonattainment areas. According to EPA's Green Book,[42] we identified additional nonattainment counties that should be assumed to have BACM controls on their fugitive dust construction emissions. These included Gila County, AZ, Arapahoe, Douglas, and Jefferson Counties in Colorado, and Lake County, OR. Control efficiencies are applied to 1999 emission estimates for these additional counties.

4.8.1.7.2.3.4 PM-2.5 Emissions. The method describes emission factors for calculating PM-10 emissions. Once PM-10 estimates are developed PM-2.5 emissions are estimated by applying a particle size multiplier of 0.20 to PM-10 emissions.

4.8.1.7.3 Mining and Quarrying —

Area source emissions for mining and quarrying are classified under SCC 2325000000.

The PM-10 emissions for the years 1985 through 1998 are the sum of the emissions from metallic ore, nonmetallic ore, and coal mining operations. The 1999 PM-10 emissions are produced through a linear projection of the emissions for the previous 5 years of data (i.e., 1994 through 1998 inclusive). The PM-2.5 emissions for the years 1990 through 1999 are determined by multiplying the PM-10 emissions for that year by the particle size adjustment factor of 0.2, represented in Table 4.8-1.

PM-10 emissions estimates from mining and quarrying operations include only the following sources of emissions: 1) overburden removal, 2) drilling and blasting, 3) loading and unloading and 4) overburden replacement. Transfer and conveyance operations, crushing and screening operations and storage are not included. Travel on haul roads is also omitted. These operations are not included in order to be consistent with previous TSP emissions estimates from these sources,[43] because they represent activities necessary for ore processing, but not necessary for actual extraction of ore from the earth, and because these activities are the most likely to have some type of control implemented.

EPA's emissions of mining and quarrying operations is a summation of three types of mining (metallic, non-metallic and coal) which are expressed in Equation 4.8-17.

$$E = E_m + E_n + E_c \qquad \text{(Eq. 4.8-17)}$$

where:
- E = PM-10 emissions from mining and quarrying operations
- E_m = PM-10 emissions from metallic mining operations
- E_n = PM-10 emissions from non-metallic mining operations
- E_c = PM-10 emissions from coal mining operations

4.8.1.7.3.1 Determination of Correction Parameters. It was assumed that, for the four operations listed above, the TSP emission factors utilized in developing copper ore processing Emission Trends estimates applied to all metallic minerals. PM-10 emission factors are determined for each of the four operations listed above by making the following assumptions. Table 11.2.3-2 of AP-42[2,3] is used to determine that 35 percent of overburden removal TSP emissions were PM-10. For drilling and blasting and truck dumping, 81 percent of the TSP emissions were assumed to be PM-10.[44] For loading operations, 43 percent of TSP emissions were assumed to be PM-10.[44]

Non-metallic mineral emissions are calculated by assuming that the PM-10 emission factors for western surface coal mining[45] applied to all non-metallic minerals.

Coal mining includes two additional sources of PM-10 emissions compared to the sources considered for metallic and non-metallic minerals. The two additional sources are overburden replacement and truck loading and unloading of that overburden. EPA assumes that tons of overburden was equal to ten times the tons of coal mined.[43]

4.8.1.7.3.2 Activity Data. The regional metallic and non-metallic crude ore handled at surface mines for 1985 through 1998 are obtained from the U.S. Geological Survey.[46] Some State-level estimates are

withheld by the U.S. Geological Survey to avoid disclosing proprietary data. Known distributions from past years are used to estimate these withheld data.

The regional production figures for surface coal mining operations are obtained from the Coal Industry Annual[47] for 1985 through 1998.

4.8.1.7.3.2.1 Metallic Mining Operations. The following PM-10 emissions estimate equation (Equation 4.8-18) calculates the emissions from overburden removal, drilling and blasting, and loading and unloading during metallic mining operations.

$$E_m = A_m \times EF_o + B \times EF_b + EF_l + EF_d \qquad \text{(Eq. 4.8-18)}$$

where:
- A_m = metallic crude ore handled at surface mines (1000 short tons)
- EF_o = PM-10 open pit overburden removal emission factor for copper ore processing (lbs/ton)
- B = fraction of total ore production that is obtained by blasting at metallic mines
- EF_b = PM-10 drilling/blasting emission factor for copper ore processing (lbs/ton)
- EF_l = PM-10 loading emission factor for copper ore processing (lbs/ton)
- EF_d = PM-10 truck dumping emission factor for copper ore processing (lbs/ton)

4.8.1.7.3.2.2 Non-metallic Mining Operations. The following PM-10 emissions estimate equation (Equation 4.8-19) calculates the emissions from overburden removal, drilling and blasting, and loading and unloading during non-metallic mining operations.

$$E_n = A_n \times \left(EF_v + D \times EF_r + EF_a + \tfrac{1}{2} \times \left(EF_e + EF_t\right)\right) \qquad \text{(Eq. 4.8-19)}$$

where:
- A_n = non-metallic crude ore handled at surface mines (1000 short tons)
- EF_v = PM-10 open pit overburden removal emission factor at western surface coal mining operations (lbs/ton)
- D = fraction of total ore production that is obtained by blasting at non-metallic mines
- EF_r = PM-10 drilling/blasting emission factor at western surface coal mining operations (lbs/ton)
- EF_a = PM-10 loading emission factor at western surface coal mining operations (lbs/ton)
- EF_e = PM-10 truck unloading: end dump-coal emission factor at western surface coal mining operations (lbs/ton)
- EF_t = PM-10 truck unloading: bottom dump-coal emission factor at western surface coal mining operations (lbs/ton)

4.8.1.7.3.2.3 Coal Mining. The following PM-10 emissions estimate equation (Equation 4.8-20) calculates the emissions from overburden removal, drilling and blasting, loading and unloading, and overburden replacement during coal mining operations.

$$E_c = A_c \times (10 \times (EF_{to} + EF_{or} + EF_{dt}) + EF_v + EF_r + EF_a + \tfrac{1}{2} \times (EF_e + EF_t)) \qquad \text{(Eq. 4.8-20)}$$

where:

A_c	=	coal production at surface mines (1000 short tons)
Ef_{to}	=	PM-10 emission factor for truck loading overburden at western surface coal mining operations (lbs/ton of overburden)
Ef_{or}	=	PM-10 emission factor for overburden replacement at western surface coal mining operations (lbs/ton of overburden)
Ef_{dt}	=	PM-10 emission factors for truck unloading: bottom dump-overburden at western surface coal mining operations (lbs/ton of overburden)
EF_v	=	PM-10 open pit overburden removal emission factor at western surface coal mining operations (lbs/ton)
EF_r	=	PM-10 drilling/blasting emission factor at western surface coal mining operations (lbs/ton)
EF_a	=	PM-10 loading emission factor at western surface coal mining operations (lbs/ton)
EF_e	=	PM-10 truck unloading: end dump-coal emission factor at western surface coal mining operations (lbs/ton)
EF_t	=	PM-10 truck unloading: bottom dump-coal emission factor at western surface coal mining operations (lbs/ton)

4.8.1.7.3.3 1999 Emissions Methodology. For the year 1999 PM-10 emissions from mining and quarrying operations are projected based on linear regression of the previous 5 years. EPA was unable to obtain regional metallic and non-metallic crude ore handled at surface mines for 1999. The U.S. Geological Survey publishes summary statistics on mining and quarrying with a one year delay.

4.8.1.7.3.4 County Distribution. Regional-level emissions are distributed equally among counties within each region (Equation 4.8-21).

$$County\ Emissions = \frac{1}{Number\ of\ Counties\ in\ Region} \times Regional\ Emissions \qquad \text{(Eq. 4.8-21)}$$

4.8.1.8 Grown Emissions

Point and area fugitive dust sources in the 1990 NET inventory were wind erosion, unpaved roads, and paved roads. (A complete list of source categories is presented in Table 4.8-11.) Emissions from these sources were grown from the 1990 NET inventory based on BEA earnings.

4.8.1.8.1 Emissions Calculations —

Base year controlled emissions are projected to the inventory year using Equation 4.8-22.

$$CE_i = CE_{BY} + (CE_{BY} \times EG_i) \qquad \text{(Eq. 4.8-22)}$$

where: CE_i = Controlled Emissions for inventory year I
CE_{BY} = Controlled Emissions for base year
EG_i = Earnings Growth for inventory year I

Earnings growth (EG) is calculated as shown in Equation 4.8-23.

$$EG_i = 1 - \frac{DAT_i}{DAT_{BY}} \qquad \text{(Eq. 4.8-23)}$$

where: DAT_i = Earnings data for inventory year I
DAT_{BY} = Earnings data in the base year

4.8.1.8.2 1990 Emissions —

The 1990 NET inventory is based primarily on State data, with the 1990 interim data filling in the gaps. The database houses U.S. annual and average summer day emission estimates for the 50 States and the District of Columbia. Seven pollutants (CO, NO_x, VOC, SO_2, PM-10, PM-2.5, and NH_3) were estimated in 1990. The State data were extracted from three sources, the OTAG inventory, the GCVTC inventory, and AIRS/FS.

Since EPA did not receive documentation on how these inventories were developed, this section only describes the effort to collect the data and any modifications or additions made to the data.

4.8.1.8.2.1 OTAG. The OTAG inventory for 1990 was completed in December 1996. The database houses emission estimates for those States in the Super Regional Oxidant A (SUPROXA) domain. The estimates were developed to represent average summer day emissions for the ozone pollutants (VOC, NO_x, and CO). This section gives a background of the OTAG emission inventory and the data collection process.

4.8.1.8.2.1.1 Inventory Components. The OTAG inventory contains data for all States that are partially or fully in the SUPROXA modeling domain. The SUPROXA domain was developed in the late 1980s as part of the EPA regional oxidant modeling (ROM) applications. EPA had initially used three smaller regional domains (Northeast, Midwest, and Southeast) for ozone modeling, but wanted to model the full effects of transport in the eastern United States without having to deal with estimating boundary conditions along relatively high emission areas. Therefore, these three domains were combined and expanded to form the Super Domain. The western extent of the domain was designed to allow for coverage of the largest urban areas in the eastern United States without extending too far west to encounter terrain difficulties associated with the Rocky Mountains. The Northern boundary was designed to include the major urban areas of eastern Canada. The southern boundary was designed to include as much of the United States as possible, but was limited to latitude 26°N, due to computational limitations of the photochemical models. (Emission estimates for Canada were not extracted from OTAG for inclusion in the NET inventory.)

The current SUPROXA domain is defined by the following coordinates:

North:	47.00°N	East:	67.00°W
South:	26.00°N	West:	99.00°W

Its eastern boundary is the Atlantic Ocean and its western border runs from north to south through North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas. In total, the OTAG Inventory completely covers 37 States and the District of Columbia.

The OTAG inventory is primarily an ozone precursor inventory. It includes emission estimates of VOC, NO_x, and CO for all applicable source categories throughout the domain. It also includes a small amount of SO_2 and PM-10 emission data that was sent by States along with their ozone precursor data. No quality assurance (QA) was performed on the SO_2 and PM-10 emission estimates for the OTAG inventory effort.

Since the underlying purpose of the OTAG inventory is to support photochemical modeling for ozone, it is primarily an average summer day inventory. Emission estimates that were submitted as annual emission estimates were converted to average summer day estimates using operating schedule data and default temporal profiles and vice versa.

The OTAG inventory is made up of three major components: (1) the point source component, which includes segment/pollutant level emission estimates and other relevant data (e.g., stack parameters, geographic coordinates, and base year control information) for all stationary point sources in the domain; (2) the area source component, which includes county level emission estimates for all stationary area sources and non-road engines; and (3) the on-road vehicle component, which includes county/roadway functional class/vehicle type estimates of VMT and MOBILE5a input files for the entire domain.

4.8.1.8.2.1.2 Interim Emissions Inventory (OTAG Default). The primary data sources for the OTAG inventory were the individual States. Where States were unable to provide data, the 1990 Interim Inventory[48] was used for default inventory data.

4.8.1.8.2.1.3 State Data Collection Procedures. Since the completion of the Interim Inventory in 1992, many States had completed 1990 inventories for ozone nonattainment areas as required for preparing SIPs. In addition to these SIP inventories, many States had developed more comprehensive 1990 emission estimates covering their entire State. Since these State inventories were both more recent and more comprehensive than the Interim Inventory, a new inventory was developed based on State inventory data (where available) in an effort to develop the most accurate emission inventory to use in the OTAG modeling.

On May 5, 1995, a letter from John Seitz (Director of EPA's Office of Air Quality Planning and Standards [OAQPS]) and Mary Gade (Vice President of ECOS) to State Air Directors, States were requested to supply available emission inventory data for incorporation into the OTAG inventory.[49] Specifically, States were requested to supply all available point and area source emissions data for VOC, NO_x, CO, SO_2, and PM-10, with the primary focus on emissions of ozone precursors. Some emission inventory data were received from 36 of the 38 States in the OTAG domain. To minimize the burden to the States, there was no specified format for submitting State data. The majority of the State data was submitted in one of three formats:

1) an Emissions Preprocessor System Version 2.0 (EPS2.0) Workfile
2) an ad hoc report from AIRS/FS
3) data files extracted from a State emission inventory database

4.8.1.8.2.1.4 State Data Incorporation Procedures/Guidelines. The general procedure for incorporating State data into the OTAG Inventory was to take the data "as is" from the State submissions. There were two main exceptions to this policy. First, any inventory data for years other than 1990 was backcast to 1990 using BEA Industrial Earnings data by State and two-digit SIC code. This conversion was required for five States that submitted point source data for the years 1992 through 1994. All other data submitted were for 1990.

Second, any emission inventory data that included annual emission estimates but not average summer day values were temporally allocated to produce average summer day values. This temporal allocation was performed for point and area data supplied by several States. For point sources, the operating schedule data, if supplied, were used to temporally allocate annual emissions to average summer weekday using Equation 4.8-24:

$$EMISSIONS_{ASD} = EMISSIONS_{ANNUAL} * SUMTHRU * 1/(13 * DPW) \qquad \text{(Eq. 4.8-24)}$$

where:

$EMISSIONS_{ASD}$	=	average summer day emissions
$EMISSIONS_{ANNUAL}$	=	annual emissions
SUMTHRU	=	summer throughput percentage
DPW	=	days per week in operation

If operating schedule data were not supplied for the point source, annual emissions were temporally allocated to an average summer weekday using EPA's default Temporal Allocation file. This computer file contains default seasonal and daily temporal profiles by SCC. The following equation was used:

$$EMISSIONS_{ASD} = EMISSIONS_{ANNUAL} / (SUMFAC_{SCC} * WDFAC_{SCC}) \qquad \text{(Eq. 4.8-25)}$$

where:

$EMISSIONS_{ASD}$	=	average summer day emissions
$EMISSIONS_{ANNUAL}$	=	annual emissions
$SUMFAC_{SCC}$	=	default summer season temporal factor for SCC
$WDFAC_{SCC}$	=	default summer weekday temporal factor for SCC

There were a small number of SCCs that were not in the Temporal Allocation file. For these SCCs, average summer weekday emissions were assumed to be the same as those for an average day during the year and were calculated using the following equation:

$$EMISSIONS_{ASD} = EMISSIONS_{ANNUAL} / 365 \qquad \text{(Eq. 4.8-26)}$$

where:

$EMISSIONS_{ASD}$	=	average summer day emissions

$EMISSIONS_{ANNUAL}$ = annual emissions

4.8.1.8.2.1.5 Point. For stationary point sources, 36 of the 38 States in the OTAG domain supplied emission estimates covering the entire State. Data from the Interim Inventory were used for the two States (Iowa and Mississippi) that did not supply data. Most States supplied 1990 point source data, although some States supplied data for later years because the later year data reflected significant improvements over their 1990 data. Inventory data for years other than 1990 were backcast to 1990 using BEA historical estimates of industrial earnings at the 2-digit SIC level. Table 4.8-12 provides a brief description of the point source data supplied by each State.

4.8.1.8.2.1.6 Area. For area sources, 17 of the 38 States in the OTAG domain supplied 1990 emission estimates covering the entire State, and an additional nine States supplied 1990 emission estimates covering part of their State (partial coverage was mostly in ozone nonattainment areas). Interim Inventory data were the sole data source for 12 States. Where the area source data supplied included annual emission estimates, the default temporal factors were used to develop average summer daily emission estimates. Table 4.8-13 provides a brief description of the area source data supplied by each State.

4.8.1.8.2.1.7 Rule Effectiveness. For the OTAG inventory, States were asked to submit their best estimate of 1990 emissions. There was no requirement that State-submitted point source data include rule effectiveness for plants with controls in place in that year. States were instructed to use their judgment about whether to include rule effectiveness in the emission estimates. As a result, some States submitted estimates that were calculated using rule effectiveness, while other States submitted estimates that were calculated without using rule effectiveness.

The use of rule effectiveness in estimating emissions can result in emission estimates that are much higher than estimates for the same source calculated without using rule effectiveness, especially for sources with high control efficiencies (95 percent or above). Because of this problem, there was concern that the OTAG emission estimates for States that used rule effectiveness would be biased to larger estimates relative to States that did not include rule effectiveness in their computations.

To test if this bias existed, county level maps of point source emissions were developed for the OTAG domain. If this bias did exist, one would expect to see sharp differences at State borders between States using rule effectiveness and States not using rule effectiveness. Sharp State boundaries were not evident in any of the maps created. Based on this analysis, it was determined that impact of rule effectiveness inconsistencies was not causing large biases in the inventory.

4.8.1.8.2.2 Grand Canyon Visibility Transport Commission Inventory. The GCVTC inventory includes detailed emissions data for eleven States: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.[50] This inventory was developed by compiling and merging existing inventory databases. The primary data sources used were State inventories for California and Oregon, AIRS/FS for VOC, NO_x, and SO_2 point source data for the other nine States, the 1990 Interim Inventory for area source data for the other nine States, and the 1985 NAPAP inventory for NH_3 and TSP data. In addition to these existing data, the GCVTC inventory includes newly developed emission estimates for forest wildfires and prescribed burning.

After a detailed analysis of the GCVTC inventory, it was determined that the following portions of the GCVTC inventory would be incorporated into the PM inventory:

- complete point and area source data for California
- complete point and area source data for Oregon
- forest wildfire data for the entire eleven State region
- prescribed burning data for the entire eleven State region

State data from California and Oregon were incorporated because they are complete inventories developed by the States and are presumably based on more recent, detailed and accurate data than the Interim Inventory (some of which is still based on the 1985 NAPAP inventory). The wildfire data in the GCVTC inventory represent a detailed survey of forest fires in the study area and are clearly more accurate than the wildfire data in the Interim Inventory. The prescribed burning data in the GCVTC inventory are the same as the data in the Interim Inventory at the State level, but contain more detailed county-level data.

Non-utility point source emission estimates in the GCVTC inventory from States other than California and Oregon came from AIRS/FS. Corrections were made to this inventory to the VOC and PM emissions. The organic emissions reported in GCVTC inventory for California are total organics (TOG). These emissions were converted to VOC using the profiles from EPA's SPECIATE[51] database.

4.8.1.8.2.3 AIRS/FS. SO_2 and PM-10 (or PM-10 estimated from TSP) sources of greater than 250 tons per year as reported to AIRS/FS that were not included in either the OTAG or GCVTC inventories were appended to the NET inventory. The data were extracted from AIRS/FS using the data criteria set listed in Table 4.8-14. The data elements extracted are also listed in Table 4.8-14. The data were extracted in late November 1996. It is important to note that *estimated* emissions were extracted.

4.8.1.8.2.4 Data Gaps. As stated above, the starting point for the 1990 NET inventory is the OTAG, GCVTC, AIRS, and 1990 Interim inventories. Data added to these inventories include estimates of SO2, PM-10, PM-2.5, and NH_3, as well as annual or ozone season daily (depending on the inventory) emission estimates for all pollutants. This section describes the steps taken to fill in the gaps from the other inventories.

4.8.1.8.2.4.1 SO_2, PM-10, and PM-2.5 Emissions. For SO_2 and PM-10, State data from OTAG were used where possible. (The GCVTC inventory contained SO_2 and PM annual emissions.) In most cases, OTAG data for these pollutants were not available. For point sources, data for plants over 250 tons per year for SO_2 and PM-10 were added from AIRS/FS. The AIRS/FS data were also matched to the OTAG plants and the emissions were attached to existing plants from the OTAG data where a match was found. Where no match was found to the plants in the OTAG data, new plants were added to the inventory. For OTAG plants where there were no matching data in AIRS/FS and for all area sources of SO_2 and PM-10, emissions were calculated based on the emission estimates for other pollutants.

The approach to developing SO_2 and PM-10 emissions from unmatched point and area sources involved using uncontrolled emission factor ratios to calculate uncontrolled emissions. This method used SO_2 or PM-10 ratios to NO_x. NO_x was the pollutant utilized to calculate the ratio because (1) the types of sources likely to be important SO_2 and PM-10 emitters are likely to be similar to important NO_x sources and (2) the generally high quality of the NO_x emissions data. Ratios of SO_2/NO_x and PM-10/NO_x

based on uncontrolled emission factors were developed. These ratios were multiplied by uncontrolled NO_x emissions to determine either uncontrolled SO_2 or PM-10 emissions. Once the uncontrolled emissions were calculated, information on VOC, NO_x, and CO control devices was used to determine if they also controlled SO_2 and/or PM-10. If this review determined that the control devices listed did not control SO_2 and/or PM-10, plant matches between the OTAG and Interim Inventory were performed to ascertain the SO_2 and PM-10 controls applicable for those sources. The plant matching component of this work involved only simple matching based on information related to the State and county FIPS code, along with the plant and point IDs.

There was one exception to the procedures used to develop the PM-10 point source estimates. For South Carolina, PM-10 emission estimates came from the Interim Inventory. This was because South Carolina had no PM data in AIRS/FS for 1990 and using the emission factor ratios resulted in unrealistically high PM-10 emissions.

There were no PM-2.5 data in either OTAG or AIRS/FS. Therefore, the point and area PM-2.5 emission estimates were developed based on the PM-10 estimates using source-specific uncontrolled particle size distributions and particle size specific control efficiencies for sources with PM-10 controls. To estimate PM-2.5, uncontrolled PM-10 was first estimated by removing the impact of any PM-10 controls on sources in the inventory. Next, the uncontrolled PM-2.5 was calculated by multiplying the uncontrolled PM-10 emission estimates by the ratio of the PM-2.5 particle size multiplier to the PM-10 particle size multiplier. (These particle size multipliers represent the percentage to total particulates below the specified size.) Finally, controls were reapplied to sources with PM-10 controls by multiplying the uncontrolled PM-2.5 by source/control device particle size specific control efficiencies.

4.8.1.8.3 Growth Indicators, 1985-1989 —

The changes in the point and area source emissions were equated with the changes in historic earnings by State and industry. Emissions from each point source in the 1985 NAPAP inventory were projected to the years 1985 through 1990 based on the growth in earnings by industry (two-digit SIC code). Historical annual State and industry earnings data from BEA's Table SA-5[52] were used to represent growth in earnings from 1985 through 1990.

The 1985 through 1990 earnings data in Table SA-5 are expressed in nominal dollars. To estimate growth, these values were converted to constant dollars to remove the effects of inflation. Earnings data for each year were converted to 1982 constant dollars using the implicit price deflator for PCE.[53] The PCE deflators used to convert each year's earnings data to 1982 dollars are:

Year	1982 PCE Deflator
1985	111.6
1987	114.8
1988	124.2
1989	129.6
1990	136.4

Several BEA categories did not contain a complete time series of data for the years 1985 through 1990. Because the SA-5 data must contain 1985 earnings and earnings for each inventory year (1985 through 1990) to be useful for estimating growth, a log linear regression equation was used where

possible to fill in missing data elements. This regression procedure was performed on all categories that were missing at least one data point and which contained at least three data points in the time series.

Each record in the inventory was matched to the BEA earnings data based on the State and the two-digit SIC. Table 4.8-15 shows the BEA earnings category used to project growth for each of the two-digit SICs found in the 1985 NAPAP Emission Inventory. No growth in emissions was assumed for all point sources for which the matching BEA earnings data were not complete. Table 4.8-15 also shows the national average growth and earnings by industry from Table SA-5.

4.8.1.8.4 Growth Indicators, 1991 through 1996 —

The 1991 through 1996 area source emissions were grown in a similar manner as the 1985 through 1989 estimates, except for using a different base year inventory. The point source inventory was also grown for those States that did not want their AIRS/FS data used. (See Table 14 for a list of States that chose AIRS/FS.) For those States requesting that EPA extract their data from AIRS/FS, the years 1990 through 1995 were downloaded from the EPA IBM Mainframe. The 1996 emissions were not extracted since States are not required to have the 1996 data uploaded into AIRS/FS until July 1997.

4.8.1.8.4.1 Grown Estimates. The 1991 through 1996 point and area source emissions were grown using the 1990 NET inventory as the basis. The algorithm for determining the estimates is detailed in section 4.8.1.8. The 1990 through 1996 SEDS and BEA data are presented in Tables 4.8-17 and 4.8-18. The 1996 BEA and SEDS data were determined based on linear interpretation of the 1988 through 1995 data. Point sources were projected using the first two digits of the SIC code by State. Area source emissions were projected using either BEA or SEDS. Table 4.8-19 lists the SCC and the source for growth.

The 1990 through 1996 earnings data in BEA Table SA-5 (or estimated from this table) are expressed in nominal dollars. In order to be used to estimate growth, these values were converted to constant dollars to remove the effects of inflation. Earnings data for each year were converted to 1992 constant dollars using the implicit price deflator for PCE. The PCE deflators used to convert each year's earnings data to 1992 dollars are:

Year	1992 PCE Deflator
1990	93.6
1991	97.3
1992	100.0
1993	102.6
1994	104.9
1995	107.6
1996	109.7

4.8.1.8.4.2 AIRS/FS. Several States responded to EPA's survey and requested that their 1991 through 1995 estimates reflect their emissions as reported in AIRS/FS. The list of these States, along with the years available in AIRS/FS is given in Table 4.8-16.

As noted in Table 4.8-16, several States did not report emissions for all pollutants for all years for the 1990 to 1995 time period. To fill these data gaps, EPA applied linear interpolation or extrapolated the closest two years worth of emissions at the plant level. If only one year of emissions data were

available, the emission estimates were held constant for all the years. The segment-SCC level emissions were derived using the average split for all available years. The non-emission data gaps were filled by using the most recent data available for the plant.

Many States do not provide PM-10 emissions to AIRS. These States' TSP emissions were converted to PM-10 emissions using uncontrolled particle size distributions and AP-42 derived control efficiencies. The PM-10 emissions are then converted to PM-2.5 in the same manner as described in section 4.8.1.8.2.4.1. The State of South Carolina provided its own conversion factor for estimating PM-10 from TSP.[54]

4.8.1.8.5 Growth Indicators, 1997 through 1999 —

Except for the source categories discussed in sections 4.8.1.2 through 4.8.1.7, the methods applied to prepare 1997 through 1999 emissions for point and area source fugitive dust categories are the same as those described in Section 4.3.9 for Industrial nonutility point and area sources. Sections 4.8.1.2 through 4.8.1.7 provide the methodologies for preparing 1997 through 1999 emissions for the area source categories discussed in those sections.

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Table 4.8-1. Particle Size Ratios

Source Category	Ratio of PM-2.5 to PM-10
Wind Erosion - Agricultural Land	0.15
Agricultural Crops	0.20
Agricultural Livestock	0.15
Paved Roads	0.25
Unpaved Roads	0.15
Construction Activities	0.20
Mining and Quarrying	0.20

Table 4.8-2. Methods for Developing Annual Emission Estimates for Miscellaneous Area Sources for the Years 1989-1999

For the category	For the years	For the pollutant(s)	EPA estimated emissions by
Agricultural Tilling (Crops)	1989	PM-10	Using State-level acres of crops planted from U.S. Department of Agriculture (USDA) to calculate emissions, and then distributing emissions to the county-level using acres of cropland harvested from the USDA. Also by using a particle size multiplier for the fraction of PM-10 in total particulate of 0.21.
	1990-1998	PM-10	Using county-level acres of land tilled by crop and tillage types from the Conservation Technology Information Center at Purdue University to calculate emissions. Relative to 1989 methodology, improving method for determining silt content of surface soil and the number of tillings per year by crop type which are variables in the equation for calculating emissions. Replaced EPA estimates for 1996 with State data when available.
	1999	PM-10	Dividing national number of acres by tillage type for 1999 by national number of acres tilled by tillage type for 1998 to get national growth factors by tillage type, and applying these factors to the 1998 county-level emissions to get 1999 emissions.
	1990-1999	PM-2.5	Using the same method as used to calculate PM-10 emissions, but substituting 0.042 as particle size multiplier. Replaced EPA estimates for 1996 with State data when available.
Beef Cattle Feedlots	1989 - 1999	PM-10	1) Obtaining county-level number of head of livestock for 1987, 1992, and 1997 from the 1997 Census of Agriculture; 2) estimating interim years activity data for1988-1991, 1993-1996, 1998, and 1999 using linear interpolation; and 3) applying national average PM-10 emissions factor to updated county activity data for each year.
	1990 - 1999	PM-2.5	Multiplying the PM-10 emissions for each year by particle size adjustment factor of 0.15.
Animal Husbandry	1990 - 1999	NH_3	1) Obtaining county-level number of head of cattle, goats, hogs and pigs, horses, poultry and sheep for 1987, 1992, 1997 from the 1997 Census of Agriculture; 2) estimating interim years activity data (1988-1991, 1993-1996, 1998, 1999) using linear interpolation; 3) dividing the activity data by 2000 to convert from pounds to tons, and apply a national average NH3 emission factor to updated county activity data for each year.

Table 4.8-2 (continued)

For the category	For the years	For the pollutant(s)	EPA estimated emissions by
Fertilizer Application	1990-1998	NH_3	Applying NH_3 emission factors to county-level fertilizer consumption by fertilizer type obtained from the Commercial Fertilizers Data Base maintained by the Association of American Plant Food Control Officials. Replaced EPA estimates for 1996 with State data when available.
	1999	NH_3	1) Using national-level emissions by SCC for years 1990, 1996, 1997 and 1998 to project 1999 national emissions; 2) Calculating a county to national-level ratio of 1998 data; 3) Applying this ratio to 1999 national emission estimate to distribute 1999 emissions to the county level.
Unpaved Road Fugitive Dust Emissions	1989-1995	PM-10	Running the PART5 model to estimate emission factors with State-specific monthly precipitation data and State-specific silt content values.
	1996-1999	PM-10	Using 9/98 AP-42 Equation 2 emission factor with State-specific monthly precipitation data and State-specific silt content values.
	1989-1999	PM-2.5	Multiplying unpaved road fugitive dust emissions by 0.15.
Paved Road Fugitive Dust Emissions	1989-1999	PM-10	Running the PART5 model to estimate emission factors with State-specific monthly precipitation data and State/roadway type-specific silt loading values.
	1989-1999	PM-2.5	Multiplying paved road fugitive dust emissions by 0.25.
Construction	1989	PM-10	Obtaining an TSP emission factor for construction, an estimate of the acres of land under construction, and the average duration of construction activity to calculate regional-level emissions; Distributing emissions to the county-level using county estimates of payroll for construction (SICs 15, 16, 17) from *County Business Patterns*.
	1990-1995	PM-10	1) Obtaining an emission factor for construction from Improvement of Specific Emission Factors, an estimate of the acres of land under construction, and the average duration of construction activity to calculate regional-level emissions; 2) Distributing to the county-level using county estimates of payroll for construction (SICs 15, 16, 17) from *County Business Patterns;* 3) Applying a control efficiency to 1995 emissions for counties classified as nonattainment areas.

Table 4.8-2 (continued)

For the category	For the years	For the pollutant(s)	EPA estimated emissions by
	1996-1998	PM-10	Growing emissions to current year by calculating ratio of number of permits issued in current year to number of permits issued in prior year. A control efficiency was applied to emissions for counties classified as nonattainment areas. Replaced EPA estimates for 1996 with State data when available.
	1999	PM-10	1) Obtaining 1999 activity data corresponding to three subcategories of construction, including residential, commercial and road. 2) Applying category-specific emission factors that account for the duration of construction; 3) Accounting for regional variances in construction activity by correcting for soil moisture level, silt content, and control efficiency.
	1990-1999	PM-2.5	Multiplying the PM-10 emissions by particle size adjustment factor of 0.20. Replaced EPA estimates for 1996 with State data when available.
Mining and Quarrying	1989-1998	PM-10	1) Obtaining regional metallic and non-metallic crude ore handled at surface mines from the U.S. Geologic Survey; 2) Estimating State withheld data using known distributions from past years; 3) Applying PM-10 emission factors to activity data to develop regional emissions for metallic ore, nonmetallic ore, and coal mining operations; 4) Distributing total emissions from the regional to county level by dividing regional emissions by the number of counties in that region. Replaced EPA estimates for 1996 with State data when available.
	1999	PM-10	Projecting emissions based on linear regression of emissions for the years 1990 to 1998.
	1990-1999	PM-2.5	Applying a particle size distribution factor of 0.20 to PM-10 emission estimates. Replaced EPA estimates for 1996 with State data when available.

Table 4.8-3. Comparison of Methodologies Used to Develop 1996 Base Year Emissions for Miscellaneous Area Source Categories for Versions 1 through 4 of the NET Inventory

For the Category	For the Pollutant(s)	EPA estimated 1996 Base Year emissions for			
		Version 1 by	Version 2 by	Version 3 by	Version 4 by
Agricultural Tilling (Crops)	PM-10	Using county-level acres of land tilled by crop and tillage types from the Conservation Technology Information Center at Purdue University. Equation multiplied acres of land tilled, number of tillings in a year, silt content of surface soil, particle size multiplier of 0.21 for PM-10, and a constant of 4.8 lbs of PM-10/acre pass to obtain county-level emissions.	Using same methodology as used in Version 1.	Using same methodology as used in Version 1. Emissions data supplied by State/local agencies replaced EPA default estimates.	Using EPA estimates for 1999 but with following methodology change: Dividing national tillage type estimates for 1999 by national tillage type estimates for 1998 to get national growth factors by tillage type, and applying these factors to the 1998 county-level estimates to get 1999 estimates. Emissions data supplied by State/local agencies replaced EPA default estimates.
	PM-2.5	Using same method as used to calculate PM-10, but substituting 0.042 as particle size multiplier.	Using same methodology as used in Version 1.	Using same methodology as used in Version 1.	Using same methodology as used in Version 1.
Beef Cattle Feedlots	PM-10	Growing from 1990 NET using surrogate indicator (BEA earnings data).	Using same methodology as used in Version 1.	1) Obtaining county-level head of beef cattle in feedlots for 1987, 1992, 1997 from the 1997 Census of Agriculture; 2) estimating interim years activity data (1988-1991, 1993-1996, 1998, 1999) using linear interpolation; 3) applying national average PM-10 emissions factor to updated county activity data for each year.	Using same methodology as used in Version 3.
	PM-2.5	Multiplying PM-10 by particle size adjustment factor of 0.15.	Using same methodology as used in Version 1.	Using same methodology as used in Version 1.	Using same methodology as used in Version 1.
Animal Husbandry	NH_3	Obtaining county-level activity data from 1992 Census of Agriculture and multiplying by national average NH_3 emission factor.	Using same methodology as used in Version 1.	1) Obtaining county-level head of livestock for 1987, 1992, 1997 from the 1997 Census of Agriculture; 2) estimating interim years activity data (1988-1991, 1993-1996, 1998, 1999) using linear interpolation; 3) applying national average NH_3 emissions factor to updated county activity data for each year.	Using same methodology as used in Version 3.

Table 4.8-3 (continued)

For the Category	For the Pollutant(s)	EPA estimated 1996 Base Year emissions for			
		Version 1 by	Version 2 by	Version 3 by	Version 4 by
Fertilizer Application	NH_3	Applying NH_3 emission factors to county-level fertilizer consumption by fertilizer type obtained from the Commercial Fertilizers Data Base maintained by the Association of American Plant Food Control Officials.	Using same methodology as used in Version 1.	Using same methodology as used in Version 1. Emissions data supplied by State/local agencies replaced EPA default estimates.	Using EPA estimates for 1999 but with following methodology change: 1) Using national-level emissions by SCC for years 1990, 1996, 1997 and 1998 to project 1999 national emissions; 2) calculating a county to national-level ratio of 1998 data; 3) applying this ratio to 1999 national emission estimate to distribute 1999 emissions to the county level. Emissions data supplied by State/local agencies replaced EPA default estimates.
Construction	PM-10	1) Using AP-42 particulate emission factor, estimate of acres of land under construction, and average duration of construction activity to determine 1995 emissions. 2) Determining emission factor from dollars spent on construction from Census Bureau, determining construction acres and duration of activity from Cowherd, and deriving PM-10 to TSP ratio from MRI. 3) Estimating 1996 emissions by extrapolating from 1995 using the ratio between the number of residential construction permits issued in 1996 and the number issued in 1995. 4) Applying a control efficiency to counties classified as nonattainment areas. 5) Distributing regional emissions to the county level using county estimates of payroll for construction (SIC 15, 16, 17) from County Business Patterns.	Using same methodology as used in Version 1.	Changing AP-42 emission factor used. Obtaining new factor from AP-42 findings report "Improvement of Specific Emission Factors." Methodology did not change. Emissions data supplied by State/local agencies replaced EPA default estimates.	Using same methodology as used in Version 3. Emissions data supplied by State/local agencies replaced EPA default estimates.
	PM-2.5	Multiplying PM-10 emissions by particle size adjustment factor of 0.2.	Using same methodology as used in Version 1.	Using same methodology as used in Version 1.	Using same methodology as used in Version 1.
Mining and Quarrying	PM-10	1) Obtaining regional metallic and non-metallic crude ore handled at surface mines from the U.S. Geologic Survey. 2) Estimating State withheld data using known distributions from past years. 3) Applying activity data to PM-10 emission factors to develop regional emissions for metallic ore, nonmetallic ore, and coal mining operations. 4) Distributing the emissions from the regional to county level by multiplying regional emissions by 1 over number of counties in that region.	Using same methodology as used in Version 1.	Using same methodology as used in Version 1. Emissions data supplied by State/local agencies replaced EPA default estimates.	Projecting emissions based on linear regression of emissions for the years 1990 to 1998. Emissions data supplied by State/local agencies replaced EPA default estimates.
	PM-2.5	Applying particle size distribution factor of 0.20 to PM-10 emission estimates.	Using same methodology as used in Version 1.	Using same methodology as used in Version 1.	Using same methodology as used in Version 1.

Table 4.8-3 (continued)

Notes: Version 1 corresponds to December 1997 Trends report, Version 2 estimates correspond to December 1998 Trends report, Version 3 corresponds to March 2000 Trends report, and Version 4 is for report yet to be published.

Table 4.8-4. Miscellaneous Area Source Categories: Summary of State-Submitted Emissions for 1996 Included in Versions 3 and 4 of the NET Inventory

Source Category/ SCC	State	Geographic Coverage	Temporal	VOC	NO_x	CO	SO_2	PM-10	PM-25	NH_3	1996 NET Version	Comments
Agricultural Tilling (Crops) (2801000003)												
	CA	Statewide	Annual/Daily					x	x		3 and 4	
	LA	Statewide	Annual/Daily					x	x		3 and 4	
	OK	Statewide	Annual/Daily					x	x		3 and 4	
Fertilizer Application (2801700001, 2801700002, 2801700003, 2801700004, 2801700005, 2801700006, 2801700007, 2801700008, 2801700009, 2801700010)												
	LA	Statewide	Annual/Daily							x	3 and 4	
Construction (2311000100, 2311010000, 2311020000, 2311030000)												
	CA	Statewide	Annual/Daily					x	x		3 and 4	Emissions reported under SCCs 2311010000, 2311020000, 2311030000
Mining and Quarrying (2325000000)												
	CA	Statewide	Annual/Daily	x	x	x	x	x	x		3 and 4	
	LA	Statewide	Annual/Daily					x	x		3 and 4	

Table 4.8-5. Silt Content by Soil Type, 1985 to 1989

Soil Type	Silt Content (%)
Silt Loam	78
Sandy Loam	33
Sand	12
Loamy Sand	12
Clay	75
Clay Loam	75
Organic Material	10-82
Loam	60

Table 4.8-6. Silt Content by Soil Type, 1990 to 1998

Soil Type	Silt Content (%)
Silt Loam	52
Sandy Loam	33
Sand	12
Loamy Sand	12
Clay	29
Clay Loam	29
Organic Material	10-82
Loam	40

Table 4.8-7. Number of Tillings by Crop Type

	Number of Tillings	
Crop	Conservation Use	Conventional Use
Corn	2	6
Spring Wheat	1	4
Rice	5	5
Fall-Seeded Small Grain	3	5
Soybeans	1	6
Cotton	5	8
Sorghum	1	6
Forage	3	3
Permanent Pasture	1	1
Other Crops	3	3
Fallow	1	1
Annual Conservation Use	(No method, not used after 1995; number of tillings = 1)	

Table 4.8-8. Livestock Operations Ammonia Emission Factors

Category	AMS SCC	Emission Factor (lb NH_3/Head)
Cattle and Calves	2805020000	50.5
Pigs and Hogs	2805025000	20.3
Poultry	2805030000	0.394
Sheep	2805040000	7.43
Horses	2710020030	26.9
Goats	2805045001	14.1
Mink	2205045002	1.28

Table 4.8-9. Assumed Values for Average Daily Traffic Volume by Volume Group

	Vehicles Per Day Per Mile			
Volume Category for Rural Roads	**Less than 50**	**50 - 199**	**200 - 499**	**500 and over**
Assumed ADTV Value for Rural Roads	5*	125**	350**	550***
Volume Category for Urban Roads	**Less than 200**	**200 - 499**	**500 - 1999**	**2000 and over**
Assumed ADTV Value for Urban Roads	20*	350**	1250**	2200***

NOTE(S): *10% of volume group's maximum range endpoint.
**Average of volume group's range endpoints.
***110% of volume group's minimum.

Table 4.8-10. PM-2.5 to PM-10 Ratios for Paved and Unpaved Roads

Source Category	Ratio of PM-2.5 to PM-10
Paved Roads	0.25
Unpaved Roads	0.15

Table 4.8-11. List of Grown Sources

SCC	SCC Description	TIER1	TIER2
2307010000	Industrial Processes Wood Products: SIC 24 Logging Operations Total	14	01
2650000005	Waste Disposal, Treatment, & Recovery Scrap & Waste Materials Scrap & Waste Materials Storage Piles	14	07
30300519	Primary Metal Production Primary Metal Production Primary Copper Smelting Unpaved Road Traffic: Fugitive Emissions	14	07
30300831	Primary Metal Production Iron Production Fugitive Emissions: Roads Unpaved Roads: LDV	14	07
30300832	Primary Metal Production Iron Production Fugitive Emissions: Roads Unpaved Roads: MDV	14	07
30300833	Primary Metal Production Iron Production Fugitive Emissions: Roads Unpaved Roads: HDV	14	07
30300834	Primary Metal Production Iron Production Fugitive Emissions: Roads Paved Roads: All Vehicle Types	14	07
30302321	Primary Metal Production Primary Metal Production Taconite Iron Ore Processing Haul Road: Rock	14	07
30302322	Primary Metal Production Primary Metal Production Taconite Iron Ore Processing Haul Road: Taconite	14	07
30501024	Mineral Products Mineral Products Surface Mining Operations Hauling	14	07
30501031	Mineral Products Mineral Products Surface Mining Operations Scrapers: Travel Mode	14	07
30501039	Mineral Products Mineral Products Surface Mining Operations Hauling: Haul Trucks	14	07
30501045	Mineral Products Mineral Products Surface Mining Operations Bulldozing: Overburden	14	07
30501046	Mineral Products Mineral Products Surface Mining Operations Bulldozing: Coal	14	07
30501047	Mineral Products Mineral Products Surface Mining Operations Grading	14	07
30501049	Mineral Products Mineral Products Surface Mining Operations Wind Erosion: Exposed Areas	14	07
30501050	Mineral Products Mineral Products Surface Mining Operations Vehicle Traffic: Light/Medium Vehicles	14	07
30501090	Mineral Products Mineral Products Surface Mining Operations Haul Roads: General	14	07
30502011	Mineral Products Mineral Products Stone Quarrying/Processing Hauling	14	07
30502504	Mineral Products Mineral Products Sand/Gravel Hauling	14	07
31100101	Building Construction Building Construction Construction: Building Contractors Site Preparation: Topsoil Removal	14	07
31100102	Building Construction Building Construction Construction: Building Contractors Site Preparation: Earth Moving (Cut & Fill)	14	07
31100103	Building Construction Building Construction Construction: Building Contractors Site Preparation: Aggregate Hauling (on dirt)	14	07
31100205	Building Construction Building Construction Construction: Demolition of Structures On-Site Truck Traffic	14	07
31100206	Building Construction Building Construction Construction: Demolition of Structures On-Site Truck Traffic	14	07

Table 4.8-12. Point Source Data Submitted

State	Data Source/Format	Temporal Resolution	Year of Data	Adjustments to Data
Alabama	AIRS/FS - Ad hoc retrievals	Annual	1994	Backcast to 1990 using BEA. Average Summer Day estimated using methodology described above.
Arkansas	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using default temporal factors.
Connecticut	State - EPS Workfile	Daily	1990	None
Delaware	State - EPS Workfile	Daily	1990	None
District of Columbia	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Florida	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Georgia - Atlanta Urban Airshed (47 counties) domain	State - State format	Daily	1990	None
Georgia - Rest of State	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using default temporal factors.
Illinois	State - EPS Workfiles	Daily	1990	None
Indiana	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Kansas	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Kentucky - Jefferson County	Jefferson County - EPS Workfile	Daily	1990	None
Kentucky - Rest of State	State - EPS Workfile	Daily	1990	None
Louisiana	State - State Format	Annual	1990	Average Summer Day estimated using methodology described above.
Maine	State - EPS Workfile	Daily	1990	None
Maryland	State - EPS Workfile	Daily	1990	None
Massachusetts	State - EPS Workfile	Daily	1990	None
Michigan	State - State Format	Annual	1990	Average Summer Day estimated using methodology described above.
Minnesota	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Missouri	AIRS/FS - Ad hoc retrievals	Annual	1993	Backcast to 1990 using BEA. Average Summer Day estimated using methodology described above.
Nebraska	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
New Hampshire	State - EPS Workfile	Daily	1990	None
New Jersey	State - EPS Workfile	Daily	1990	None
New York	State - EPS Workfile	Daily	1990	None
North Carolina	State - EPS Workfiles	Daily	1990	None
North Dakota	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Ohio	State - State Format	Annual	1990	Average Summer Day estimated using methodology described above.
Oklahoma	State - State Format	Annual	1994	Backcast to 1990 using BEA. Average Summer Day estimated using methodology described above.
Pennsylvania - Allegheny County	Allegheny County - County Format	Daily	1990	None
Pennsylvania - Philadelphia County	Philadelphia County - County Format	Daily	1990	None
Pennsylvania - Rest of State	State - EPS Workfile	Daily	1990	None
Rhode Island	State - EPS Workfile	Daily	1990	None
South Carolina	AIRS/FS - Ad hoc retrievals	Annual	1991	Average Summer Day estimated using default temporal factors.

Table 4.8-12 (continued)

State	Data Source/Format	Temporal Resolution	Year of Data	Adjustments to Data
South Dakota	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Tennessee	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using default temporal factors.
Texas	State - State Format	Daily	1992	Backcast to 1990 using BEA.
Vermont	State - EPS Workfile	Daily	1990	None
Virginia	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
West Virginia	AIRS/FS - Ad hoc retrievals	Annual	1990	Average Summer Day estimated using methodology described above.
Wisconsin	State - State Format	Daily	1990	None

Table 4.8-13. Area Source Data Submitted

State	Data Source/Format	Temporal Resolution	Geographic Coverage	Adjustments to Data
Connecticut	State - EPS Workfile	Daily	Entire State	None
Delaware	State - EPS Workfile	Daily	Entire State	None
District of Columbia	State - Hard copy	Daily	Entire State	None
Florida	AIRS-AMS - Ad hoc retrievals	Daily	Jacksonville, Miami/ Ft. Lauderdale, Tampa	Added Non-road emission estimates from Int. Inventory to Jacksonville (Duval County)
Georgia	State - State format	Daily	Atlanta Urban Airshed (47 Counties)	None
Illinois	State - State format	Daily	Entire State	None
Indiana	State - State format	Daily	Entire State	Non-road emissions submitted were county totals. Non-road emissions distributed to specific SCCs based on Int. Inventory
Kentucky	State - State Format	Daily	Kentucky Ozone Nonattainment Areas	None
Louisiana	State - State Format	Daily	Baton Rouge Nonattainment Area (20 Parishes)	None
Maine	State - EPS Workfile	Daily	Entire State	None
Maryland	State - EPS Workfile	Daily	Entire State	None
Michigan	State - State Format	Daily	49 Southern Michigan Counties	None
Missouri	AIRS-AMS- Ad hoc retrievals	Daily	St. Louis area (25 counties)	Only area source combustion data was provided. All other area source data came from Int. Inventory
New Hampshire	State - EPS Workfile	Daily	Entire State	None
New Jersey	State - EPS Workfile	Daily	Entire State	None
New York	State - EPS Workfile	Daily	Entire State	None
North Carolina	State - EPS Workfiles	Annual	Entire State	Average Summer Day estimated using default temporal factors.
Ohio	State - Hard copy	Daily	Canton, Cleveland Columbus, Dayton, Toledo, and Youngstown	Assigned SCCs and converted from kgs to tons. NO_x and CO from Int. Inventory added to Canton, Dayton, and Toledo counties.
Pennsylvania	State - EPS Workfile	Daily	Entire State	Non-road emissions submitted were county totals. Non-road emissions distributed to specific SCCs based on Int. Inventory
Rhode Island	State - EPS Workfile	Daily	Entire State	None
Tennessee	State - State format	Daily	42 Counties in Middle Tennessee	No non-road data submitted. Non-road emissions added from Int. Inventory
Texas	State - State Format	Annual	Entire State	Average Summer Day estimated using default temporal factors.
Vermont	State - EPS Workfile	Daily	Entire State	None
Virginia	State - EPS Workfile	Daily	Entire State	None
West Virginia	AIRS-AMS - Ad hoc retrievals	Daily	Charleston, Huntington/Ashland, and Parkersburg (5 counties total)	None
Wisconsin	State - State Format	Daily	Entire State	None

Table 4.8-14. Ad Hoc Report

Criteria		Plant Output		Point Output		Stack Output		Segment Output General		Segment Output Pollutant	
Regn	GT 0	YINV	YEAR OF INVENTORY	STTE	STATE FIPS CODE	STTE	STATE FIPS CODE	STTE	STATE FIPS CODE	STTE	STATE FIPS CODE
PLL4	CE VOC	STTE	STATE FIPS CODE	CNTY	COUNTY FIPS CODE	CNTY	COUNTY FIPS CODE	CNTY	COUNTY FIPS CODE	CNTY	COUNTY FIPS CODE
PLL4	CE CO	CNTY	COUNTY FIPS CODE	PNED	NEDS POINT ID	PNED	NEDS POINT ID	PNED	NEDS POINT ID	PNED	NEDS POINT ID
PLL4	CE SO2	CYCD	CITY CODE	PNUM	POINT NUMBER	STNB	STACK NUMBER	STNB	STACK NUMBER	STNB	STACK NUMBER
PLL4	CE NO2	ZIPC	ZIP CODE	CAPC	DESIGN CAPACITY	LAT2	LATITUDE STACK	PNUM	POINT NUMBER	PNUM	POINT NUMBER
PLL4	CE PM-10	PNED	NEDS POINT ID	CAPU	DESIGN CAPACITY UNITS	LON2	LONGITUDE STACK	SEGN	SEGMENT NUMBER	SEGN	SEGMENT NUMBER
PLL4	CE PT	PNME	PLANT NAME	PAT1	WINTER THROUGHPUT	STHT	STACK HEIGHT	SCC8	SCC	SCC8	SCC
DES4	GE 0	LAT1	LATITUDE PLANT	PAT2	SPRING THROUGHPUT	STDM	STACK DIAMETER	HEAT	HEAT CONTENT	PLL4	POLLUTANT CODE
DUE4	ME TY	LON1	LONGITUDE PLANT	PAT3	SUMMER THROUGHPUT	STET	STACK EXIT TEMPERATURE	FPRT	ANNUAL FUEL THROUGHPUT	D034	OSD EMISSIONS
YINV	ME 90	SIC1	STANDARD INDUSTRIAL CODE	PAT4	FALL THROUGHPUT	STEV	STACK EXIT VELOCITY	SULF	SULFUR CONTENT	DU04	OSD EMISSION UNITS
		OPST	OPERATING STATUS	NOHD	NUMBER HOURS/DAY	STFR	STACK FLOW RATE	ASHC	ASH CONTENT	DES4	DEFAULT ESTIMATED EMISSIONS
		STRS	STATE REGISTRATION NUMBER	NODW	NUMBER DAYS/WEEK	PLHT	PLUME HEIGHT	PODP	PEAK OZONE SEASON DAILY PROCESS RATE	DUE4	DEFAULT ESTIMATED EMISSIONS UNITS
				NOHY	NUMBER HOURS/YEAR					CLEE	CONTROL EFFICIENCY
										CLT1	PRIMARY CONTROL DEVICE CODE
										CTL2	SECONDARY CONTROL DEVICE CODE
										REP4	RULE EFFECTIVENESS
										DME4	METHOD CODE
										Emfa	Emission factor

Table 4.8-15. Bureau of Economic Analysis's SA-5 National Changes in Earnings by Industry

		Percent Growth from:			
Industry	**SIC**	**1985 to 1987**	**1987 to 1988**	**1988 to 1989**	**1989 to 1990**
Farm	01, 02	14.67	-2.73	14.58	-3.11
Agricultural services, forestry, fisheries, and other	07, 08, 09	23.58	5.43	1.01	2.48
Coal mining	11, 12	-17.46	-6.37	-4.16	4.73
Metal mining	10	-3.03	18.01	8.94	4.56
Nonmetallic minerals, except fuels	14	2.33	3.74	-2.79	-0.45
Construction	15, 16, 17	7.27	4.81	-1.36	-3.80

Table 4.8-16. Emission Estimates Available from AIRS/FS by State, Year, and Pollutant

State	1990						1991						1992						1993						1994						1995					
	C	N	S	P	T	V	C	N	S	P	T	V	C	N	S	P	T	V	C	N	S	P	T	V	C	N	S	P	T	V	C	N	S	P	T	V
Alabama	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Alaska	✓	✓	✓		✓	✓													✓	✓	✓		✓	✓	✓	✓	✓		✓	✓						
Arizona	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
California	✓	✓	✓	✓	✓	✓													✓						✓	✓		✓	✓	✓						
Colorado	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Connecticut	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓
Hawaii	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Illinois	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Louisiana	✓	✓	✓		✓	✓													✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓						
Michigan	✓	✓	✓	✓	✓	✓													✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓
Minnesota	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Montana	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Nebraska	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
Nevada	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
New Hampshire	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
New Mexico	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
North Dakota	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓
Oregon	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pennsylvania	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
South Carolina																			✓	✓	✓		✓	✓												
South Dakota		✓	✓	✓	✓	✓		✓	✓	✓		✓		✓	✓	✓		✓		✓	✓	✓		✓		✓	✓	✓		✓		✓	✓	✓		✓
Texas	✓	✓	✓	✓	✓	✓													✓	✓	✓	✓	✓	✓							✓	✓	✓	✓		✓
Utah	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓		✓	✓		✓	✓		✓	✓		✓
Vermont	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Virginia	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Washington	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Wisconsin	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
Wyoming	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes: C = CO N = NO_2 S = SO_2 P = PM-10 T = TSP V = VOC

Pennsylvania only includes Allegheny County (State 42, County 003); New Mexico only includes Albuquerque (State 35, County 001); Washington only includes Puget Sound (State 53, County 033, 053, or 061); Nebraska includes all except Omaha City (State 31, County 055); the CO emissions in NET were maintained for South Dakota (State 46).

Table 4.8-17. SEDS National Fuel Consumption, 1990-1996 (trillion Btu)

Fuel Type End-User	Code	1990	1991	1992	1993	1994	1995	1996
Population								
	TPOPP	248,709	252,131	255,025	257,785	259,693	261,602	263,510

Table 4.8-18. BEA SA-5 National Earnings by Industry, 1990-1996 (million $)

Industry	LNUM	SIC	1990	1991	1992	1993	1994	1995	1996
Farm	81	1, 2	48	41	46	45	42	31	29
Farm	82	1, 2	3,586	3,552	3,686	3,740	3,849	3,980	4,058
Farm	90	1, 2	3,001	2,957	3,079	3,126	3,228	3,353	3,423
Agricultural services, forestry, fisheries, and other	100	7-9	24	24	24	24	26	27	27
Agricultural services, forestry, fisheries, and other	110	7-9	20	20	21	22	23	24	25
Agricultural services, forestry, fisheries, and other	120	7-9	4	3	3	3	3	3	3
Agricultural services, forestry, fisheries, and other	121	7-9	1	1	1	0	1	1	1
Agricultural services, forestry, fisheries, and other	122	7-9	2	2	2	2	2	2	1
Agricultural services, forestry, fisheries, and other	123	7-9	1	1	1	1	1	1	1
Agricultural services, forestry, fisheries, and other	200	7-9	36	37	36	34	35	35	35
Nonmetallic minerals, except fuels	240	14	4	4	4	4	4	4	4
Construction	300	15-17	218	197	195	199	216	219	219
Construction	310	15-17	54	47	46	47	51	51	50
Construction	320	15-17	29	28	28	27	29	29	29
Construction	330	15-17	135	123	121	125	136	138	139
Primary metal industries	423	33	33	30	31	30	32	33	32
Transportation by air	542	45	30	30	31	31	31	31	31

Table 4.8-19. Area Source Listing by SCC and Growth Basis

SCC	SCC DESCRIPTION	FILE	CODE
2275000000	Mobile Sources Aircraft All Aircraft Types and Operations Total	BEA	542
2275001000	Mobile Sources Aircraft Military Aircraft Total	BEA	920
2275020000	Mobile Sources Aircraft Commercial Aircraft Total: All Types	BEA	542
2275020021	Mobile Sources Aircraft Commercial Aircraft	BEA	542
2275050000	Mobile Sources Aircraft General Aviation Total	BEA	542
2275060000	Mobile Sources Aircraft Air Taxi Total	BEA	542
2275070000	Mobile Sources Aircraft Aircraft Auxiliary Power Units Total	BEA	542
2275085000	Mobile Sources Aircraft Unpaved Airstrips Total	BEA	542
2275900000	Mobile Sources Aircraft Refueling: All Fuels All Processes	BEA	542
2275900101	Mobile Sources Aircraft Refueling: All Fuels Displacement Loss/Uncontrolled	BEA	542
2275900102	Mobile Sources Aircraft Refueling: All Fuels Displacement Loss/Controlled	BEA	542
2301000000	Industrial Processes Chemical Manufacturing: SIC 28 All Processes Total	BEA	471
2301010000	Industrial Processes Chemical Manufacturing: SIC 28 Industrial Inorganic Chemical Manufacturing Total	BEA	471
2301020000	Industrial Processes Chemical Manufacturing: SIC 28 Process Emissions from Synthetic Fibers Manuf (NAPAP cat. 107) Total	BEA	471
2301030000	Industrial Processes Chemical Manufacturing: SIC 28 Process Emissions from Pharmaceutical Manuf (NAPAP cat. 106) Total	BEA	471
2301040000	Industrial Processes Chemical Manufacturing: SIC 28 Fugitive Emissions from Synthetic Organic Chem Manuf (NAPAP cat. 102) Total	BEA	471
2801000005	Miscellaneous Area Sources Agriculture Production - Crops Agriculture - Crops Harvesting	BEA	100

4.9 BIOGENICS

This section explains EPA's methodologies for estimating volatile organic compounds (VOC) and nitric oxides (NO) from natural sources for the years 1988, 1990, 1991, 1995, 1996, and 1997. Biogenic emissions from natural sources are classified under SCC 2701000000 and the following Tier I and II categories:

Tier I Category	Tier II Category
(13) Natural Sources	(01) Biogenic

4.9.1 How are biogenic emissions estimated?

EPA calculated biogenic emissions for 1988, 1991, 1995, 1996 and 1997 using the Biogenic Emissions Inventory System-Version 2 (BEIS-2).[1,2,3] EPA used a slightly different version of BEIS-2 to generate the 1990 estimates, based on an interim version of processed land use data and spatial interpolation of meteorological data. BEIS-2 estimates VOC emissions from vegetation and NO emissions from soil. Biogenic VOC emissions are comprised of isoprene, monoterpenes, and other nonmethane hydrocarbons. BEIS-2 calculates VOC emissions for 75 tree genera, 17 agricultural crops, and urban grasses, and calculates emissions of NO_x as NO based on crop type and fertilizer use. The BEIS model continues to evolve and is expected to result in new versions of the model.

4.9.2 What factors affect biogenic emissions?

Biogenic emission estimates are strongly affected by differences in climatology and land use. The highest emission levels occur in the summer when temperatures rise the highest. An increase of 10 degrees Celsius (°C) can result in over a two-fold increase in both VOC and NO. Variations in land use can also greatly affect spatial variation in biogenic emissions densities. For example, higher densities of VOC in the southern United States and Missouri can be attributed to large areas of high-emitting oak trees, while high densities of NO in the midwestern United States are associated with areas of fertilized crop land.

4.9.3 What is the uncertainty associated with these estimates?

These estimates have an uncertainty factor of two. However, continuous improvements in these emission estimates are expected over the next few years.

4.9.4 References

1. Birth, T., "User's Guide to the PC Version of the Biogenic Emissions Inventory System (PC-BEIS2), "EPA-600/R-95-091, U.S. Environmental Protection Agency, Research Triangle Park, NC. 1995.

2. Geron, C., A. Guenther, and T. Pierce, "An Improved Model for Estimating Emissions of Volatile Organic Compounds from Forests in the Eastern United States," *Journal of Geophysical Research*, vol. 99, pp. 12773-12791. 1994.

3. Williams, E., A. Guenther, and F. Fehsenfeld, "An Inventory of Nitric Oxide Emissions from Soils in the United States," *Journal of Geophysical Research*, vol. 97, pp. 7511-7519. 1992.

SECTION 5.0
LEAD EMISSIONS METHODOLOGY

5.1 INTRODUCTION

The methodology used to estimate the lead emissions presented in the *Trends* reports for the years 1970 to 1996 was based on the 1940-1984 Methodology. This section describes, in detail, the procedures used to create these estimates.

5.1.1 Background

The lead emissions methodology was based on a "top-down" approach where national information was used to create a national inventory of lead emissions. The emissions were estimated based on the source of the emissions and, in the case of combustion sources, the fuel type. The national activity of a process producing lead emissions was measured by the consumption of fuel, the throughput of raw materials, or an alternative production indicator. An emission factor was then applied to activity data to determine the amount of lead emitted from a specific process. For some categories, the lead content of the fuel was incorporated into the estimating procedure as part of the emission factor. The final element used to estimate emissions was the control efficiency, which quantifies the amount of lead not emitted due to the presence of control devices.

The lead emissions were presented in the 1997 *Trends* report by Tier categories, but in the lead emissions methodology, emissions were estimated by a different set of source categories. The source categories or subcategories contributing to lead emissions were regrouped into the Tier categories. The estimation procedures are presented in this section by Tier II category. The correspondence between the Tier II categories and the lead emissions methodology source categories is presented in Table 5.1-1. Within the description of the procedures for each Tier II category, the correlation between the categories is reiterated.

5.1.2 General Procedure

Lead emissions were calculated according to Equation 5.1-1.

$$\textit{Lead Emissions}_{i,j} = A_{i,j} \times EF_{i,j} \times [1 - CE_{i,j}] \qquad \text{(Eq. 5.1-1)}$$

where:
- A = activity
- EF = emission factor
- CE = control efficiency
- I = year
- j = source category

As an aid in the calculation of emissions by the lead methodology, two Excel spreadsheets were created for each year and are collectively referred to as the *Trends* spreadsheets. The spreadsheets were

entitled TRENDSxx.XLS and MGTMPxx.XLS, where xx represents the year. The required data were entered into the TRENDSxx.XLS spreadsheet, after which the MGTMPxx.XLS spreadsheet was opened and the necessary calculations were made to estimate the national emissions. This procedure was designed to simplify the process of estimating emissions for a new year. By using the TRENDSxx.XLS spreadsheets from the previous year as templates, the spreadsheets for the new year were created by editing only the data requiring updating.

The calculations utilized within the TRENDSxx.XLS spreadsheets required specific units for the activity indicators and the emission factors. The required units are specified within the procedures for each Tier II category. In general, the units for activity indicators were short tons for solids, gallons for liquids, and cubic feet for gases. Emission factors were expressed in units of metric pounds of pollutant per unit consumption or throughput. Control efficiencies were expressed as a dimensionless decimal fraction. By using these units, the emissions calculated within the spreadsheets were expressed in metric tons. Raw data used as the basis for activity indicators or emission factors were often expressed in units which required conversion to the appropriate units. The following conversion factors were used in many cases.

1 ton (metric)	=	1.1023 tons (short)
1 ton (long)	=	1.1016 tons (short)
1 ton (short)	=	0.9072 tons (metric)
1 bbl	=	42 gal

The emission factors used to estimate lead emissions were based on the most recent information available. For many categories, the most recent emission factor was used to estimate the emissions for all years.

When the emissions were estimated for 1996, not all of the activity information was available. In order to make a preliminary emissions estimate, activity data from preceding years were used to estimate the activity data for 1996. This was done using several different methods. The first method used a quadratic equation and the past 20 years of activity data. Data for 1976-1995 were used, and the previous ten year's data (1986-1995) was repeated. The second method used a linear regression and the past 7 years of activity data. Data from 1989-1995 were used, 1993-1995 data were repeated, and the 1995 data were repeated a third time. The third method, used in cases where the first method resulted in a negative activity value, calculated the average of the activity data over the past 5 years. Table 5.1-2 presents by general source category the method used to estimate activity data for generating 1996 emissions. For general source categories not listed, activity data for the current year were available at the time the emissions were estimated.

5.1.3 Organization of Procedures

The methodology used to estimate lead emissions is described by Tier II category except for the On-road vehicles category which is described at the Tier I level. For each category, the procedure is divided into four sections, reflecting the data required to generate the estimates: (1) technical approach, (2) activity indicator, (3) emission factor, and (4) control efficiency. The procedures for obtaining activity indicators, emission factors or control efficiencies are arranged in a variety of ways, depending on the

specific requirements of the category. The procedures could be arranged by process, fuel type, or other subcategory.

References are provided at the end of the description of the procedure for each Tier II category. Many of the references are published annually as part of a series. In some cases, several references are provided for the same information, reflecting a change or discontinuation of one source and its replacement by another. The specific source used would depend on the specific year for which information is needed. All tables and supporting data immediately follow the description of the procedure for each Tier II category.

Table 5.1-1. Correspondence Between Tier II Categories and Lead Emissions Methodology Categories

Tier I Category	Tier II Category	Tier I/Tier II Code	Lead Emissions Methodology Category	Lead Emissions Methodology Subcategory
Fuel Combustion - Electric Utility	Coal	01-01	Bituminous Coal and Lignite	Electric Utility
			Anthracite Coal	Electric Utility
	Oil	01-02	Residual Oil	Electric Utility
			Distillate Oil	Electric Utility
Fuel Combustion - Industrial	Coal	02-01	Bituminous Coal and Lignite	Industrial
			Anthracite Coal	Industrial
	Oil	02-02	Residual Oil	Industrial
			Distillate Oil	Industrial
Fuel Combustion - Other	Commercial and Institutional Coal	03-01	Bituminous Coal and Lignite	Commercial and Institutional
			Anthracite Coal	Commercial and Institutional
	Commercial and Institutional Oil	03-02	Residual Oil	Commercial and Institutional
			Distillate Oil	Commercial and Institutional
	Miscellaneous Fuel Combustion (except residential)	03-04	Residual Oil	Waste Oil
	Residential Other	03-06	Bituminous Coal and Lignite	Residential
			Anthracite Coal	Residential
			Residual Oil	Residential
			Distillate Oil	Residential

Table 5.1-1 (continued)

Tier I Category	Tier II Category	Tier I/Tier II Code	Lead Emissions Methodology Category	Lead Emissions Methodology Subcategory
Chemical and Allied Product Manufacture	Inorganic Chemical Manufacturing	04-02	Industrial Processes	Secondary Metals (lead oxide/pigment)
Metals Processing	Nonferrous	05-01	Industrial Processes	Nonferrous Metals (copper, zinc, and lead production) Secondary Metals (lead, copper, and battery production) Miscellaneous Process Sources [miscellaneous products (can soldering and cable covering)]
	Ferrous	05-02	Industrial Processes	Iron and Steel Industry Nonferrous Metals (ferroalloy production) Secondary Metals Industry (grey iron foundries)
	Not Elsewhere Classified	05-03	Industrial Processes	Mineral Products (ore crushing) Miscellaneous Process Sources [miscellaneous products (type metal production)]
Other Industrial Processes	Mineral Products	07-05	Industrial Processes	Mineral Products (cement manufacturing and glass production, lead-glass)
	Miscellaneous Industrial Processes	07-10	Industrial Processes	Miscellaneous Process Sources (lead alkyl production - electrolytic process, sodium lead alloy, and miscellaneous products (ammunition)]
Waste Disposal and Recycling	Incineration	10-01	Solid Waste Disposal	Incineration
On-road vehicles	All Categories (Light-Duty Gas Vehicles and Motorcycles, Light-Duty Gas Trucks, and Heavy-Duty Gas Vehicles)	11	On-road vehicles	Gasoline (leaded and unleaded)
Non-road engines and vehicles	Nonroad Gasoline	12-01	Other Non-road engines and vehicles	Gasoline Gasoline
	Aircraft	12-03	Vessels Aircraft	Aviation Gasoline

Table 5.1-2. Method Used for Estimating 1996 Activity Data

General Source Category	Activity Data Estimation Method
Non-road engines and vehicles	Quadratic equation method
All Anthracite Coal Categories	Linear regression method
Fuel Combustion, excluding Electric Utility	
Bituminous Coal	Linear regression method
Residual Oil	Quadratic equation method
Distillate Oil	Linear regression method
Solid Waste	Quadratic equation method
Industrial Process Sources	Linear regression method

5.2 FUEL COMBUSTION ELECTRIC UTILITY - COAL: 01-01

The emissions for this Tier II category were determined by the Lead Emissions Methodology for the following source categories (See Table 5.1-1 for Tier correspondence):

Category:	**Subcategory:**
Bituminous Coal and Lignite	Electric Utility
Anthracite Coal	Electric Utility

5.2.1 Technical Approach

The lead emissions included in this Tier category were the sum of the emissions from the source categories listed above. Emissions were estimated from an activity indicator and an emissions factor. In order to utilize these values in the *Trends* spreadsheets, activity indicators were expressed in million short tons for bituminous coal, and in thousand short tons for anthracite coal. Emission factors were expressed in metric pounds/thousand short tons.

The following procedures for determining activity indicators and emission factors were used for the years 1970 through 1995.

5.2.2 Activity Indicator

The activity indicator for the combustion of coal at electric Utility was the anthracite coal receipts at electric Utility obtained from Reference 1a or 1b.

The activity indicator for the combustion of bituminous coal and lignite was calculated as the difference between the total national consumption of coal by electric Utility and the anthracite coal consumption at electric Utility as determined above. The total national consumption of coal was obtained from Reference 2a or Reference 3.

5.2.3 Emission Factor

The emission factors for the combustion of anthracite coal and of bituminous coal and lignite were obtained from Reference 4a.

5.2.4 Control Efficiency

No control efficiencies were applied to activity data to estimate emissions from the sources included in this Tier II category.

5.2.5 References

1. *Cost and Quality of Fuels for Electric Utility Plants.* DOE/EIA-0191(xx). Energy Information Administration, U.S. Department of Energy, Washington, DC. Annual.
   a. Appendix A
   b. Table entitled, "Receipts and Average Delivered Cost of Coal By Rank, Census Division, and state, 19xx."

2. *Electric Power Annual.* DOE/EOA-0348(xx). Energy Information Administration, U.S. Department of Energy, Washington, DC. Annual.
   a. Volume I. Table entitled, "Consumption of Fossil Fuels and End-year Stocks of Coal and Petroleum at U.S. Utility."

3. *Quarterly Coal Report: January - March.* DOE/EIA-0121(xx/1Q). Energy Information Administration, U.S. Department of Energy, Washington, DC. Quarterly.

4. *Compilation of Air Pollutant Emission Factors, Third Edition, Supplements 1 through 14, AP-42*. NTIS PB-275525. U.S. Environmental Protection Agency, Research Triangle Park, NC. September 1977.
   a. Appendix E

5.3 FUEL COMBUSTION ELECTRIC UTILITY - OIL: 01-02

The emissions for this Tier II category were determined by the Lead Emissions Methodology for the following source categories (see table 5.1-1 for Tier correspondence):

Category:	Subcategory:
Residual Oil	Electric Utility
Distillate Oil	Electric Utility

5.3.1 Technical Approach

The lead emissions included in this Tier category were the sum of the emissions from the source categories listed above. Emissions were estimated from an activity indicator and an emissions factor. In order to utilize these values in the *Trends* spreadsheets, activity indicators were expressed in million gallons and emission factors were expressed in metric pounds/million gallons.

The following procedures for determining activity indicators and emission factors were used for the years 1970 through 1995.

5.3.2 Activity Indicators

The activity indicators for the combustion of residual and distillate oils were the consumption of these fuel types by electric Utility. The distillate oil consumption was assumed to be equal to the "adjusted" distillate fuel oil sales to electric Utility obtained from Reference 1a or Reference 2. The residual fuel oil consumption was obtained from "adjusted" residual fuel sales in Reference 1a. When this reference was unavailable, the residual oil consumption was calculated as the difference between the total oil consumption and the distillate oil consumption. The total annual oil consumption was obtained from Reference 3.

5.3.3 Emission Factors

The emission factors for the combustion of residual oil and of distillate oil by electric Utility were obtained from Reference 4a.

5.3.4 Control Efficiency

No control efficiencies were applied to activity data to estimate emissions from the sources included in this Tier II category.

5.3.5 References

1. *Fuel Oil and Kerosene Sales 19xx.* DOE/EIA-0535(xx). Energy Information Administration, U.S. Department of Energy, Washington, DC. Annual.
   a. Table entitled, "Adjusted Sales of Distillate Fuel Oil By End Use in the U.S."
   b. Table entitled, "Adjusted Sales of Residual Fuel Oil By End Use in the U.S."

2. *Petroleum Marketing Annual.* DOE/EIA-0389(xx/07). Energy Information Administration, U.S. Department of Energy, Washington, DC. Annual.

3. *Electric Power Annual.* DOE/EOA-0348(xx). Energy Information Administration, U.S. Department of Energy, Washington, DC. Annual.

4. *Compilation of Air Pollutant Emission Factors, Third Edition, Supplements 1 through 14, AP-42*. NTIS PB-275525. U.S. Environmental Protection Agency, Research Triangle Park, NC. September 1977.
   a. Appendix E

5.4 FUEL COMBUSTION INDUSTRIAL - COAL: 02-01

The emissions for this Tier II category were determined by the Lead Emissions Methodology for the following source categories (see table 5.1-1 for Tier correspondence):

Category:	Subcategory:
Anthracite Coal	Industrial
Bituminous Coal and Lignite	Industrial

5.4.1 Technical Approach

The lead emissions included in this Tier category were the sum of the emissions from the source categories listed above. Emissions were estimated from an activity indicator and an emissions factor. In order to utilize these values in the *Trends* spreadsheets, the activity indicators were expressed in million short tons for bituminous coal, and in thousand short tons for anthracite coal. The emission factors were expressed in metric pounds/thousand short tons.

The following procedures for determining activity indicators and emission factors were used for the years 1970 through 1995.

5.4.2 Activity Indicator

The activity indicator for the industrial combustion of anthracite coal was the distribution of anthracite coal from Pennsylvania (i.e. District 24) obtained from Reference 1a under the category "Industrial Plants (except coke)."

The activity indicator for the combustion of bituminous coal and lignite was based on total national coal consumption obtained from Reference 2a under the category "Industrial Plants (except coke)." The sum of coal consumption by cement plants and lime plants was subtracted from the total coal consumption. The coal consumption by cement plants was obtained from Reference 3 or Reference 4a. The coal consumption by lime plants was estimated by multiplying the lime production value obtained from Reference 5 by the conversion factor, 0.1 tons coal/ton lime produced. If Reference 4 was unavailable, the previous year's data was used.

5.4.3 Emission Factors

The emission factors for the industrial combustion of anthracite coal and of bituminous coal and lignite were obtained from Reference 6a.

5.4.4 Control Efficiency

No control efficiencies were applied to activity data to estimate emissions from the sources included in this Tier II category.

5.4.5 References

1. *Coal Distribution January-December 19xx.* DOE/EIA-0125(xx/4Q). Energy Information Administration, U.S. Department of Energy, Washington, DC. Annual.
   a. Table entitled, "Domestic Distribution of U.S. Coal by Origin, Destination, and Consumer: January-December 19xx."

2. *Quarterly Coal Report: January - March.* DOE/EIA-0121(xx/1Q). Energy Information Administration, U.S. Department of Energy, Washington, DC. Quarterly.
   a. Table entitled, "U.S. Coal Receipts By End-Use Sector"

3. *Minerals Industry Surveys*, Cement. Bureau of Mines, U.S. Geological Survey, Washington, DC. Monthly.

4. Minerals Yearbook, Cement. US Geological Survey (formerly Bureau of Mines), Washington, DC. Annual
   a. Table entitled, "Clinker Produced and Fuel Consumed by the Portland Cement Industry the U.S. by process."

5. *Chemical and Engineering News, Facts and Figures Issue.* American Chemical Society, Washington, DC. Annual.

6. *Compilation of Air Pollutant Emission Factors, Third Edition, Supplements 1 through 14, AP-42*. NTIS PB-275525. U.S. Environmental Protection Agency, Research Triangle Park, NC. September 1977.
   a. Appendix E

5.5 FUEL COMBUSTION INDUSTRIAL - OIL: 02-02

The emissions for this Tier II category were determined by the Lead Emissions Methodology for the following source categories (see table 5.1-1 for Tier correspondence):

Category:	Subcategory:
Residual Oil	Industrial
Distillate Oil	Industrial

5.5.1 Technical Approach

The lead emissions included in this Tier category were the sum of the emissions from the source categories listed above. Emissions were estimated from an activity indicator and an emissions factor. In order to utilize these values in the *Trends* spreadsheets, activity indicators were expressed in million gallons and emission factors were expressed in metric pounds/million gallons.

The following procedures for determining activity indicators and emission factors were used for the years 1970 through 1995.

5.5.2 Activity Indicator

The activity indicator for industrial combustion of residual oil was based on the adjusted quantity of residual oil sales for industrial and oil company use obtained from Reference 1 or 2a. The total of three statistics was subtracted from this value to obtain the activity indicator. The first statistic was two-thirds of the quantity of oil consumed by cement plants reported in Reference 3 or 4a. The second statistic was the quantity of residual oil consumed by petroleum refineries reported in Reference 5a. The third statistic was the quantity of residual oil consumed by steel mills; this value was calculated by multiplying the quantity of raw steel production obtained from Reference 6a or 7, by $0.00738 * 10^6$ gal/10^3 ton steel. The conversion factor between the gallons of oil and the tons of steel was updated in 1982 based on Reference 8.

The activity indicator for industrial combustion of distillate oil was based on the adjusted quantity of distillate oil sales to industrial and oil companies obtained from Reference 1 or 2a. The total of two statistics was subtracted from this value to obtain the activity indicator for distillate oil. The first statistic was one-third of the quantity of oil consumed by cement plants, expressed in gallons, reported in Reference 3 or 4a. The second statistic was the quantity of distillate oil consumed by petroleum refineries, expressed in gallons, reported in Reference 5a or 5b.

5.5.3 Emission Factor

The lead emission factor for the industrial combustion of residual oil and of distillate oil were obtained from Reference 9a.

5.5.4 Control Efficiency

No control efficiencies were applied to activity data to estimate emissions from the sources included in this Tier II category.

5.5.5 References

1. *Petroleum Marketing Monthly.* DOE/EIA-0380(xx/01). Energy Information Administration, U.S. Department of Energy, Washington, DC. Annual.

2. *Fuel Oil and Kerosene Sales 19xx.* DOE/EIA-0535(xx). Energy Information Administration, U.S. Department of Energy, Washington, DC. Annual.
   a. Table entitled, "Adjusted Sales of Residual Fuel Oil by End-Use in the U.S."

3. *Minerals Industry Surveys*, Cement. Bureau of Mines, U.S. Department of the Interior, Washington, DC. Monthly.
   a. Table entitled, "Clinker Produced and Fuel Consumed by the Portland Cement Industry in the U.S. By Process."

4. Minerals Yearbook, Cement. US Geological Survey (formerly Bureau of Mines), Washington, DC. Annual
   a. Table entitled, "Clinker Produced and Fuel Consumed by the Portland Cement Industry in the U.S. By Process."

5. *Petroleum Supply Annual.* DOE/EIA-0340(xx/07). Energy Information Administration, U.S. Department of Energy, Washington, DC. Annual.
   a. Table entitled, "Fuel Consumed at Refineries by PAD District."
   b. Table entitled, "Refinery Fuel Use and Losses by PAD District."

6. *Survey of Current Business*. Bureau of Economic Analysis, U.S. Department of Commerce, Washington, DC.
   a. Table containing information on metals and manufactures.

7. Mineral Industry Surveys. Iron and Steel. US Geological Survey (formerly Bureau of Mines).
   a. Table entitled, "Salient Iron and Steel Statistics."

8. *Census of Manufactures (Fuels and Electric Energy Consumed).* Bureau of the Census, U.S. Department of Commerce, Washington, DC. 1982.

9. *Compilation of Air Pollutant Emission Factors, Third Edition, Supplements 1 through 14, AP-42.* NTIS PB-275525. U.S. Environmental Protection Agency, Research Triangle Park, NC. September 1977.
   a. Appendix E

5.6 FUEL COMBUSTION OTHER - COMMERCIAL/INSTITUTIONAL COAL: 03-01

The emissions for this Tier II category were determined by the Lead Emissions Methodology for the following source categories (see table 5.1-1 for Tier correspondence):

Category:	**Subcategory:**
Anthracite Coal	Commercial / Institutional
Bituminous Coal and Lignite	Commercial / Institutional

5.6.1 Technical Approach

The lead emissions included in this Tier category were the sum of the emissions from the source categories listed above. Emissions were estimated from an activity indicator and an emissions factor. In order to utilize these values in the *Trends* spreadsheets, the activity indicators were expressed in million short tons for bituminous coal, and in thousand short tons for anthracite coal. The emission factors were expressed in metric pounds/thousand short tons.

The following procedures for determining activity indicators and emission factors were used for the years 1970 through 1995.

5.6.2 Activity Indicator

The activity indicators for the combustion of anthracite and bituminous coal and lignite were the consumption of each coal type by commercial and institutional users. Determination of these activity indicators required activity data for both anthracite and bituminous residential coal combustion.

The commercial/institutional consumption of anthracite coal was obtained by subtracting the residential anthracite consumption from residential and commercial/institutional anthracite consumption. Residential and commercial/institutional consumption of anthracite coal was obtained from Reference 1a for District 24 only. This calculation is shown in Equation 5.6-1.

$$Anthracite\ Coal_{C/I} = Anthracite\ Coal_{R\ and\ C/I} - Anthracite\ Coal_{R} \qquad \text{(Eq. 5.6-1)}$$

where: R = residential consumption
C / I = commercial/institutional consumption

Residential consumption of anthracite coal was determined by extrapolating the consumption of the previous year based on the change in the number of dwelling units in the Northeastern United States having coal as the main fuel for space heating. Data concerning the number of dwelling units were obtained from Reference 2. The calculation of the residential anthracite coal consumption is summarized in Equation 5.6-2.

$$Anthracite\ Coal_{R,\,i} = Anthracite\ Coal_{R,\,i-1} \times \frac{Dwelling\ Units_i}{Dwelling\ Units_{i-1}} \qquad \text{(Eq. 5.6-2)}$$

where: R = residential consumption
I = year under study

Commercial/institutional consumption of bituminous coal was obtained by subtracting the residential bituminous consumption from the residential and commercial/institutional bituminous consumption. Residential and commercial/institutional consumption of bituminous coal was calculated by subtracting residential and commercial/institutional consumption of anthracite coal from residential and commercial/institutional consumption of all types of coal. These two consumption values were obtained from Reference 1a and excluded coal from District 24 which represents anthracite coal consumption. This calculation is summarized in Equation 5.6-3.

$$Bituminous\ Coal_{C/I} = (All\ Coal_{R\ and\ C/I} - Anthracite\ Coal_{R\ and\ C/I}) - Bituminous\ Coal_R \qquad \text{(Eq. 5.6-3)}$$

where: R = residential consumption
C / I = commercial/institutional consumption

The residential consumption of bituminous coal was determined by estimating the quantity of all coal consumed by all dwelling units using coal as the main fuel and subtracting from this value the residential consumption of anthracite coal calculated above. The quantity of all coal consumed was calculated using the number of dwelling units using coal as the main fuel for space heating obtained from Reference 2 and a factor estimating the average annual consumption of coal per dwelling unit. This calculation is summarized in Equation 5.6-4.

$$Bituminous\ Coal_R = (Dwelling\ Units \times 6.73\ tons\ burned/dwelling/year) - Anthracite\ Coal_R \qquad \text{(Eq. 5.6-4)}$$

where: R = residential consumption

5.6.3 Emission Factors

The emission factors for the commercial/institutional combustion of anthracite coal and of bituminous coal and lignite were obtained from Reference 3a.

5.6.4 Control Efficiency

No control efficiencies were applied to activity data to estimate emissions from the sources included in this Tier II category.

5.6.5 References

1. *Coal Distribution January-December 19xx.* DOE/EIA-0125(xx/4Q). Energy Information Administration, U.S. Department of Energy, Washington, DC. Annual.
   a. Table entitled, "Domestic Distribution of U.S. Coal to the Residential and Commercial Sector by Origin."

2. *American Housing Survey, Current Housing Reports, Series H-150-83*. Bureau of the Census, U.S. Department of Commerce, Washington DC. Biennial.

3. *Compilation of Air Pollutant Emission Factors, Third Edition, Supplements 1 through 14, AP-42*. NTIS PB-275525. U.S. Environmental Protection Agency, Research Triangle Park, NC. September 1977.
   a. Appendix E

5.7 FUEL COMBUSTION OTHER - COMMERCIAL/INSTITUTIONAL OIL: 03-02

The emissions for this Tier II category were determined by the Lead Emissions Methodology for the following source categories (see table 5.1-1 for Tier correspondence):

Category:	**Subcategory:**
Residual Oil	Commercial / Institutional
Distillate Oil	Commercial / Institutional

5.7.1 Technical Approach

The lead emissions included in this Tier category were the sum of the emissions from the source categories listed above. Emissions were estimated from an activity indicator and an emissions factor. In order to utilize these values in the *Trends* spreadsheets, activity indicators were expressed in million gallons and emission factors were expressed in metric pounds/million gallons.

The following procedures for determining activity indicators and emission factors were used for the years 1970 through 1995.

5.7.2 Activity Indicator

The activity indicator for the commercial/institutional combustion of residual oil was the "adjusted" total quantity of residual oil sales for commercial and military use obtained from Reference 1 or Reference 2a.

The activity indicator for the combustion of distillate oil was the "adjusted" total quantity of distillate oil sales for commercial and military use (not including military diesel fuel) obtained from Reference 1, or commercial and military use obtained from Reference 2b minus military diesel fuel use obtained from Reference 2c.

5.7.3 Emission Factor

The emission factors for the commercial/institutional combustion of residual oil and of distillate oil were obtained from Reference 3a.

5.7.4 Control Efficiency

No control efficiencies were applied to activity data to estimate emissions from the sources included in this Tier II category.

5.7.5 References

1. *Petroleum Marketing Monthly*. DOE/EIA-0380(xx/01). Energy Information Administration, U.S. Department of Energy, Washington, DC. Annual.

2. *Fuel Oil and Kerosene Sales 19xx*. DOE/EIA-0535(xx). Energy Information Administration, U.S. Department of Energy, Washington, DC. Annual.
   a. Table entitled, "Adjusted Sales of Residual Fuel Oil by End Use in the US."
   b. Table entitled, "Adjusted Sales of Distillate Fuel Oil by End Use in the US."
   c. Table entitled, "Adjusted Sales for Military, Non-road engines and vehicles, and All Other Uses: Distillate Fuel Oil, Residual Fuel Oil and Kerosene."

3. *Compilation of Air Pollutant Emission Factors, Third Edition, Supplements 1 through 14, AP-42*. NTIS PB-275525. U.S. Environmental Protection Agency, Research Triangle Park, NC. September 1977.
   a. Appendix E

5.8 FUEL COMBUSTION OTHER - MISCELLANEOUS FUEL COMBUSTION (EXCEPT RESIDENTIAL): 03-04

The emissions for this Tier II category were determined by the Lead Emissions Methodology for the following source categories (see table 5.1-1 for Tier correspondence):

Category:	**Subcategory:**
Residual Oil	Waste Oil

5.8.1 Technical Approach

The lead emissions included in this Tier category were the sum of the emissions from the source categories listed above. Emissions were estimated from an activity indicator and an emissions factor. In order to utilize these values in the *Trend*s spreadsheets, the activity indicator was expressed in million gallons and the emission factor was expressed in metric pounds/million gallons.

The following procedures for determining activity indicators and emission factors were used for the years 1970 through 1996.

5.8.2 Activity Indicator

The activity indicator for the combustion of residual waste oil was assumed to be a constant annual consumption of 500 x 10^6 gallons of waste oil.

5.8.3 Emission Factor

The emission factor for the combustion of residual waste oil was calculated as 75 lb/1,000 gal multiplied by the average percentage of lead. It was assumed that the percentage of lead had a constant value of 0.5333 up to the year 1975; after which, it was assumed that the lead percentage steadily decreased. After 1984, the value has remained constant at 0.0213. The average lead percentage values are presented in Table 5.8-1.

5.8.4 Control Efficiency

No control efficiency was applied to activity data to estimate lead emissions from the combustion of waste oil.

5.8.5 References

None.

Table 5.8-1. Annual Percentage Lead Content

Year	Percent Lead
1975	0.5333
1976	0.4702
1977	0.407
1978	0.3439
1979	0.2807
1980	0.2176
1981	0.1545
1982	0.0913
1983	0.0282
1984	0.0213

5.9 FUEL COMBUSTION OTHER - RESIDENTIAL OTHER: 03-06

The emissions for this Tier II category were determined by the Lead Emissions Methodology for the following source categories (see table 5.1-1 for Tier correspondence):

Category:	**Subcategory:**
Anthracite Coal	Residential
Bituminous Coal and Lignite	Residential
Residual Oil	Residential
Distillate Oil	Residential

5.9.1 Technical Approach

The lead emissions included in this Tier category were the sum of the emissions from the source categories listed above. Emissions were estimated from an activity indicator and an emissions factor. In order to utilize these values in the *Trend*s spreadsheets, the activity indicators were expressed in million tons for bituminous coal and in thousand tons for anthracite coal. The emission factors for these categories were expressed in metric pounds/thousand tons. Activity indicators for residual and distillate oils were expressed in million gallons and emission factors were expressed in metric pounds/million gallons.

The following procedures for determining activity indicators and emission factors were used for the years 1970 through 1995.

5.9.2 Activity Indicator

The activity indicator for the residential combustion of anthracite coal was the residential consumption of anthracite coal. This value was determined by extrapolating the residential consumption of anthracite coal during the previous year based on the change in the number of dwelling units in the Northeastern United States having coal as the main fuel for space heating. Data concerning the number of dwelling units were obtained from Reference 1. The calculation of the residential anthracite coal consumption is summarized in Equation 5.9-1.

$$Anthracite\ Coal_{R,\,i} = Anthracite\ Coal_{R,\,i-1} \times \frac{Dwelling\ Units_i}{Dwelling\ Units_{i-1}} \qquad \text{(Eq. 5.9-1)}$$

where: R = residential consumption
I = year under study

The activity indicator for the combustion of bituminous coal and lignite was the residential consumption of bituminous coal and lignite. This value was determined by estimating the quantity of all coal consumed by all dwelling units using coal as the main fuel and subtracting from this value the

residential consumption of anthracite coal calculated above. The quantity of all coal consumed was calculated using the number of dwelling units using coal as the main fuel for space heating obtained from Reference 1 and a factor estimating the average annual consumption of coal per dwelling unit. This calculation is summarized in Equation 5.9-2.

$$\textit{Bituminous Coal}_R = (\textit{Dwelling Units} \times 6.73\ \textit{tons burned/dwelling/year}) - \textit{Anthracite Coal}_R \qquad \text{(Eq. 5.9-2)}$$

where: R = residential consumption

The activity indicator for the residential combustion of residual oil was assumed to be zero. The activity indicator for the combustion of distillate oil was the sum of the "adjusted" sales (or deliveries) for residential use of distillate oil and for farm use of other distillates as reported in Reference 2 or Reference 3a and 3b.

5.9.3 Emission Factors

The emission factor for the residential combustion of anthracite coal was obtained from Reference 4.

The emission factor for the combustion of bituminous coal and lignite and for distillate oil was obtained from Reference 5a.

No emission factor was required for the combustion of residual oil because the activity was assumed to be zero.

5.9.4 Control Efficiency

No control efficiencies were applied to activity data to estimate emissions from the sources included in this Tier II category.

5.9.5 References

1. *American Housing Survey, Current Housing Reports, Series H-150-83*. Bureau of the Census, U.S. Department of Commerce, Washington DC. Biennial.

2. *Petroleum Marketing Monthly*. DOE/EIA-0380(xx/01). Energy Information Administration, U.S. Department of Energy, Washington, DC. Annual.

3. *Fuel Oil and Kerosene Sales 19xx*. DOE/EIA-0535(xx). Energy Information Administration, U.S. Department of Energy, Washington, DC. Annual.
   a. Table entitled, "Adjusted Sales of Distillate Fuel Oil by End Use in the U.S."
   b. Table entitled, "Adjusted Sales for Gram Use: Distillate Fuel Oil and Kerosene; Sales for Electric Utility and Oil Company Uses; Distillate Fuel Oil and Residual Fuel Oil."

4. *Development of HATREMS Data Base and Emission Inventory Evaluation*. EPA-450/3-77-011. U.S. Environmental Protection Agency, Research Triangle Park, NC. April 1977.

5. *Compilation of Air Pollutant Emission Factors, Third Edition, Supplements 1 through 14, AP-42*. NTIS PB-275525. U.S. Environmental Protection Agency, Research Triangle Park, NC. September 1977.
   a. Appendix E

5.10 CHEMICAL AND ALLIED PRODUCT MANUFACTURE - INORGANIC CHEMICAL MANUFACTURE: 04-02

The emissions for this Tier II category were determined by the Lead Emissions Methodology for the following source categories (see table 5.1-1 for Tier correspondence):

Category:	**Subcategory:**
Industrial Processes - Lead Emissions	Secondary Metals (lead oxide/pigment)

5.10.1 Technical Approach

The lead emissions included in this Tier category were the sum of the emissions from the source categories listed above. Emissions were estimated from an activity indicator and an emissions factor. In order to utilize these values in the *Trend*s spreadsheets, activity indicators were expressed in thousand tons and emission factors were expressed in metric pounds/tons.

The following procedures for determining activity indicators and emission factors were used for the years 1970 through 1995.

5.10.2 Activity Indicator

Activity indicators for the of barton pot (litharge and leady oxide), red lead, and white lead were the respective quantities of each produced (using the lead content) as reported in Reference 1. If the litharge and red lead are reported together, the last known distribution was used to distribute the activity. If the value for white lead was withheld, the previous year's data was used.

5.10.3 Emission Factor

The lead emission factors for barton pot, red lead, and white lead were obtained from Reference 2a.

5.10.4 Control Efficiency

No control efficiencies were applied to activity data to estimate lead emissions from the sources included in this Tier II category.

5.10.5 References

1. *Minerals Yearbook*, Lead. US Geological Survey (formerly Bureau of Mines), Washington, DC. Annual.
   a. Table entitled, "Production & Shipments of Lead Pigments and Oxides in the U.S."

2. *Compilation of Air Pollutant Emission Factors, Fourth Edition, Supplements A through D, AP-42*. U.S. Environmental Protection Agency, Research Triangle Park, NC. September 1991.
   a. Table 7.16-1

5.11 METALS PROCESSING - NONFERROUS: 05-01

The emissions for this Tier II category were determined by the Lead Emissions Methodology for the following source categories (see table 5.1-1 for Tier correspondence):

Category:	Subcategory:
Industrial Processes - Lead Emissions	Nonferrous Metals (copper, zinc, and lead production)
	Secondary Metals (lead, copper, and battery production)
	Miscellaneous Process Sources [miscellaneous products (can soldering and cable covering)]

5.11.1 Technical Approach

The lead emissions included in this Tier category were the sum of the emissions from the source categories listed above. Emissions were estimated from an activity indicator, emissions factor, and control efficiency, where applicable. In order to utilize these values in the *Trend*s spreadsheets, activity indicators were expressed in thousand tons and emission factors were expressed in metric pounds/tons. All control efficiencies were expressed as dimensionless fractions.

The following procedures for determining activity indicators, emission factors, and applicable control efficiencies were used for the years 1970 through 1995.

5.11.2 Activity Indicator

5.11.2.1 Nonferrous Metals

The activity indicator for copper roasting was based on the primary copper smelter production from domestic and foreign ores from Reference 1a. Copper smelter production was expressed in units of blister copper produced. It was assumed that of the 4 tons of copper concentrate/ton of blister, only half was roasted. Therefore, the amount of blister copper produced multiplied by 2 resulted in the activity indicator for the roasting process.

Activity indicators for copper smelting and converting were assumed to be equivalent. Activity data were calculated in the same manner as for the roasting process, except it was assumed that all of the blister copper produced was smelted and converted. Therefore, units of blister copper produced multiplied by 4 resulted in the activity indicators for the smelting and converting process.

Activity data for zinc sintering was based on the redistilled slab zinc production obtained from Reference 2a. The activity indicator for the horizontal retort process was assumed to be zero. The activity indicator for the vertical retort process was assigned the same value as used for zinc sintering.

The activity indicators for lead sintering, blast furnaces, and reverberatory furnaces were assumed to be equal to the primary refined lead production from domestic and foreign ores as listed in Reference 3.

5.11.2.2 Secondary Metals

Activity data for three copper-producing processes were obtained from Reference 1b. The production level of high-leaded tin bronze was used as the basis for high Lead (58%) activity. The production level of yellow brass was used as the basis for red-yellow brass (15%) activity. Other alloys (7%) activity was based on the production level of leaded red brass and semi-red brass.

Activity indicators for three lead-producing furnace types and fugitive lead processes were obtained from Reference 3 or 4a. The pot furnace activity was estimated as 90 percent of the total consumption of lead scrap by all consumers obtained from Reference 4a. The activity indicator for reverberatory furnaces was estimated by multiplying the total consumption of lead scrap by the ratio between the quantity of lead recovered as soft lead (obtained from Reference 3b) and the total lead recovered from scrap. The activity indicator for blast furnaces was estimated by multiplying the total consumption of lead scrap by the ratio between lead recovered as antimonial lead and the total lead recovered from scrap. Fugitive lead activity was assumed to be equal to the total quantity of lead recovered.

Battery production consists of five processes: (1) grid casting, (2) paste mixing, (3) lead oxide mill, (4) three process operations, and (5) lead reclamation furnace. The number of batteries produced was used as the activity indicator for each process. The total weight of lead used to produce storage batteries was obtained from Reference 3c. This value was converted from metric tons to English units and was used to calculate the number of batteries produced, expressed in thousands of batteries, as shown in Equation 5.11-1.

$$\textit{Number of Batteries} = \frac{\textit{Weight}_{Pb} \times 1.10231 \times 2{,}000\ \textit{lb/ton}}{1{,}000 \times 26\ \textit{lb/battery}} \qquad \text{(Eq. 5.11-1)}$$

The activity indicator for lead reclamation furnaces was 1 percent of the number of batteries produced as calculated above.

5.11.2.3 Miscellaneous Process Sources

The activity indicator for can soldering was the can soldering consumption as listed in Reference 3c. If this activity indicator was not available, the previous year's value was used. The activity indicator for cable covering was based on the value for cable covering consumption, also obtained from Reference 3c, which was multiplied by 10 to account for recycling.

5.11.3 Emission Factor

5.11.3.1 Nonferrous Metals

The emission factors for primary copper and lead smelting processes were obtained from References 5a and 5b, respectively. The emission factors for processes associated with primary zinc smelting were obtained from Reference 6a. Values for these emission factors were established as the midpoint of the emission factor ranges reported in the references cited.

5.11.3.2 Secondary Metals

The emission factors for secondary lead processing were obtained from Reference 6a. The emission factors for secondary copper processing were obtained from Reference 5c. Battery production emission factors were reported in Reference 5d.

5.11.3.3 Miscellaneous Process Sources

The emission factors for can soldering and can covering were obtained from Reference 5e.

5.11.4 Control Efficiency

5.11.4.1 Nonferrous Metals

The control efficiencies for all copper, zinc, and lead production processes for the years 1970 through 1984 were equivalent to the TSP control efficiencies for the same processes. The TSP control efficiencies were derived from Reference 7 or Reference 8 using Equation 5.11-2. Values for the control efficiency were assumed constant after the year 1984.

$$CE = \left[\frac{(UE - AE)}{UE}\right] \qquad \text{(Eq. 5.11-2)}$$

where: CE = control efficiency
UE = emissions before control
AE = emissions after control

5.11.4.2 Secondary Metals

The control efficiencies for the secondary lead production processes were obtained from Reference 9.

5.11.4.3 Miscellaneous Process Sources

The control efficiencies for can soldering and cable covering were obtained from Reference 9.

5.11.5 References

1. *Minerals Yearbook*, Copper. US Geological Survey (formerly Bureau of Mines), Washington, DC. Annual.
   a. Table entitled, "Copper: World Smelter Production, by Country."
   b. Table entitled, "Production of Secondary Copper & Copper Alloy Products in the U.S. by Item Produced From Scrap."

2. *Minerals Yearbook*, Zinc. US Geological Survey (formerly Bureau of Mines), Washington, DC. Annual.
   a. Table entitled, "Salient Zinc Statistics" (production of slab zinc from scrap).

3. *Minerals Yearbook*, Lead. US Geological Survey (formerly Bureau of Mines), Washington, DC. Annual.
   a. Table entitled, "Salient Lead Statistics."
   b. Table entitled, "Pb Recovered from Scrap Processed in the U.S., by Kind of Scrap and Form of Recovery."
   c. Table entitled, "U.S. Consumption of Lead, by Product."

4. *Minerals Yearbook*, Recycling of Nonferrous Materials. US Geological Survey (formerly Bureau of Mines), Washington, DC. Annual.
   a. Table entitled, "Stocks and Consumption of New and Old Lead Scrap in the U.S. by Type of Scrap."

5. *Compilation of Air Pollutant Emission Factors, Fourth Edition, Supplements A through D, AP-42*. U.S. Environmental Protection Agency, Research Triangle Park, NC. September 1991.
   a. Table 7.3-10
   b. Table 7.6-1
   c. Table 7.9-1
   d. Table 7.15-1
   e. Table 7.17-1

6. *Compilation of Air Pollutant Emission Factors, Third Edition, Supplements 1 through 14, AP-42*. NTIS PB-275525. U.S. Environmental Protection Agency, Research Triangle Park, NC. September 1977.
   a. Appendix E

7. *Standard Computer Retrievals, AFP650 report, from the AIRS Facility Subsystem.* Unpublished computer reports. National Air Data Branch, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC. Annual.

8. *Standard Computer Retrievals, NE257 report, from the National Emissions Data System (NEDS)*. Unpublished computer reports. National Air Data Branch, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC. Annual.

9. *Control Techniques for Lead Air Emissions, Volumes 1 and 2.* U.S. Environmental Protection Agency, Research Triangle Park, NC. December 1977.

5.12 METALS PROCESSING - FERROUS: 05-02

The emissions for this Tier II category were determined by the Lead Emissions Methodology for the following source categories (see table 5.1-1 for Tier correspondence):

Category:	Subcategory:
Industrial Processes - Lead Emissions	Iron and Steel Industry (coke, blast furnace, sintering, open hearth, BOF (Basic Oxygen Furnace), and electric arc furnace)
	Nonferrous Metals (ferroalloy production)
	Secondary Metals Industry (grey iron foundries)

5.12.1 Technical Approach

The lead emissions included in this Tier category were the sum of the emissions from the source categories listed above. Emissions were estimated from an activity indicator, emissions factor, and control efficiency, where applicable. In order to utilize these values in the *Trend*s spreadsheets, activity indicators for all source categories, except those in the iron and steel industry, were expressed in thousand tons. For the iron and steel industry source categories, activity indicators were expressed in million tons. All emission factors were expressed in metric pounds/tons. All control efficiencies were expressed as dimensionless fractions.

The following procedures for determining activity indicators, emission factors, and applicable control efficiencies were used for the years 1970 through 1995.

5.12.2 Activity Indicator

5.12.2.1 Iron and Steel

The activity indicator for coke production was the oven production figure obtained from Reference 1a. The activity for coke production was assumed to be zero for all years including and following 1994. The activity indicator for blast furnaces was the total pig iron production as reported in Reference 1b, Reference 2a, or Reference 3. This value included exports. The activity indicator for the windbox sintering process was the total production of pig iron, divided by 3 (two other processes [discharge, sinter-fugitive] to not contribute to Pb emissions).

The activity indicators for open hearth, basic oxygen, and electric arc furnaces were based on the total scrap and pig iron consumption. Reference 4 contained the total scrap and pig iron consumed by each furnace type by manufacturers of pig iron and raw steel and castings. The fraction of the combined quantity of scrap and pig iron consumed by each of the three furnace types was calculated. Total raw steel production reported in Reference 1b or Reference 2a was multiplied by each fraction to obtain the raw steel production for each furnace type.

5.12.2.2 Nonferrous Metals

The activity indicator for ferrosilicon production was the net gross weight production obtained from Reference 5a or 6a. Silicon manganese activity was assumed to be 42.1 percent of the net production of ferrosilicon. Production of ferromanganese by electric furnaces was assumed to be 57.9 percent of the net production of ferrosilicon. Production of silicon metal was obtained from Reference 6a. For ferromanganese from blast furnaces and for Ferro-Mang (std), the activity indicators were assumed to be zero.

Ferrochrome-silicon activity was obtained from Reference 5a or 7, and activity data for High Carbon Ferro production was obtained from Reference 5a or 8. If these data were not available, values for the previous year were used.

5.12.2.3 Secondary Metals

The activity indicator for cupola furnaces in grey iron foundries was based on the combined quantity of scrap and pig iron consumed by cupola furnaces. This value was obtained from Reference 4a under the category of iron foundries and miscellaneous users. The final activity was determined by adjusting this production value to account for this category's respective emission factor, which was expressed in terms of the charged quantity, and not the fresh feed quantity. This adjustment required dividing the production value by 0.78.

The activity indicator for electric induction was based on the combined quantity of iron and steel scrap and pig iron consumed in electric furnaces. This value was obtained from Reference 4a under the category of iron foundries and miscellaneous users. The amount consumed was adjusted to account for recycling by dividing the consumption value by 0.78.

5.12.3 Emission Factor

5.12.3.1 Iron and Steel

The emission factors for all processes were obtained from Reference 9a. The emission factor used for by-product coke was the same as that established for metallurgical coke manufacturing.

5.12.3.2 Nonferrous Metals

The emission factors for all processes were set equal to the midpoint of the emission factor ranges reported in Reference 10a.

5.12.3.3 Secondary Metals - Grey Iron Foundries

The emission factors for all processes were reported in Reference 10b.

5.12.4 Control Efficiency

The control efficiencies for all processes included in this Tier II category for the years 1970 through 1984 were equivalent to the TSP control efficiencies for the same processes. The TSP control efficiencies were derived from Reference 11 or Reference 12 using Equation 5.12-1. Values after the year 1984 were assumed constant.

$$CE = \left[\frac{(UE - AE)}{UE}\right] \qquad \text{(Eq. 5.12-1)}$$

where: CE = control efficiency
UE = emissions before control
AE = emissions after control

5.12.5 References

1. *Survey of Current Business*. Bureau of Economic Analysis, U.S. Department of Commerce, Washington, DC.
   a. Table containing information on "Petroleum, Coal, and Products." SCC = 3-03-003
   b. Table containing information on "Metals and Manufactures."

2. Minerals Yearbook, Iron and Steel. U.S. Geological Survey (formerly Bureau of Mines), Washington, DC. Annual.
   a. Table entitled, "Salient Iron and Steel Statistics."
   b. Table entitled, "U.S. Consumption of Iron and Steel Scrap, Pig Iron, and Direct-Reduced Iron (DRI) in 19xx, by Type of Furnace and Other Use."

3. *Minerals Industry Surveys*, Iron Ores. U.S. Geological Survey (formerly Bureau of Mines), Washington, DC. Monthly.

4. *Minerals Industry Surveys*, Iron and Steel Scrap. U.S. Geological Survey (formerly Bureau of Mines), Washington, DC. Monthly.
   a. Table on consumption of iron and steel scrap and pig iron in the United States by type of furnace or other use.

5. *Minerals Yearbook*, Ferroalloys. U.S. Geological Survey (formerly Bureau of Mines), Washington, DC. Annual.
   a. Table entitled, "Table 2. Ferroalloys Produced and Shipped from Furnaces in the U.S."

6. *Minerals Yearbook*, Silicon. U.S. Geological Survey (formerly Bureau of Mines), Washington, DC. Annual.
   a. "Table 1. Production, Shipments, and Stocks of Silvery Pig Iron, Ferrosilicon, and Silicon Metal in the U.S. in 19xx"

7. *Minerals Yearbook*, Chromium. U.S. Geological Survey (formerly Bureau of Mines), Washington, DC. Annual.

8. *Minerals Yearbook*, Iron and Steel. US Geological Survey (formerly Bureau of Mines), Washington, DC. Annual.

9. *Compilation of Air Pollutant Emission Factors, Third Edition, Supplements 1 through 14, AP-42*. NTIS PB-275525. U.S. Environmental Protection Agency, Research Triangle Park, NC. September 1977.
   a. Appendix E

10. *Compilation of Air Pollutant Emission Factors, Fourth Edition, Supplements A through D, AP-42*. U.S. Environmental Protection Agency, Research Triangle Park, NC. September 1991.
   a. Table 7.4-5
   b. Table 7.10-3

11. *Standard Computer Retrievals, AFP650 report, from the AIRS Facility Subsystem.* Unpublished computer reports. National Air Data Branch, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC. Annual.

12. *Standard Computer Retrievals, NE257 report, from the National Emissions Data System (NEDS)*. Unpublished computer reports. National Air Data Branch, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC. Annual.

5.13 METALS PROCESSING - NOT ELSEWHERE CLASSIFIED: 05-03

The emissions for this Tier II category were determined by the Lead Emissions Methodology for the following source categories (see table 5.1-1 for Tier correspondence):

Category:	**Subcategory:**
Industrial Processes - Lead Emissions	Mineral Products (ore crushing)
	Miscellaneous Process Sources [miscellaneous products (type metal production)]

5.13.1 Technical Approach

The lead emissions included in this Tier category were the sum of the emissions from the source categories listed above. Emissions were estimated from an activity indicator, emissions factor, and control efficiency, where applicable. In order to utilize these values in the *Trend*s spreadsheets, activity indicators were expressed in thousand tons and emission factors were expressed in metric pounds/tons. All control efficiencies were expressed as dimensionless fractions.

The following procedures for determining activity indicators, emission factors, and applicable control efficiencies were used for the years 1970 through 1995.

5.13.2 Activity Indicator

The activity indicator for lead ore production was the gross weight of lead ore produced on a dry weight basis as reported in Reference 1a or 1b. If this value is not reported on a dry weight basis, the dry weight is estimated from the Pb ore production, in terms of recoverable Pb content, divided by 0.0799. The activity indicator for Zn, Cu, Cu-Zn ores was estimated as the sum of the "ore produced" listed in Reference 2a, and "all other sources" listed in Reference 1a. The activity data for Pb-Zn, Cu-Pb, Cu-Pb-Zn ores was assumed to be zero. If Reference 1a is not available, Zn, Cu, Cu-Zn ores are estimated using the following equation:

$$1.4291(x) - 49736.557 \qquad \text{(Eq. 5.13-1)}$$

where: x = value for copper ore produced, in short tons.

The activity indicator for type metal production was based on the consumption of lead for type metal production obtained from Reference 1. In accordance with procedures provided in Reference 3, this value was multiplied by 330 to account for recycling. If the value is withheld, use the most recent available year.

5.13.3 Emission Factor

The emission factors for ore crushing and grinding processes were obtained from Reference 4a. The emission factors for type metal production were obtained from Reference 4b.

5.13.4 Control Efficiency

The control efficiencies for ore crushing and grinding processes and type metal production were obtained from Reference 3. No control efficiencies were applied to the activity data to estimate emissions from type metal production.

5.13.5 References

1. *Minerals Yearbook*, Lead. U.S. Geological Survey (formerly Bureau of Mines), Washington, DC. Annual.
   a. Table entitled, "Production of Lead and Zinc in Terms of Recoverable Metals, in U.S. in 19xx, by State."
   b. Table Entitled, "Salient Lead Statistics."

2. *Minerals Yearbook*, Copper. U.S. Geological Survey (formerly Bureau of Mines), Washington, DC. Annual.
   a. Table entitled, "Salient Copper Statistics."

3. *Control Techniques for Lead Air Emissions, Volumes 1 and 2.* U.S. Environmental Protection Agency, Research Triangle Park, NC. December 1977.

4. *Compilation of Air Pollutant Emission Factors, Fourth Edition, Supplements A through D, AP-42*. U.S. Environmental Protection Agency, Research Triangle Park, NC. September 1991.
   a. Table 7.6-1
   b. Table 7.17-1

5.14 OTHER INDUSTRIAL PROCESSES - MINERAL PRODUCTS: 07-05

The emissions for this Tier II category were determined by the Lead Emissions Methodology for the following source categories (see table 5.1-1 for Tier correspondence):

Category:	**Subcategory:**
Industrial Processes - Lead Emissions	Mineral Products [Cement Manufacturing (wet kiln/cooler, wet dryer/grinder, dry kiln/cooler and dry dryer/grinder) and Glass Production (lead-glass)]

5.14.1 Technical Approach

The lead emissions included in this Tier category were the sum of the emissions from the source categories listed above. Emissions were estimated from an activity indicator, emissions factor, and control efficiency, where applicable. In order to utilize these values in the *Trend*s spreadsheets, activity indicators were expressed in thousand tons and emission factors were expressed in metric pounds/tons. All control efficiencies were expressed as dimensionless fractions.

The following procedures for determining activity indicators, emission factors, and applicable control efficiencies were used for the years 1970 through 1995.

5.14.2 Activity Indicator

The activity indicators for wet kiln/cooler and wet dryer/grinder used in cement manufacturing were assumed to be equal. The value used was the sum of two categories: "wet" clinker produced and "both" clinker produced, reported in Reference 1a or Reference 2a. The activity indicators for dry kiln/cooler and dry dryer/grinder were both estimated to be the sum of "dry" clinker produced and "both" clinker produced, as reported in Reference 1a. The activity indicator for lead-glass production was assumed to be zero.

5.14.3 Emission Factor

The emission factors for cement manufacturing processes were obtained from Reference 3a. The emission factor for glass production was obtained from Reference 3b.

5.14.4 Control Efficiency

The control efficiencies for the wet and dry kiln/cooler used in cement manufacturing for the years 1970 through 1984 were equivalent to the TSP control efficiencies for kilns. The control efficiencies for the wet and dry dryer/grinders for the years 1970 through 1984 were equivalent to the TSP control efficiencies for grinders. These TSP control efficiencies were derived from Reference 4 or Reference 5 using Equation 5.14-1. All control efficiencies for the years following 1984 were assumed constant.

$$CE = \left[\frac{(UE - AE)}{UE}\right] \qquad \text{(Eq. 5.14-1)}$$

where: CE = control efficiency
UE = emissions before control
AE = emissions after control

No control efficiencies were applied to activity data to estimate emissions from lead-glass production.

5.14.5 References

1. *Minerals Industry Surveys*, Cement. US Geological Survey (formerly Bureau of Mines), Washington, DC. Monthly.
   a. Table entitled, "Clinker Produced and Fuel Consumed by the Portland Cement Industry."

2. Minerals Yearbook, Cement. US Geological Survey (formerly Bureau of Mines), Washington, DC. Annual
   a. Table entitled, "Clinker Produced and Fuel Consumed by the Portland Cement Industry in the U.S. by process."

3. *Compilation of Air Pollutant Emission Factors, Fourth Edition, Supplements A through D, AP-42*. U.S. Environmental Protection Agency, Research Triangle Park, NC. September 1991.
   a. Table 8.6-1
   b. Table 8.13-1

4. *Standard Computer Retrievals, AFP650 report, from the AIRS Facility Subsystem.* Unpublished computer reports. National Air Data Branch, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC. Annual.

5. *Standard Computer Retrievals, NE257 report, from the National Emissions Data System (NEDS)*. Unpublished computer reports. National Air Data Branch, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC. Annual.

5.15 OTHER INDUSTRIAL PROCESSES - MISCELLANEOUS INDUSTRIAL PRODUCTS: 07-10

The emissions for this Tier II category were determined by the Lead Emissions Methodology for the following source categories (see table 5.1-1 for Tier correspondence):

Category:	**Subcategory:**
Industrial Processes - Lead Emissions	Miscellaneous Process Sources [Lead Alkyl Production (electrolytic process), Sodium Lead Alloy (recovery furnace, TEL process vents, TML process vents, and sludge pits), and Miscellaneous Products (ammunition)]

5.15.1 Technical Approach

The lead emissions included in this Tier category were the sum of the emissions from the source categories listed above. Emissions were estimated from an activity indicator, emissions factor, and control efficiency, where applicable. In order to utilize these values in the *Trend*s spreadsheets, activity indicators were expressed in thousand tons and emission factors were expressed in metric pounds/tons. All control efficiencies were expressed as dimensionless fractions.

The following procedures for determining activity indicators, emission factors, and applicable control efficiencies were used for the years 1970 through 1995.

5.15.2 Activity Indicator

The activity indicator for lead alkyl production by the electrolytic process was based on the quantity of lead consumed in anti-knock manufacturing obtained from Reference 1a. This quantity of lead was converted to a quantity of additive by multiplying by 1.76. The activity indicator for this category was assumed to be 10 percent of the quantity of additive consumed based on Reference 2. As of 1992, it was assumed that there were no producers of lead alkyl products in the United States. All emissions after 1992 for this category are zero.

The activity indicator for sodium lead alloy production processes was based on the remaining 90 percent of the quantity of additive consumed as determined above for lead alkyl production. The activity for recovery furnaces and sludge pits was assumed to be equal to the remaining quantity of additive. The activity of TEL (TetraEthyl Lead) process vents and TML (TetraMethyl Lead) process vents was 63 percent and 37 percent, respectively, of the remaining quantity of additive. These apportionments were based on Reference 2. As of 1992, it was assumed that there were no producers of sodium lead alloy products in the US. All emissions after 1992 for this category are zero.

The activity indicator for ammunition production was the sum of lead consumption for the following uses: (1) caulking lead (building construction), (2) total pipes, traps, and other extruded products, (3) total sheet lead, and (4) other metal products. The consumption information was obtained from Reference 1.

5.15.3 Emission Factor

The emission factors for lead alkyl and sodium lead alloy production processes were obtained from Reference 3a. The emission factors for ammunition production were obtained from Reference 3b.

5.15.4 Control Efficiency

The control efficiencies for ammunition production were obtained from Reference 2. No control efficiencies were applied to estimate emissions from the other sources included in this Tier II category.

5.15.5 References

1. *Minerals Yearbook*, Lead. U.S. Geological Survey (formerly Bureau of Mines), Washington, DC. Annual.
   a. Table entitled, "U.S. Consumption of Lead, by Product."

2. *Control Techniques for Lead Air Emissions, Volumes 1 and 2.* U.S. Environmental Protection Agency, Research Triangle Park, NC. December 1977.

3. *Compilation of Air Pollutant Emission Factors, Fourth Edition, Supplements A through D, AP-42*. U.S. Environmental Protection Agency, Research Triangle Park, NC. September 1991.
   a. Table 5.22-1
   b. Table 7.17-1

5.16 WASTE DISPOSAL AND RECYCLING : 10-01

The emissions for this Tier II category were determined by the Lead Emissions Methodology for the following source categories (see table 5.1-1 for Tier correspondence):

Category:	**Subcategory:**
Solid Waste Disposal	Incineration (Municipal, Residential, Commercial/Institutional, and Conical Woodwaste)

5.16.1 Technical Approach

The lead emissions included in this Tier category were the sum of the emissions from the source categories listed above. Emissions were estimated from an activity indicator and an emissions factor. In order to utilize these values in the *Trend*s spreadsheets, activity indicators were expressed in million tons and emission factors were expressed in metric pounds/thousand tons.

The following procedures for determining activity indicators, emission factors, and applicable control efficiencies were used for the years 1970 through 1995.

5.16.2 Activity Indicator

The activity indicator for municipal incineration was the sum of the operating rates for the SCCs 5-01-001-01 and 5-01-001-02 obtained from Reference 1 or 2. The activity for 1995 was calculated by multiplying the 1990 activity by the ratio of 1995 combustion to 1990 combustion from Reference 3.

The activity indicator for residential incineration was the operating rate for residential on-site incineration obtained from Reference 4. The activity for 1995 and 1996 was calculated by multiplying the 1994 activity obtained from reference 4 by the ratio of 1994 activity to 1995 or 1996 activity obtained from Reference 5.

Commercial/industrial incineration was based on the sum of the operating rates provided in Reference 1 or 2 for the following SCCs: 5-02-001-01, 5-02-001-02, 5-03-001-01, and 5-03-001-02. The previous year's activity data reported in the *Trends* spreadsheet was scaled based on the ratio of the total operating rate for the current year to the total for the previous year. This calculation is shown in Equation 5.16-1.

$$A_i = A_{i-1} \times \left(\frac{\sum_{SCCs} OR_i}{\sum_{SCCs} OR_{i-1}} \right) \qquad \text{(Eq. 5.16-1)}$$

where: A = activity indicator
I = year
OR = operating rates for SCCs 5-02-001-01, 5-02-001-02, 5-03-001-01, and 5-03-001-02

The activity for commercial/industrial incineration for the years 1995 and 1996 was calculated by multiplying the 1994 activity obtained from Reference 1 by the ratio of 1994 emissions to 1995 or 1996 emissions obtained from Reference 5.

The activity indicator for conical woodwaste incineration was the sum of the operating rates for the SCCs 5-02-001-05 and 5-03-001-05 obtained from Reference 1 or 2.

5.16.3 Emission Factor

The emission factors for municipal, residential, and commercial/institutional incineration were obtained from Reference 6a or Reference 7a.

The emission factor for conical woodwaste incineration (SCC 5-02-001-05) was assumed to be zero.

5.16.4 Control Efficiency

The control efficiency associated with municipal incineration was obtained from Reference 1 or 2 for SCC 5-01-001.

No control efficiencies were applied to the activity data to estimate emissions from the remaining types of incineration (i.e., residential, commercial/institutional, and conical woodwaste).

5.16.5 References

1. *Standard Computer Retrievals, AFP650 report, from the AIRS Facility Subsystem.* Unpublished computer reports. National Air Data Branch, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC. Annual.

2. *Computer Retrieval, NE257 report, by Source Classification Code (SCC) from the National Emission Data System (NEDS).* Unpublished computer report. National Air Data Branch, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC. February 9, 1980.

3. *Characterization of Municipal Solid Waste in the United States. (1996 Update)* Municipal and Industrial Solid Waste Division, U.S. Environmental Protection Agency, Washington, DC. June 1997.

4. *Computer Retrieval, NE260 report, by Source Classification Code (SCC) from the National Emission Data System (NEDS).* Unpublished computer report. National Air Data Branch, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC. February 9, 1980.

5. *National Emission Trends Report.* Draft Report. Prepared by E.H. Pechan and Associates, Inc. under contract No. 68-D3-0035, work assignment III-102 for Emission Factor and Inventory Group, U.S. Environmental Protection Agency, Research Triangle Park, NC. September 1997.

6. *Compilation of Air Pollutant Emission Factors, Fourth Edition, Supplements A through D, AP-42*. U.S. Environmental Protection Agency, Research Triangle Park, NC. September 1991.
   a. Table 2.1-1.

7. *Compilation of Air Pollutant Emission Factors, Third Edition, Supplements 1 through 14, AP-42*. NTIS PB-275525. U.S. Environmental Protection Agency, Research Triangle Park, NC. September 1977.
   a. Appendix E

5.17 ON-ROAD VEHICLES: 11

The emissions for all Tier II categories under this Tier I category were determined by the Lead Emissions Methodology for the following source categories (see table 5.1-1 for Tier correspondence):

Category:	**Subcategory:**
On-road vehicles	Gasoline (leaded, unleaded)

5.17.1 Technical Approach

The lead emissions included in these Tier II categories were the sum of the emissions from the source categories listed above. Emissions were estimated from an activity indicator and an emissions factor. In order to utilize these values in the *Trend*s spreadsheets, activity indicators were expressed in million gallons and emission factors were expressed in metric pounds/gallons. The total lead emissions for the Tier I category were allocated to the Tier II categories by the relative fraction of vehicle miles traveled (VMT) for the appropriate vehicle types.

The following procedures for determining activity indicators, emission factors, and allocation to the Tier II categories were used for the years 1970 through 1996.

5.17.2 Activity Indicator

The activity indicator for On-road vehicles was the gasoline consumption by all On-road vehicles as reported in Reference 1a. If this consumption value was not available, the previous year's consumption was adjusted based on the vehicle miles traveled (VMT) obtained from Reference 2a using Equation 5.17-1:

$$GC_i = GC_{i-1} \times \frac{VMT_i}{VMT_{i-1}} \qquad \text{(Eq. 5.17-1)}$$

where: GC = total gasoline consumption by all On-road vehicles
I = year of interest
VMT = vehicle miles traveled

The percentage of total unleaded gasoline was obtained from Reference 3a, and this value was applied to the total consumption of gasoline, resulting in unleaded gasoline use. This procedure was repeated to obtain leaded gasoline activity.

5.17.3 Emission Factor

The lead emission factors for On-road vehicles were reported in Reference 4 to be 1.5(Y) lb/ton, where Y is the number of grams of lead/gasoline. Y values are shown in Table 5.17-1. The values for Y were obtained from Reference 5.

5.17.4 Control Efficiency

No control efficiencies were applied to activity data to estimate emissions from On-road vehicles.

5.17.5 Allocation of Emissions to the Tier II Categories

The total lead emissions were the sum of the emissions from leaded gasoline and from unleaded gasoline. Lead emissions from these two types of gasolines were calculated by multiplying the activity indicator by the emission factor. In order to allocate the total lead emissions to the Tier II categories, the relative fraction of the VMT for each of the three vehicle classifications was determined. The VMT data for this purpose were obtained from a variety of sources. Relative VMT fractions used for the years 1940 through 1993 for each of the vehicle classifications are given in Table 5.17-2.

5.17.6 References

1. *On-road vehicles Statistics*. Federal On-road vehicles Administration, U.S. Department of Transportation, Washington, DC. Annual.
   a. Table MF-21, "Motor Fuel Use"

2. Welty, K. On-road vehicles Information Management, Federal On-road vehicles Administration, US Department of Transportation, personal communications with E.H. Pechan and Associates, Inc., Durham, NC, 1997. (Information received on floppy diskette.)

3. *Petroleum Supply Annual*. DOE/EIA-0340(xx/07). Energy Information Administration, U.S. Department of Energy, Washington, DC. Annual.
   a. Table entitled, "Finished Motor Gasoline Supply and Disposition."

4. *Control Techniques for Lead Air Emissions, Volumes 1 and 2*. U.S. Environmental Protection Agency, Research Triangle Park, NC. December 1977.

5. *Motor Gasolines*. National Institute for Petroleum and Energy Research, IIT Research Institute, Barltesville, OK. Summer 1987 and Summer 1990.

Table 5.17-1. Number of Grams of Lead/Gasoline (Y)

Year	Leaded Gasoline	Unleaded Gasoline
1970	2.43	NA
1971	2.59	NA
1972	2.63	NA
1973	2.2	0.014
1974	2.07	0.014
1975	1.82	0.014
1976	2.02	0.014
1977	2.03	0.014
1978	1.76	0.01
1979	1.76	0.016
1980	1.33	0.028
1981	1.01	0.009
1982	1.02	0.005
1983	0.83	0.003
1984	0.84	0.006
1985	0.59	0.002
1986	0.37	0.002
1987	0.15	0.001
1988	0.15	0.001
1989	0.08	0.002
1990	0.08	0.0004
1991	0.0002	0.0002
1992	0.0002	0.0002
1993	0.0002	0.0002
1994	0.0002	0.0002
1995	0.0002	0.0002
1996	0.0002	0.0002

Table 5.17-2. Relative VMT Fractions for Each Tier II Category

Year	Light-Duty Gas Vehicles and Motorcycles	Light-Duty Gas Trucks	Heavy-Duty Gas Trucks
1970	0.83	0.13	0.04
1971	0.83	0.13	0.03
1972	0.82	0.14	0.03
1973	0.82	0.14	0.03
1974	0.82	0.15	0.03
1975	0.82	0.15	0.03
1976	0.81	0.16	0.03
1977	0.80	0.17	0.03
1978	0.80	0.17	0.03
1979	0.79	0.18	0.03
1980	0.78	0.19	0.03
1981	0.76	0.21	0.03
1982	0.79	0.19	0.02
1983	0.78	0.20	0.02
1984	0.77	0.21	0.02
1985	0.76	0.22	0.02
1986	0.75	0.23	0.02
1987	0.74	0.24	0.02
1988	0.75	0.24	0.02
1989	0.75	0.24	0.02
1990	0.75	0.24	0.02
1991	0.75	0.24	0.01
1992	0.75	0.24	0.01
1993	0.75	0.24	0.01
1994	0.75	0.24	0.01
1995	0.75	0.24	0.01
1996	0.75	0.24	0.01

5.18 NON-ROAD ENGINES AND VEHICLES - NONROAD GASOLINE: 12-01

The emissions for this Tier II category were determined by the Lead Emissions Methodology for the following source categories (see table 5.1-1 for Tier correspondence):

Category:	**Subcategory:**
Other Non-road engines and vehicles	Gasoline (Farm Tractors, Other Farm Equipment, construction, Snowmobiles, Small Utility Engines, Heavy Duty General Utility Engines, Motorcycles)
Vessels	Gasoline
Aircraft	Aviation Gasoline

5.18.1 Technical Approach

The lead emissions included in this Tier category were the sum of the emissions from the source categories listed above. Emissions were estimated from an activity indicator and an emissions factor. In order to utilize these values in the *Trend*s spreadsheets, activity indicators were expressed in million gallons and emission factors were expressed in metric pounds/thousand gallons.

The following procedures for determining activity indicators, emission factors, and applicable control efficiencies were used for the years 1970 through 1995.

5.18.2 Activity Indicator

The activity indicator for gasoline-powered farm tractors was based on the 1973 gasoline consumption by farm tractors reported in Reference 1. The adjustment factor applied to the 1973 data was the ratio of the quantity of gasoline consumed by all agricultural equipment in 1973 and in the year under study as reported in Reference 2a. It is assumed that this procedure was used for the years both before 1973 and after 1973. Equation 5.18-1 summarizes this procedure.

$$GC_{Tractor,\ i} = GC_{Tractor,\ 1973} \times \frac{GC_{Agriculture,\ i}}{GC_{Agriculture,\ 1973}} \qquad \text{(Eq. 5.18-1)}$$

where: GC = gasoline consumption
I = year under study

The activity indicator for other gasoline-powered farm equipment was also based on gasoline consumption. It was assumed that the gasoline consumption by other farm equipment was equivalent to 8.52 percent of the quantity of gasoline consumed by farm tractors as determined by the preceding

procedure. Activity for other farm equipment is considered zero for the year 1991 and all subsequent years.

The activity indicator for gasoline-powered construction equipment was the total gasoline consumption by construction equipment as reported in Reference 2.

Activity data for snowmobiles were based on the 1973 gasoline consumption by snowmobiles, as reported in Reference 1. An adjustment factor was applied to the 1973 value to account for the ratio of the number of snowmobile registrations in 1973 and in the year under study as reported in Reference 3. It is assumed that this procedure was used for the years both before 1973 and after 1973. Equation 5.18-2 summarizes this procedure.

$$GC_{Snowmobiles,\ i} = GC_{Snowmobiles,\ 1973} \times \frac{N_{Snowmobiles,\ i}}{N_{Snowmobiles,\ 1973}} \qquad \text{(Eq. 5.18-2)}$$

where: GC = gasoline consumption
I = year under study
N = number of registered vehicles

Activity data for small utility gasoline engines was based on the 1980 value for gasoline consumption by small engines (533 x 10^6 gallons). An adjustment factor was applied to the 1980 data to account for the ratio of the number of single unit dwellings in 1980 and in the year under study. The number of single unit dwellings in 1980 was obtained from Reference 4. For the year under study, the number of single unit dwellings was estimated by adding or subtracting the number of new one-family structures started each year between 1980 and the year under study to the number of single unit dwellings in 1980. The number of new one-family structures started was obtained from Reference 5 for each year. It is assumed that this procedure was used for the years both before 1973 and after 1973. Equation 5.18-3 summarizes this procedure.

$$GC_{SmallEngines,\ i} = (533 \times 10^6\ gal) \times \frac{Single\ Unit\ Dwellings_i}{Single\ Unit\ Dwellings_{1980}} \qquad \text{(Eq. 5.18-3)}$$

where: GC = gasoline consumption
I = year under study

The activity indicator for heavy duty general gasoline utility engines was the total gasoline consumed by the industrial/commercial category obtained from Reference 2.

The activity indicator for motorcycles was calculated from the number of motorcycles, the average annual Non-road engines and vehicles mileage traveled, and the median estimated average miles per gallon. The motorcycle population and the Non-road engines and vehicles mileage were obtained from Reference 6. The average miles per gallon (MPG) was assumed to be 44.0 miles/gallon. Activity for motorcycles was considered zero for the year 1995 and all subsequent years because no leaded gasoline was consumed by motorcycles after this year. Equation 5.18-4 summarizes this calculation.

$$GC_{Motorcycles} = N_{Motorcycles} \times \frac{M_{Motorcyles,\ Off-highway}}{MPG} \qquad \text{(Eq. 5.18-4)}$$

where: GC = gasoline consumption
N = number of motorcycles
M = mileage
MPG = miles/gallon

The activity indicator for aircraft was the total national quantity of aviation gasoline supplied as reported in Reference 7a, Reference 8a, or Reference 9a. Reference 7a was used for the years 1970 through 1978. Reference 8a was used for the years 1979 and 1980. Reference 9a was used for the years 1981 through 1995.

5.18.3 Emission Factor

The lead emission factor for the combustion of gasoline in Non-road engines and vehicles was reported in Reference 10 to be 1.5(Y) lb/ton, where Y is the number of grams of lead/gasoline. It was assumed that all gasoline used for these engines was leaded. The value of Y was obtained from Reference 11 for the years 1970 to 1988 and Reference 12 for the years 1989 to 1996.

The lead emission factor for aircraft was reported in Reference 13 to be the lead content of aviation gasoline multiplied by the percent of lead emitted. Therefore, the emission factor is 2g/gal times 0.75.

5.18.4 Control Efficiency

No control efficiencies were applied to activity data to estimate emissions from Non-road engines and vehicles.

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SECTION 6.0
OVERVIEW OF PROJECTION METHODS USED BY EPA

The EPA projects emissions for many reasons. Typically, the reason is to evaluate benefits or determine cost-effective control strategies of potential regulations and policies. The purpose of the EPA's emission projection may influence the methodology selected and the data that is developed. If control cost analyses will be performed, source-specific information may need to be retained. If the projected inventory will be used in grid-based air quality models, source-specific information, including location and stack parameters, is required. Other efforts such as benefits analysis, may also require county/source category level information so that emissions can be aggregated for projection purposes. The EPA's National Emission Inventory (NEI) of criteria and toxic air pollutants is generally the starting point for EPA's projected inventories. A recent example includes EPA projection inventories to support evaluation and analysis of controls for onroad mobile and nonroad mobile emission source sectors under the Tier 2 Tailpipe rulemaking.

The purpose of this chapter is to describe information and procedures that EPA uses in projecting air pollutant emissions for various regulatory purposes. Included in this discussion is general information for projecting future emissions for the following sectors: point, area, onroad mobile, and nonroad mobile. A more thorough description of some of the methods noted may be found in projection guidance documents by the Emission Inventory Improvement Program (EIIP) located at http://www.epa.gov/ttn/chief/eiip. EPA generally includes documentation with each projection inventory to describe specific assumptions, models, etc. that were used for a particular analysis.

6.1 EMISSION PROJECTIONS

The goal in developing emission projections is to account for as many of the important variables that affect future year emissions as possible. Emission projections are a function of change in activity (growth or decline) combined with changes in the emission rate or controls applicable to the source. To a large extent, projection inventories are based on forecasts of industrial growth, population growth, changes in land use patterns, and transportation growth. Changes in emission rates can be influenced by such causes as technological advances, environmental regulations, age or deterioration of process and control equipment, how the source is operated and maintained, and fuel formulations.

In general, stationary point and area source projections are based on the following equation:

$$E_{fy} = E_{by} * G * C \qquad \text{(Eq. 6.1-1)}$$

where:
- E_{fy} = projection year emissions
- E_{by} = base year emissions
- G = growth factor
- C = control factor, accounting for changes in emission factors or controls

For onroad and nonroad mobile sources, the general equation is:

$$E_{fy} = A_{by} * G * F \qquad \text{(Eq. 6.1-2)}$$

where: E_{fy} = projection year emissions
A_{by} = base year activity
G = growth factor
F = projection year emission factor

In equation 6.1-2, the projection year emission factor accounts for the effect of any new regulations as well as technological changes.

There are complicating issues which go beyond the parameters explained in these two equations, so a specific projection calculation should be developed for each sector. For example, within the point source sector, industry growth and the addition of new plants are often accompanied by the retirement of aging facilities. Projections should reflect this because net growth can only be determined after retirement is defined, and emission rates often differ for the new sources that replace existing ones. Other sectors may also require such adjustments to the generalized equations listed above.

6.2 GROWTH FACTORS

The growth factor accounts for changes (increases or decreases) in the emissions-generating activity. In selecting growth factors, the most important considerations are how closely the surrogate data approximates or relates to changes in the emission-generating activity; how closely it relates to the activity indicator used to develop the base year emissions; and the locality (how well it characterizes the activity in the area of interest versus a larger geographical area). Potential growth indicators include employment, earnings, value added, and product output. Each of these growth indicators are described in more detail in the EIIP projection/guidance documents located at http://www.epa.gov/ttn/chief/eiip.

6.2.1 Growth Data Sets Used by EPA

The data used to project activity growth depend on the sector of analysis. Onroad mobile projections often use VMT data. EPA generally bases point and area source projections on U.S. Department of Commerce's Bureau of Economic Analysis (BEA), Economic Growth Analysis System (EGAS), or Regional Economic Models, Inc. (REMI) data. Table 6.2-1 contains references for several data sets containing regional-level forecasts of growth.

Future changes in activity level will be the result of complex interactions between human population growth, changes in national and local economic factors, and changes in the markets for the sector being examined and the products it produces. Historically, EPA has often used projections of economic indicators as surrogates for growth in activity for the purpose of estimating future emissions. In addition to the data sets above, projections based on historical economic time-series data are also used. The most simplistic method is through extrapolations of the historic data. Projections based on historic extrapolations capture long-term trends and may not accurately represent year-to-year fluctuations in activity. Projections of economic activity should be carried out using accepted statistical and economic techniques, such as multiple regression analysis, moving averages, or autoregression.

Table 6.2-1. Projection (Growth) Resources

Resource	Where To Go	Brief Description
National		
Economic Growth Analysis System (E-GAS)	http://www.epa.gov/ttn/chief/ ei_data.html#EGAS	Provides emission growth factors based on various methods and data sources, including regional economic models.
BEA Data (from U.S. Department of Commerce's Bureau of Economic Analysis)	http://www.bea.doc.gov/	BEA's national and regional economic accounts present basic information on issues such as U.S. economic growth and regional economic development.
Standard & Poor's DRI Regional Economic Service	http://www.dri.mcgraw-hill.com/ regional/index.htm	Standard & Poor's forecasts of key economic and demographic concepts for 50 states, 310 metropolitan areas, and over 3000 counties, along with U.S. regional models which provide current projections of interest rates, GDP, inflation, and other economic indicators.
DOE/EIA's Annual Energy Outlook	http://www.eia.doe.gov/oiaf/ forecasting.html	Overview forecasts of annual energy supply, demand, and prices based on results from EIA's National Energy Modeling System (NEMS). Site also contains information on climate change and other projections.
WEFA	http://www.wefa.com/	Provides data at the state, MSA, county, and census tract level for the United States. Statistics range from general macroeconomic indicators to company-specific detail.
Regional Economic Models, Inc. (REMI)	http://www.remi.com/	REMI constructs regional and national economic forecasting models; REMI models are included within EGAS.

The use of economic indicators to predict growth in an emissions sector has its drawbacks. Economic indicators generally predict growth for broad economic sectors, and therefore cannot identify trends within individual emission sectors. Another drawback is that economic indicators may not be able to adequately predict the effects of substitution of equipment for labor in the market.

6.3 CONTROL FACTORS/EMISSION FACTORS

Control strategy projections are estimates of future year emissions that also include the expected impact of modified or additional control regulations. To the extent possible, EPA incorporates the effect of future scheduled regulations in their control strategy projections. Future year emissions may also be

affected by fuel switching, fuel efficiency improvements, improvements in performance due to economic influences, or any occurrence that alters the emissions-producing process. Programs other than those aimed at reducing the emissions of the criteria pollutants of interest may affect future year emissions. These may include energy efficiency programs, pollution prevention programs, and greenhouse gas or global warming initiatives. These programs generally are reflected in the projections through the future year control factor, emission factor, or in some cases, by adjusting the activity growth forecast.

6.3.1 Conditions & Influences on Determining Controls and Emission Rates

Several conditions are accounted for when developing control strategy information. Control factors and emission factors vary by source category and are continuously being revised and improved based on field and laboratory measurements. Future year control factors or emission factors are examined in relation to the base year values to ensure any existing controls are not double-counted by taking additional credit in the future year, noting that the control factor and/or emission factor may also be a weighted composite. For mobile sources where emission factors are generally used in the projections, models are available which calculate the future year emission factor (i.e., EPA's NONROAD and MOBILE models).

In determining the future year control factor or emission factor, three basic parameters are quantified: regulation control, rule effectiveness (RE), and rule penetration (RP). Regulation control is the level of reduction expected from full compliance with a control measure. Rule effectiveness accounts for the level of expected compliance with the regulation. Rule penetration indicates the fraction of emissions within a source category which are subject to the regulation, accounting for size cutoffs and other exemptions.

When accounting for regulation control, RE, and RP, the control factor can be described as:

$$C = 1 - [(RC/100) * (RE/100) * (RP/100)] \qquad \text{(Eq. 6.3-1)}$$

where: C = control factor
RC = regulation control
RE = rule effectiveness
RP = rule penetration

More than one control measure can affect the emissions in a single emission category. The methodology addressing the effects of multiple control measures must reflect each control measure's level of control, and how many pollutants will be affected. In some cases, a new measure can be adopted on top of the control measure already in place, leading to a greater combined emission reduction. In these cases, it is imperative that any reductions credited by the new control measure configuration reflect the emission reductions due to new controls. In all cases, emission reductions should be correctly assigned to the control measures.

6.4 MEASURING THE EFFECTIVENESS OF CONTROL PROGRAMS

The previous sections discussed the two major elements of an emission projection: the growth or activity projection and the future year control or emission factor. It is important to note that control programs may in some cases affect either or both of these parameters. Installing a control device or

making other modifications may impact the control factor. Nonroad engine standards may impact the future year emission factor. Seasonal bans may reduce the level of emission generating activity and, therefore, should be incorporated into the projection by either adjusting the activity projection, or including a control factor. Efficiency improvements in a plant may reduce the need for steam, thereby reducing the amount of fuel which must be burned to supply the steam. This can also be reflected through adjustments to the activity projection, or through the use of a control factor which will account for the reduced fuel usage (though the former is preferred).

In many cases, it is also necessary to account for multiple programs which affect the same source category. Industrial boiler emission projections may be affected by both new regulations requiring the installation of controls as well as efficiency improvements. Onroad mobile emissions may be affected by tailpipe standards, inspection and maintenance programs, as well as transportation initiatives aimed at reducing vehicle miles traveled. Therefore, expected controls should be calculated for each action and applied appropriately based on their implementation dates.

Other programs are complex, and determining appropriate control factors or adjustments to activity forecasts for specific source categories is not straightforward. For example, initiatives such as the EPA Green Lights program are aimed at reducing energy use by reducing electricity demand. This, in turn, is tied to reductions in emissions from individual utility boilers. Emission caps or allowance programs set overall constraints on future emission levels, but this must also be translated into reductions at individual units in most cases. For trading programs, a simplified approach may be used to constrain emissions at individual units to the level used to calculate the emission budget. More complex approaches would examine how individual units will respond – by controlling emissions or purchasing credits.

6.5 USE OF SCCS AND SICS TO ASSOCIATE GROWTH AND CONTROL INFORMATION

The EPA's Source Classification Code value (SCC) is a key emission inventory field used in developing emission projections. SCCs describe the types of processes within each point, area, nonroad, and onroad mobile source sector. The SCCs are used to link the type of emission process controls, and may also be used to identify appropriate emission growth factors. The latest posted SCC code lists are available in various formats at: http://www.epa.gov/ttn/chief/scccodes.html.

Another key emission inventory field used in developing emission projections are the Standard Industrial Classification (SIC) (and NAICS) codes which are published by the U.S. Office of Management and Budget (OMB). These codes describe the type of activity in which businesses are engaged. SIC codes identify establishments using a coding system that ranges from 2 to 4 digits. SIC codes indicate the type of industry and are often used in selecting appropriate growth factors.

Some area and mobile source categories do not have associated SIC codes. For these categories, surrogates such as population, vehicle miles traveled (VMT), and engine populations are used to estimate activity growth. For certain area source categories, such as wood furniture surface coating, the link between SCCs and SIC codes is straightforward. Others, such as open top vapor degreasing, may be a combination of several industries, so the link is not straightforward and may require using surrogate data representing a cross-section of industries.

The EPA national point source inventory generally includes SIC codes for individual plants and points. In cases where SIC codes are not provided, SCCs may be linked to SIC code forecast data. As

for area sources, there is no perfect mapping scheme between the SCC and SIC code, particularly for the industrial fuel combustion SCCs, which can be associated with many industries.

The OMB has recently produced a new industry classification system. The North American Industry Classification System (NAICS) identifies industries by NAICS codes, which are defined using a 6-digit coding system. Because of the larger number of digits, the NAICS accommodates more sectors and provides additional flexibility in designating subsectors versus the SIC system. Although Federal government agencies are in the process of transitioning from the SIC system to the NAICS, the EPA's National Emission Inventory currently contains only SIC code information. The NAICS web site provides information on this new classification system: http://www.naics.com. The following site provides links to pages maintained by OSHA and other agencies regarding the SIC codes and their replacement NAICS codes: http://www.epa.gov/ttn/chief/eiip/eicrepts.htm#techpapers.

6.6 OTHER CONSIDERATIONS

There are several other factors which should be considered in performing emission projections, particularly when air quality modeling will be performed using the projection. This includes potential changes in the spatial, temporal, and/or speciation profiles of the emissions. Additional information on spatial, temporal, and speciation considerations can be found in respective EIIP emission inventory development documents (http://www.epa.gov/ttn/chief/eiip/techrep.htm).

6.6.1 Spatial Considerations

In performing emission projections, it is important to account for any geographic shifts in emissions. Changes in land use patterns may lead to shifts in the location of emissions or may result in higher growth in some areas as opposed to others.

Changes in land use patterns may also influence the types of sources emitting in an area. For example, suburbanization of rural areas may result in decreases in the agricultural sector activities and increases in activity of population-based emission sources such as lawn and garden equipment, consumer solvents, and highway vehicles.

6.6.2 Temporal Considerations

The temporal profile (when the pollution is emitted, including seasonal, monthly, daily, and hourly differences) is important, because meteorology also impacts the dispersion of pollution and the chemical transformations to species of concern (ozone, fine particles). Control strategies should be reviewed to determine whether any will have a seasonal impact, or result in shifts in the time period of emissions.

6.6.3 Speciation Considerations

Emission modeling systems speciate criteria pollutant emissions. VOC emissions are dispersed into many different compounds with varying degrees of reactivity. In projecting emissions, changes in fuel and solvent formulations should be reviewed to identify changes in the projection year speciation profiles. Changes may be the result of regulations such as the control of toxic pollutants (especially VOC) or economic incentives (e.g., cost of solvents).

6.7 QUALITY ASSURANCE

The functions of quality assurance during development of projection inventories include the following:

1. Ensure reasonableness of the emission projections and data used,
2. Ensure validity of the assumptions and methods used,
3. Ensure mathematical correctness (e.g., ensure calculations were performed correctly),
4. Ensure valid data were used,
5. Assess the accuracy of the estimates.

Projected emissions are generally compared with base year emissions to identify any anomalies that might indicate calculation or data errors, and to verify reasons for trends towards higher or lower emissions. For example, if projected emissions are lower than those in the base year, the activity projection data may be examined versus the change in projection year emission factors, to ensure that the magnitude of these changes support the overall change in emissions from the base year. Comparisons of contributions of different source categories to total emissions in the base year and in the projection year are also reviewed and any significant changes investigated and explained.

TECHNICAL REPORT DATA

(Please read Instructions on reverse before completing)

1. REPORT NO. EPA-454/R-01-006	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE PROCEDURES DOCUMENT FOR NATIONAL EMISSION INVENTORY, CRITERIA AIR POLLUTANTS 1985-1999		5. REPORT DATE (of preparation) March 2001 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Rebecca Lee Tooly		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Environmental Protection Agency Office of Air Quality Planning and Standards Research Triangle Park, NC 27711		10. PROGRAM ELEMENT NO. (EMAD / EFIG) 11. CONTRACT/GRANT NO. 68-D7-0067
12. SPONSORING AGENCY NAME AND ADDRESS Director Office of Air Quality Planning and Standards Office of Air and Radiation U.S. Environmental Protection Agency Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Final 14. SPONSORING AGENCY CODE EPA/200/04

15. SUPPLEMENTARY NOTES

Supersedes EPA-454/R-00-002, March 2000

16. ABSTRACT

This document includes methodologies for estimating emissions, for years 1985-1999, for the following criteria pollutants: carbon monoxide (CO), nitrogen oxides (NOx), lead (Pb), particulate matter less than 10 and 2.5 microns in diameter (PM-10/ PM2.5), sulfur dioxide (SO2), volatile organic compounds (VOC), and ammonia (NH3). This document does not include data results, only method descriptions. This document and the data results are distributed electronically on EPA Internet sites.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
	Air Pollution control	

18. DISTRIBUTION STATEMENT Release Unlimited	19. SECURITY CLASS *(Report)* Unclassified	21. NO. OF PAGES 405
	20. SECURITY CLASS *(Page)* Unclassified	22. PRICE

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