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**PROCEDURES FOR DEVELOPING BASE YEAR
AND FUTURE YEAR MASS AND MODELING
INVENTORIES FOR THE TIER 2 FINAL RULEMAKING**

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ACRONYMS AND ABBREVIATIONS

AAMA	American Automobile Manufacturers Association
APUs	Aircraft and Auxiliary Power Units
ASTM	American Society for Testing and Materials
BEA	Bureau of Economic Analysis
CAA	Clean Air Act
CAAA	CAA Amendments of 1990
CI	compression-ignition
CNG	compressed natural gas
CO	carbon monoxide
DOE	U.S. Department of Energy
DR	deterioration rate
E-GAS	Economic Growth Analysis System
EGU	electric generating unit
EIA	Energy Information Administration
EMS	Emissions Modeling System
EPA	U.S. Environmental Protection Agency
EPCD	Engine Programs and Compliance Division
EPS	Emissions Preprocessor System
F	Fahrenheit
FAA	Federal Aviation Administration
FCM	Fuel Consumption Model
FIPS	Federal Information Processing Standard
ft	feet
ft/min	feet per minute
g/bhp-hr	grams per brake horsepower-hour
GSP	Gross State Product
HC	hydrocarbon
HDDV	Heavy-Duty Diesel Vehicle
HON	Hazardous Organic NESHAP
hp	horsepower
HPMS	Highway Performance Monitoring System
I/M	Inspection and Maintenance
IPM	Integrated Planning Model
LDDT	Light-Duty Diesel Truck
LDDV	Light-Duty Diesel Vehicle
LEV	Low-Emission Vehicle
LNB	low-NO _x burner
LPG	liquid petroleum gas
LTOs	Landing-Takeoff Operations
m	meter
MACT	maximum achievable control technology
MMBtu	million British thermal units
NAAQS	National Ambient Air Quality Standards

ACRONYMS AND ABBREVIATIONS (continued)

NERC	North American Electric Reliability Council
NESHAP	National Emission Standards for Hazardous Air Pollutants
NET	National Emission Trends
NH ₃	ammonia
NLEV	National Low Emission Vehicle
NMHC	nonmethane hydrocarbon
NMOG	Nonmethane Organic Gas
NO _x	oxides of nitrogen
OBD	on-board diagnostic
OMS	Office of Mobile Sources
OTAG	Ozone Transport Assessment Group
OTC	Ozone Transport Commission
OTR	Ozone Transport Region
PM	particulate matter
PM ₁₀	primary particulate matter with an aerodynamic diameter less than or equal to 10 micrometers
PM _{2.5}	primary particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers
POTWs	Publicly-Owned Treatment Works
ppm	parts per million
psi	pounds per square inch
RACT	reasonably available control technology
REMSAD	Regulatory Modeling System for Aerosols and Deposition
RFG	reformulated gasoline
RSD	Regulatory Support Document
RVP	Reid vapor pressure
SCCs	Source Classification Codes
SCR	selective catalytic reduction
SI	spark-ignition
SIC	Standard Industrial Classification
SIP	State Implementation Plan
SMOKE	Sparse Matrix Operator Kernel Emissions
SNCR	Selective Noncatalytic Reduction
SO ₂	sulfur dioxide
SOA	secondary organic aerosols
SOCMI	Synthetic Organic Chemical Manufacturing Industry
SO _x	oxides of sulfur
SSD	summer season daily
TLEV	transitional LEV
tpd	tons per day
tpy	tons per year
TSDFs	treatment, storage, and disposal facilities
UAM-V	Urban Airshed Model

ACRONYMS AND ABBREVIATIONS (continued)

ULEV	Ultra-Low Emission Vehicle
USDA	U.S. Department of Agriculture
UTM	Universal Transverse Mercator
VMT	vehicle miles traveled
VOC	volatile organic compound
ZML	zero-mile level

CHAPTER I

BACKGROUND

To assist future State and Federal implementation of the Tier 2 mobile source emission standards, the United States (U.S.) Environmental Protection Agency (EPA) is developing national annual and temporal emission inventories and applying the Urban Airshed Model (UAM-V) and Regulatory Modeling System for Aerosols and Deposition (REMSAD) to examine the regional ozone and particulate matter (PM) concentration response to a series of emission control strategies. The purpose of this report is to describe the procedures and assumptions used to develop the mass emissions inventories and the emissions input files for the Emissions Modeling System (EMS-95)/Sparse Matrix Operator Kernel Emissions (SMOKE) and Emissions Preprocessor System (EPS-2.5) air quality model preprocessors.

The emission inventories developed to support the Tier 2 final rulemaking include the following:

- 1996 Base Year;
- 2007 Base Case;
- 2007 Control Case;
- 2030 Base Case; and
- 2030 Control Case.

These national inventories are prepared at the county-level for on-highway mobile, electric generating unit (EGU), non-EGU point, stationary area, and nonroad sources. The inventories contain annual and summer season daily (SSD) emissions for the following pollutants: oxides of nitrogen (NO_x), volatile organic compounds (VOC), carbon monoxide (CO), oxides of sulfur (SO_x), primary particulate matter with an aerodynamic diameter less than or equal to 10 micrometers and 2.5 micrometers (PM_{10} and $\text{PM}_{2.5}$), ammonia (NH_3), and secondary organic aerosols (SOA). The 2007 and 2030 Base Case inventories are prepared by applying growth and control assumptions to the 1996 Base Year inventory. The 2007 and 2030 Control Case inventories are developed from the 2007 and 2030 Base Case inventories, respectively, by applying Tier 2 control assumptions to the on-highway vehicle and nonroad emission source sectors. The growth and control assumptions used to prepare the 2007 and 2030 inventories are documented in this report.

Chapters II through VII of this report document the inventories for the EGU, non-EGU point, stationary area, nonroad, and on-highway vehicle source sectors. The chapter for each emission sector documents the procedures and assumptions applied to prepare the mass emissions inventories for the 1996 Base Year, 2007 and 2030 Base Cases, and 2007 and 2030 Control Cases. Each chapter also discusses the procedures and assumptions applied to prepare the emissions input files for the EMS-95/SMOKE and EPS-2.5 air quality model preprocessors. Chapter VII provides emissions summaries and density maps for the emissions inventories.

CHAPTER II

ELECTRICITY GENERATING UNITS (EGUs)

A. 1996 BASE YEAR MASS EMISSIONS INVENTORY

The 1996 base year mass emissions inventory for EGUs is the 1996 National Emission Trends (NET) inventory (EPA, 1998a). Inventory records with Source Classification Codes (SCCs) of 101xxx and 201xxx were extracted to develop the EGU inventory.

B. 2007 AND 2030 FUTURE YEAR MASS EMISSIONS INVENTORIES

Projection year unit-level files were provided to Pechan-Avanti by EPA for the EGU sector. These files, developed based on output from the Integrated Planning Model (IPM), include heat input, sulfur dioxide (SO₂) emissions, NO_x emissions, and unit characteristics such as prime mover (boiler, gas turbine), primary fuel, bottom type, and firing type. This section focuses on the steps used to supplement these data by adding emissions of VOCs, CO, PM₁₀, PM_{2.5}, NH₃, and SOA, as well as adding data elements needed for modeling (e.g., location and stack parameters).

The data elements included in the IPM parsed data sets are shown in Table II-1. The data sets include unit level information for all existing or known planned units. For new units (additional capacity needed to meet generation demands), State level estimates by plant type (prime mover) and fuel type are provided. Processing of new capacity is discussed separately below.

1. County Identifiers

For those units with no county identifiers, counties available in cross-reference files developed for the NO_x State Implementation Plan (SIP) Call EGU file and other prior analyses were utilized to incorporate the county code. Plants were matched to other inventories by State and plant name in some cases. Others were matched to Energy Information Administration (EIA)-860 planned unit files to identify the county or to North American Electric Reliability Council (NERC) reports.

2. Latitude and Longitude

Latitude and longitude coordinates from other inventories, including the NET inventory and the Ozone Transport Assessment Group (OTAG) inventory, were used where units were matched to these inventories at the boiler or plant level. For all other units, county centroids were assigned.

**Table II-1
Data Elements Provided in EGU Projection Files
IPM Parsed Data Sets**

Data Elements	Description
Plant Name	Plant name
Plant Type	Combined cycle, coal steam, oil/gas steam, turbine, other
State Name	State name
State Code	Federal Information Processing Standard (FIPS) State code
County Name	County name (sometimes missing)
County Code	FIPS county code (sometimes missing)
ORIS Code	ORIS plant code for those units assigned codes, IPM plant code otherwise
Blr	ORIS boiler or unit code where available, otherwise IPM unit code
Capacity	Boiler/unit capacity (MW)
July Day Heat	July day heat input (BBtu/day)
Fuel Type	Primary fuel burned: coal, gas, natural gas, none, refuse, waste coal, wood waste
Bottom	Boiler bottom type: dry, wet, other, unknown, or blank
Firing	Firing type: cell, cyclone, tangential, vertical, well, wet, other, or unknown
Existing SO ₂ /NO _x Controls	Existing control for SO ₂ and/or NO _x - scrubbed, unscrubbed, or blank
Retrofit SO ₂ /NO _x Controls	Coal to combined cycle, gas reburn, oil/gas selective noncatalytic reduction (SNCR), oil/gas to combined cycle, retirement, coal selective catalytic reduction (SCR), coal scrubber, coal SNCR, or blank
Typical July Day NO _x	Typical July day NO _x emissions (tons/day)
Ash Content	Coal ash content (for fuel type - coal only)
Fuel Sum	5 month summer fuel use or heat input (TBtu)
Fuel Tot	Annual fuel use or heat input (TBtu)
NO _x Sum	5 month NO _x emissions (MTon)
NO _x Tot	Annual NO _x emissions (MTon)
SO ₂ Tot	Annual SO ₂ emissions (MTon)

3. SCC

The SCC is needed to determine the appropriate emission rates to use for the additional pollutants and to incorporate stack parameters for units which do not match to existing inventories. SCCs were assigned by first matching to existing inventories and then by assigning SCCs based on the unit, fuel, firing, and bottom types. In cases where SCCs taken from other inventories indicate a fuel other than that specified in the IPM unit-level file, SCCs were updated based on the indicated fuel, unit, bottom, and firing types.

4. Stack Parameters

Stack parameters were also added to the EGU file by matching to other inventories. For units where matches to other inventories could not be made, default parameters by SCC were assigned. These default parameters are shown in Table II-2. Stack flow rate and velocity were quality assured to ensure consistency between the two data elements and that the velocities were within acceptable modeling ranges (below 650 feet per second).

5. Emissions

Emissions of VOC, CO, PM₁₀, PM_{2.5}, NH₃, and SOA were added to the inventory. AP-42 (or updated) rates were applied to the reported heat input for each unit to calculate these emissions. For PM₁₀ and PM_{2.5}, the reported ash content was also utilized along with control efficiency data obtained from other inventories. A default PM efficiency of 80 percent was applied to all coal-fired units which did not match to other inventories. The emission rates used in this analysis are also shown in Table II-2.

6. New Units

The IPM data set provides projected heat input from new units, by prime mover and fuel type. This projected heat input is divided into individual new units based on the model plant parameters shown in Table II-3. New units are then allocated to existing unit sites based on a hierarchy that avoids ozone nonattainment areas (Pechan-Avanti, 1997a). After siting the units, SCCs were assigned based on prime mover and fuel type. Default stack parameters and emissions were added using the same methods applied for existing units.

C. MASS EMISSIONS INVENTORY AND PREPROCESSOR INPUT FILES

After adding the additional parameters to the IPM unit-level file, the final mass and modeling inventories were prepared. June and August daily heat input and emissions were added to the file for ozone modeling (the IPM file contains July heat input and emissions). This was based on monthly percentage profiles by State, prime mover, and fuel provided by EPA (Stella, 1999). The 5-month (May through September) heat input was allocated to the month and then divided by the number of days in the month. Summer season day emissions were allocated using the same procedure, assuming that the emission rate remained the same across these five months. The June and August daily heat input and emissions were incorporated into the mass and EMS-95 files. Table II-4 documents the names of the EGU mass and modeling files.

**Table II-2
Default Parameters for Utility Boilers**

Unit Type	Primary Fuel	Bottom Type	Firing Type	Ash Content (%)	SCC	PM ₁₀ Rate (lbs/MMBtu)	CO Rate (lbs/MMBtu)	VOC Rate (lbs/MMBtu)	Stack Temp. (degrees F)	Stack Height (feet)	Stack Diameter (feet)	Stack Flow (ft ³ /sec)
AB	Coal			all	10100217	0.3000	0.6923	0.0019	175	570	24	16286
CC	Gas			---	20100201	0.0133	0.1095	0.0120	300	280	12	2601
CT	Gas			---	20100201	0.0133	0.1095	0.0120	300	280	12	2601
ST	Gas			---	10100601	0.0029	0.0381	0.0013	300	280	12	2601
ST	Coal			5.46	10100202	0.4830	0.0192	0.0023	175	570	24	16286
ST	Coal	DRY	FRONT	5.92	10100202	0.5237	0.0192	0.0023	175	570	24	16286
ST	Coal	DRY	FRONT	6.22	10100202	0.5502	0.0192	0.0023	175	570	24	16286
ST	Coal	DRY	FRONT	9.58	10100202	0.8475	0.0192	0.0023	175	570	24	16286
ST	Coal	DRY	OPPOSED	9.85	10100202	0.8713	0.0192	0.0023	175	570	24	16286
ST	Coal	DRY	OPPOSED/CELL	9.32	10100202	0.8245	0.0192	0.0023	175	570	24	16286
ST	Coal	WET	CYCLONE	7.03	10100203	0.0703	0.0192	0.0042	175	570	24	16286
ST	Coal	WET	CYCLONE	10.21	10100203	0.1021	0.0192	0.0042	175	570	24	16286
ST	Coal	DRY	TANGENTIAL	9.92	10100212	0.8775	0.0192	0.0023	175	570	24	16286
ST	Coal	DRY	TANGENTIAL	16.63	10100212	1.4711	0.0192	0.0023	175	570	24	16286
ST	Coal	DRY	TANGENTIAL	21.18	10100212	1.8736	0.0192	0.0023	175	570	24	16286
ST	Oil			---	10100401	0.0190	0.0333	0.0051	300	290	12	3619
ST	Gas			---	10100601	0.0029	0.0381	0.0013	300	280	12	2601

**Table II-3
Model Plant Parameters for Projected New Utility Units**

Plant Parameters	Combined		
	Cycle	Gas Turbine	Coal
Fuel Type	Natural Gas	Natural Gas	Coal
Unit Capacity (megawatts)	225	80	500
SCC	20100201	20100201	10100201
Stack Height [feet (ft)]	280	280	570
Stack Diameter (ft)	12	12	24
Stack Temperature (F)	300	300	175
Exhaust Gas Flow Rate (ft ³ /sec)	2,601	2,601	16,286
Stack Gas Velocity (ft/sec)	23	23	36

**Table II-4
EGU Mass and Preprocessor Input Files**

Year	Mass	EPS2.5	EMS95	Comments
1996	EG96MSB.DBF	EG96EPSB.TXT	EG696EME.TGZ EG796EME.TGZ EG896EME.TGZ	For EMS95, June day For EMS95, July day For EMS95, August day
2007	EG07MS.DBF	EG07EPS.TXT	EG607EME.TGZ EG707EME.TGZ EG807EME.TGZ	For EMS95, June day For EMS95, July day For EMS95, August day
2030	EG30MS.DBF	EG30EPS.TXT	EG630EME.TGZ EG730EME.TGZ EG830EME.TGZ	For EMS95, June day For EMS95, July day For EMS95, August day

1. Mass Emission Inventory

The structure for the base year and projection year mass emission inventories is shown in Tables II-5 and II-6. The structures differ since the base year inventory was taken directly from the NET, while the projection year inventory was based on the IPM data set, which provides different information in some cases.

2. EPS-2.5 Files

The EPS-2.5 input files were derived directly from the mass emission files, utilizing the annual emissions. The structures for the base year and projection year files are shown in Tables II-7 and II-8.

3. EMS-95/SMOKE Files

The structure for the EGU EMS-95 input files is identical to the non-EGU point source files as shown in Chapter III. Also, the structures for the EMS-95 and SMOKE emissions preprocessor files are the same. In order to eliminate potential duplicate identifiers, the letter “e” was added to all stack and segment IDs in the EGU EMS-95 input files.

A weekly profile code of 8 was utilized for all EGU sources, consistent with files prepared for the NO_x SIP Call analysis. This assumes operation 7 days a week, with slightly lower utilization on the weekends.

Daily profile codes of 31 through 36 were applied based on a plant-level match file developed for the NO_x SIP Call analysis (Solomon, 1999). A default profile of 33 was applied to units which did not match to this cross-reference.

**Table II-5
Structure for 1996 EGU Mass Emissions File**

Variable	Type	Length	Decimals	Description
FIPSST	C	2	0	FIPS State Code
FIPSCNTY	C	3	0	FIPS County Code
PLANTID	C	15	0	State Plant ID
PLANTID5	C	5	0	State Plant ID (5 Digit)
POINTID	C	15	0	Point ID
POINTID5	C	5	0	Point ID (5 Digit)
STACKID	C	12	0	Stack ID
STACKID3	C	3	0	Stack ID (3 Digit)
ORISID	C	6	0	U.S. Department of Energy (DOE) Plant ID
BLRID	C	6	0	Boiler ID
SEGMENT	C	2	0	Segment ID
PLANT	C	40	0	Plant Name
SCC	C	10	0	SCC
STKHGT	N	4	0	Stack Height (ft)
STKDIAM	N	6	2	Stack Diameter (ft)
STKTEMP	N	4	0	Stack Temperature (degrees F)
STKFLOW	N	10	2	Stack Flow Rate (cubic feet per second)
STKVEL	N	9	2	Stack Velocity (ft/sec)
BOILCAP	N	8	2	Boiler Design Capacity
CAP_UNITS	C	1	0	Capacity Unit Code
WINTHRU	N	3	0	Winter Thruput (%)
SPRTHRU	N	3	0	Spring Thruput (%)
SUMTHRU	N	3	0	Summer Thruput (%)
FALTHRU	N	3	0	Fall Thruput (%)
HOURS	N	2	0	Hours per Day
START_HR	N	2	0	Hourly Start Time
DAYS	N	1	0	Days per Week
WEEKS	N	2	0	Weeks per Year
THRUPUT	N	11	1	Throughput Rate (SCC units/year)
MAXRATE	N	12	3	Maximum Ozone Season Rate (units/day)
HEATCON	N	8	2	Heat Content (MMBtu/SCC unit)
SULFCON	N	5	2	Sulfur Content (mass percent)
ASHCON	N	5	2	Ash Content (mass percent)
NETDC	N	9	3	Maximum Nameplate Capacity (MW)
SIC	N	4	0	Standard Industrial Classification (SIC) Code
LATC	N	9	4	Latitude (degrees)
LONC	N	9	4	Longitude (degrees)
VOC_EMF	N	11	4	VOC Emission Factor (SCC units)
NOX_EMF	N	11	4	NO _x Emission Factor (SCC units)

Table II-5 (continued)

Variable	Type	Length	Decimals	Description
CO_EMF	N	11	4	CO Emission Factor (SCC units)
SO2_EMF	N	11	4	SO ₂ Emission Factor (SCC units)
PM10_EMF	N	11	4	PM ₁₀ Emission Factor (SCC units)
PM25_EMF	N	11	4	PM _{2.5} Emission Factor (SCC units)
NH3_EMF	N	11	4	NH ₃ Emission Factor (SCC units)
VOC_CE	N	7	2	VOC Control Efficiency (%)
NOX_CE	N	7	2	NO _x Control Efficiency (%)
CO_CE	N	7	2	CO Control Efficiency (%)
SO2_CE	N	7	2	SO ₂ Control Efficiency (%)
PM10_CE	N	7	2	PM ₁₀ Control Efficiency (%)
PM25_CE	N	7	2	PM _{2.5} Control Efficiency (%)
NH3_CE	N	7	2	NH ₃ Control Efficiency (%)
VOC_CPRI	N	3	0	VOC Primary Control Equipment Code
NOX_CPRI	N	3	0	NO _x Primary Control Equipment Code
CO_CPRI	N	3	0	CO Primary Control Equipment Code
SO2_CPRI	N	3	0	SO ₂ Primary Control Equipment Code
PM10_CPRI	N	3	0	PM ₁₀ Primary Control Equipment Code
PM25_CPRI	N	3	0	PM _{2.5} Primary Control Equipment Code
NH3_CPRI	N	3	0	NH ₃ Primary Control Equipment Code
VOC_CSEC	N	3	0	VOC Secondary Control Equipment Code
NOX_CSEC	N	3	0	NO _x Secondary Control Equipment Code
CO_CSEC	N	3	0	CO Secondary Control Equipment Code
SO2_CSEC	N	3	0	SO ₂ Secondary Control Equipment Code
PM10_CSEC	N	3	0	PM ₁₀ Secondary Control Equipment Code
PM25_CSEC	N	3	0	PM _{2.5} Secondary Control Equipment Code
NH3_CSEC	N	3	0	NH ₃ Secondary Control Equipment Code
VOC_ANN	N	13	4	Annual VOC (tons)
NOX_ANN	N	13	4	Annual NO _x (tons)
CO_ANN	N	13	4	Annual CO (tons)
SO2_ANN	N	13	4	Annual SO ₂ (tons)
PM10_ANN	N	13	4	Annual PM ₁₀ (tons)
PM25_ANN	N	13	4	Annual PM _{2.5} (tons)
SOA_ANN	N	13	4	Annual SOA (tons)
NH3_ANN	N	13	4	Annual NH ₃ (tons)
VOC_OSD06	N	13	4	June Day VOC (tons)
NOX_OSD06	N	13	4	June Day NO _x (tons)
CO_OSD06	N	13	4	June Day CO (tons)
SO2_OSD06	N	13	4	June Day SO ₂ (tons)
PM10_OSD06	N	13	4	June Day PM ₁₀ (tons)
PM25_OSD06	N	13	4	June Day PM _{2.5} (tons)

Table II-5 (continued)

Variable	Type	Length	Decimals	Description
SOA_OSD06	N	13	4	June Day SOA (tons)
NH3_OSD06	N	13	4	June Day NH ₃ (tons)
VOC_OSD07	N	13	4	July Day VOC (tons)
NOX_OSD07	N	13	4	July Day NO _x (tons)
CO_OSD07	N	13	4	July Day CO (tons)
SO2_OSD07	N	13	4	July Day SO ₂ (tons)
PM10_OSD07	N	13	4	July Day PM ₁₀ (tons)
PM25_OSD07	N	13	4	July Day PM _{2.5} (tons)
SOA_OSD07	N	13	4	July Day SOA (tons)
NH3_OSD07	N	13	4	July Day NH ₃ (tons)
VOC_OSD08	N	13	4	August Day VOC (tons)
NOX_OSD08	N	13	4	August Day NO _x (tons)
CO_OSD08	N	13	4	August Day CO (tons)
SO2_OSD08	N	13	4	August Day SO ₂ (tons)
PM10_OSD08	N	13	4	August Day PM ₁₀ (tons)
PM25_OSD08	N	13	4	August Day PM _{2.5} (tons)
SOA_OSD08	N	13	4	August Day SOA (tons)
NH3_OSD08	N	13	4	August Day NH ₃ (tons)
VOC_RE	N	3	0	VOC Rule Effectiveness (%)
NOX_RE	N	3	0	NO _x Rule Effectiveness (%)
CO_RE	N	3	0	CO Rule Effectiveness (%)
SO2_RE	N	3	0	SO ₂ Rule Effectiveness (%)
PM10_RE	N	3	0	PM ₁₀ Rule Effectiveness (%)
PM25_RE	N	3	0	PM _{2.5} Rule Effectiveness (%)
NH3_RE	N	3	0	NH ₃ Rule Effectiveness (%)

**Table II-6
Structure for 2007 and 2030 EGU Mass Emissions Files**

Variable	Type	Length	Decimals	Description
FIPSST	C	2	0	FIPS State Code
FIPSCNTY	C	3	0	FIPS County Code
PLANTID	C	15	0	State Plant ID
POINTID	C	15	0	Point ID
STACKID	C	12	0	Stack ID
SEGMENT	C	2	0	Segment ID
PLANT	C	40	0	Plant Name
SCC	C	10	0	SCC
STKHGT	N	4	0	Stack Height (ft)
STKDIAM	N	6	2	Stack Diameter (ft)
STKTEMP	N	4	0	Stack Temperature (degrees F)
STKFLOW	N	10	2	Stack Flow Rate (cubic feet per second)
STKVEL	N	9	2	Stack Velocity (ft/sec)
BOILCAP	N	8	2	Boiler Design Capacity
LAT	N	9	4	Latitude (degrees)
LON	N	9	4	Longitude (degrees)
ANNHEAT	N	9	0	Annual Heat Input (MMBtu)
WINHEAT	N	9	0	7 Month Winter Heat Input (MMBtu)
SUMHEAT	N	9	0	5 Month Summer Heat Input (MMBtu)
JUNDHEAT	N	9	0	June Daily Heat Input (MMBtu)
JULDHEAT	N	9	0	July Daily Heat Input (MMBtu)
AUGDHEAT	N	9	0	August Daily Heat Input (MMBtu)
VOC_ANN	N	10	4	Annual VOC (tons)
VOC_WIN	N	10	4	7 Month Winter VOC (tons)
VOC_SUM	N	10	4	5 Month Summer VOC (tons)
VOC_OSD06	N	10	4	June Day VOC (tons)
VOC_OSD07	N	10	4	July Day VOC (tons)
VOC_OSD08	N	10	4	August Day VOC (tons)
NOX_ANN	N	10	4	Annual NO _x (tons)
NOX_WIN	N	10	4	7 Month Winter NO _x (tons)
NOX_SUM	N	10	4	5 Month Summer NO _x (tons)
NOX_OSD06	N	10	4	June Day NO _x (tons)
NOX_OSD07	N	10	4	July Day NO _x (tons)
NOX_OSD08	N	10	4	August Day NO _x (tons)
CO_ANN	N	10	4	Annual CO (tons)
CO_WIN	N	10	4	7 Month Winter CO (tons)
CO_SUM	N	10	4	5 Month Summer CO (tons)
CO_OSD06	N	10	4	June Day CO (tons)
CO_OSD07	N	10	4	July Day CO (tons)

Table II-6 (continued)

Variable	Type	Length	Decimals	Description
CO_OSD08	N	10	4	August Day CO (tons)
SO2_ANN	N	10	4	Annual SO ₂ (tons)
SO2_WIN	N	10	4	7 Month Winter SO ₂ (tons)
SO2_SUM	N	10	4	5 Month Summer SO ₂ (tons)
SO2_OSD06	N	10	4	June Day SO ₂ (tons)
SO2_OSD07	N	10	4	July Day SO ₂ (tons)
SO2_OSD08	N	10	4	August Day SO ₂ (tons)
PM10_ANN	N	10	4	Annual PM ₁₀ (tons)
PM10_WIN	N	10	4	7 Month Winter PM ₁₀ (tons)
PM10_SUM	N	10	4	5 Month Summer PM ₁₀ (tons)
PM10_OSD06	N	10	4	June Day PM ₁₀ (tons)
PM10_OSD07	N	10	4	July Day PM ₁₀ (tons)
PM10_OSD08	N	10	4	August Day PM ₁₀ (tons)
PM25_ANN	N	10	4	Annual PM _{2.5} (tons)
PM25_WIN	N	10	4	7 Month Winter PM _{2.5} (tons)
PM25_SUM	N	10	4	5 Month Summer PM _{2.5} (tons)
PM25_OSD06	N	10	4	June Day PM _{2.5} (tons)
PM25_OSD07	N	10	4	July Day PM _{2.5} (tons)
PM25_OSD08	N	10	4	August Day PM _{2.5} (tons)
NH3_ANN	N	10	4	Annual NH ₃ (tons)
NH3_WIN	N	10	4	7 Month Winter NH ₃ (tons)
NH3_SUM	N	10	4	5 Month Summer NH ₃ (tons)
NH3_OSD06	N	10	4	June Day NH ₃ (tons)
NH3_OSD07	N	10	4	July Day NH ₃ (tons)
NH3_OSD08	N	10	4	August Day NH ₃ (tons)
SOA_ANN	N	10	4	Annual SOA (tons)
SOA_WIN	N	10	4	7 Month Winter SOA (tons)
SOA_SUM	N	10	4	5 Month Summer SOA (tons)
SOA_OSD06	N	10	4	June Day SOA (tons)
SOA_OSD07	N	10	4	July Day SOA (tons)
SOA_OSD08	N	10	4	August Day SOA (tons)

Table II-7
1996 EGU EPS-2.5 Input File Structure

Variable	Type	Length	Decimals	Description
FIPSST	C	2	0	FIPS State Code
FIPSCNTY	C	3	0	FIPS County Code
PLANTID	C	5	0	State Plant ID
POINTID	C	5	0	Point ID
SIC	N	4	0	SIC Code
STACKID	C	3	0	Stack ID
SEGMENT	C	2	0	Segment ID
SCC	C	8	0	SCC
STKHGT	N	4	0	Stack Height (ft)
STKDIAM	N	6	2	Stack Diameter (ft)
STKTEMP	N	4	0	Stack Temperature (degrees F)
STKFLOW	N	10	2	Stack Flow Rate (cubic feet per second)
WINTHRU	N	3	0	Winter Thruput (%)
SPRTHRU	N	3	0	Spring Thruput (%)
SUMTHRU	N	3	0	Summer Thruput (%)
FALTHRU	N	3	0	Fall Thruput (%)
HOURS	N	2	0	Hours per Day
DAYS	N	1	0	Days per Week
WEEKS	N	2	0	Weeks per Year
LATC	N	9	4	Latitude (degrees)
LONC	N	9	4	Longitude (degrees)
VOC	N	9	3	Annual VOC (tons)
NOX	N	9	3	Annual NO _x (tons)
CO	N	9	3	Annual CO (tons)
SO2	N	9	3	Annual SO ₂ (tons)
PM10	N	9	3	Annual PM ₁₀ (tons)
PM25	N	9	3	Annual PM _{2.5} (tons)
SOA	N	9	3	Annual SOA (tons)
NH3	N	9	3	Annual NH ₃ (tons)

**Table II-8
2007 and 2030 EGU EPS-2.5 Input File Structure**

Variable	Type	Length	Decimals	Description
ORISID	C	6		ORIS Plant ID
BLRID	C	6		ORIS Boiler ID
SEGMENT	C	2		Segment ID
STACKID	C	6		Stack ID
STKHGT	N	4	0	Stack Height (ft)
STKDIAM	N	6	2	Stack Diameter (ft)
STKTEMP	N	4	0	Stack Temperature (degrees F)
STKFLOW	N	10	2	Stack Flow Rate (cubic feet per second)
IPMCAP	N	9	1	IPM Boiler Capacity (MW)
SCC	C	8		SCC
FIPSST	C	2		FIPS State Code
FIPSCNTY	C	3		FIPS County Code
LATC	N	9	4	Latitude (degrees)
LONGC	N	9	4	Longitude (degrees)
WINHEAT	N	9	3	Winter Heat Input (trillion Btu/7 months)
SUMHEAT	N	9	3	Summer Heat Input (trillion Btu/5 months)
WINVOC	N	9	3	Winter VOC (tons)
SUMVOC	N	9	3	Summer VOC (tons)
WINNOX	N	9	3	Winter NO _x (tons)
SUMNOX	N	9	3	Summer NO _x
WINCO	N	9	3	Winter CO
SUMCO	N	9	3	Summer CO
WINSO2	N	9	3	Winter SO ₂
SUMSO2	N	9	3	Summer SO ₂
WINPM10	N	9	3	Winter PM ₁₀
SUMPM10	N	9	3	Summer PM ₁₀
WINPM2.5	N	9	3	Winter PM _{2.5}
SUMPM2.5	N	9	3	Summer PM _{2.5}
WINNH3	N	9	3	Winter NH ₃
SUMNH3	N	9	3	Summer NH ₃
WINSOA	N	9	3	Winter SOA
SUMSOA	N	9	3	Summer SOA
PNAME	C	30		Plant Name

CHAPTER III NON-EGU POINT SOURCES

A. 1996 BASE YEAR MASS EMISSIONS INVENTORY

The 1996 NET inventory was utilized for non-EGU point sources. This inventory includes both annual and SSD emissions. Units with SCCs of 101xxx or 201xxx were excluded from the non-EGU inventory because they are included in the EGU inventory.

SOA emissions were added to the inventory. SOA emissions were calculated using fractional aerosol coefficients based on speciation of the VOC emissions (Grosjean and Seinfeld, 1989). Several updates to the 1996 NET inventory were also incorporated into the 1996 base year emissions inventory. Latitude and longitude coordinates for some sources were corrected. Stack parameters were also corrected for several sources.

For some sources, multiple SCCs were listed under a single point, stack, and segment. New non-duplicate segment IDs were created for the emissions file, so that each record had a unique identification code for inclusion in the emissions preprocessor input files.

B. 2007 AND 2030 FUTURE YEAR MASS EMISSIONS INVENTORIES

To calculate emission projections, emissions were grown from the 1996 base year mass emission inventory to 2007 and 2030 utilizing Bureau of Economic Analysis (BEA) gross state product (GSP) growth factors at the State level by 2-digit Standard Industrial Classification (SIC) code. Control measures reflecting Clean Air Act (CAA) requirements were then incorporated. Two separate mass inventories were created for each year to reflect emissions without and with NO_x SIP Call control requirements. The air quality modelers will then select the appropriate file depending on the season which they are modeling.

1. Growth Assumptions

The 1995 BEA GSP projections by 2-digit SIC code were applied to estimate changes in activity between 1996 and 2007 and 2030 for the point source sector. Growth for the point source sector was distributed among existing sources according to their base year uncontrolled emissions. After applying the changes in activity, additional controls were added to reflect the alternative scenarios.

EPA guidance for projecting emissions (EPA, 1991) lists the following economic variables (in order of preference) for projecting emissions:

- product output;
- value added;

- earnings; and
- employment.

In the absence of product output projections, EPA guidance recommends value added projections. *Value added* is the difference between the value of industry outputs and inputs. BEA GSP projections represent a measure of value added, and are a fuller measure of growth than BEA's earnings projections because earnings represents only one component of GSP. GSP measures reflect the value added to revenue from selling a product minus the amounts paid for inputs from other firms. By incorporating inputs to production, GSP reflects future changes in production processes, efficiency, and technological changes. A comparison of BEA's 1995 GSP projections and BEA's 1990 earnings projections indicates that GSP growth factors are slightly higher than the earnings data. This is most often true for capital-intensive industries (e.g., manufacturing) than for labor-intensive industries (e.g., services). Components of GSP include payments to capital. This is an important distinction to make because it implicitly reflects the effect of factor substitution in production. As discussed in EPA's projections guidance, factor substitution should be included in growth projections, making value added data preferable to earnings data for projecting emissions.

The 1995 BEA industry GSP projections by State (BEA, 1995) are available at the 2-digit SIC code level. For each record in the industrial point source component of the base year inventory, a link was established between the State code, the SIC code field, and the BEA GSP growth factors. National BEA GSP growth factors by industry are listed in Table III-1.

For fuel combustion sources, energy adjustment factors were also applied to the baseline projections. These factors, developed from the U.S. Department of Energy (DOE) publication *Annual Energy Outlook 1997*, account for increases in fuel and process efficiency in future years. Basically, less fuel will be needed to provide the same amount of energy (generally in the form of steam) to an industrial process and the amount of energy needed per unit output will also decrease as processes become more efficient. These adjustments were based on those used in the NET projections (EPA, 1998a).

2. Control Assumptions

Since the base year inventory for this effort is 1996, reasonably available control technology (RACT) requirements were assumed to have already been implemented. So, for stationary sources, CAA controls include Federal initiatives as shown in Table III-2 for point sources. Maximum achievable control technology (MACT) controls were also included as shown in Tables III-3 and III-4.

NO_x emissions for the 23 States (22 States plus the District of Columbia) covered by the NO_x SIP Call were also reduced to reflect the NO_x SIP Call requirements. The NO_x SIP Call controls were applied to the 2007 projection inventory. For the 2030 projection, sources affected by the NO_x SIP Call were capped at 2007 emission levels.

The NO_x SIP Call was modeled by first identifying the sources in the inventory which are large, and are within the source categories covered under the SIP Call. Where boiler capacities are provided in the inventory, these were used to identify large sources for

**Table III-1
BEA National GSP Growth Forecasts**

Industry (SIC Code)	Annual Growth (% per year) 1996 to 2007	Annual Growth (% per year) 1996 to 2030
All-Industry Total		
Farm (01)	2.0	2.2
Nonfarm (02)	2.0	2.2
Agricultural services (07, 08, 09)	4.6	6.2
Mining (10, 12, 13, 14)		
Metal mining (10)	3.8	4.8
Coal mining (12)	3.0	3.3
Oil and gas extraction (13)	0.1	0.3
Nonmetallic minerals (14)	1.4	2.0
Construction (15, 16, 17)	1.3	1.6
Manufacturing (20 - 39)	1.3	1.9
Durable goods		
Lumber and wood products (24)	0.6	1.1
Furniture and fixtures (25)	1.8	2.4
Stone, clay, and glass products (32)	0.9	1.5
Primary metals (33)	0.4	0.7
Fabricated metals (34)	0.7	1.2
Industrial machinery (35)	3.9	4.2
Electronic equipment (36)	2.4	2.9
Motor vehicles and equipment (371)	1.1	1.6
Other transportation equipment (37)	2.6	3.5
Instruments and related products (38)	1.4	2.4
Miscellaneous manufacturing (39)	1.9	2.6
Nondurable goods		
Food and kindred products (20)	1.3	2.0
Tobacco products (21)	-2.7	-2.2
Textile mill products (22)	1.2	1.7
Apparel and other textile products (23)	1.8	2.1
Paper products (26)	2.2	3.0
Printing and publishing (27)	0.6	1.0
Chemicals and allied products (28)	1.5	2.3
Petroleum and coal products (29)	1.2	1.9
Rubber and plastics products (30)	3.4	4.7
Leather and leather products (31)	-0.1	-0.1

Table III-1 (continued)

Industry (SIC Code)	Annual Growth (% per year) 1996 to 2007	Annual Growth (% per year) 1996 to 2030
Transportation and Public Utilities (40 - 49)		
Railroad transportation (40)	3.5	4.1
Local and interurban transit (41)	1.8	2.2
Trucking and warehousing (42)	2.3	3.1
Water transportation (44)	0.1	0.5
Transportation by air (45)	4.0	5.2
Pipelines (46)	1.0	1.3
Transportation services (47)	3.4	4.1
Communications (48)	3.2	4.3
Utilities (49)	2.1	2.8
Wholesale and Retail Trade (50 - 59)		
Wholesale trade (50, 51)	2.7	3.5
Retail trade (52 - 59)	2.3	3.1
Finance, Insurance, and Real Estate (60 - 67)		
Banks and investment (60, 61, 62, 67)	3.2	4.1
Insurance (63, 64)	2.1	3.1
Real estate (65)	2.2	3.1
Services (70 - 89)		
Hotels and other lodging (70)	2.3	3.2
Personal services (72)	1.1	1.6
Business services (73)	3.3	4.1
Auto repair and parking (75)	1.8	2.3
Amusement (79)	3.3	4.2
Health services (80)	2.6	3.4
Legal services (81)	1.6	2.1
Educational services (82)	2.0	2.7
Social services (83)	3.2	4.1
Private households (88)	1.0	1.4
Other services (84, 86, 89)	3.1	4.1
Government		
Federal, civilian	0.3	0.8
Federal, military	-0.1	0.6
State and local	1.5	2.0
Population	1.0	1.3

SOURCE: Developed from BEA, 1995.

**Table III-2
Point Source CAA Baseline Control Assumptions**

Source Category	Pollutant	Control Efficiency (%)*
National Rules		
Marine vessel loading: petroleum liquids	VOC	80
Treatment, storage, and disposal facilities (TSDFs)	VOC	96
Municipal solid waste landfills	VOC	82

NOTE: *From uncontrolled levels.

**Table III-3
Point Source MACT Control Assumptions**

Source Category	VOC Control Efficiency (%)*
Benzene National Emission Standards for Hazardous Air Pollutants (NESHAP) (national)	
By-product coke mfg	85
By-product coke - flushing-liquor circulation tank	95
By-product coke - excess-NH ₃ liquor tank	98
By-product coke mfg. - tar storage	98
By-product coke mfg. - light oil sump	98
By-product coke mfg. - light oil dec/cond vents	98
By-product coke mfg. - tar bottom final cooler	81
By-product coke mfg. - naphthalene processing	100
By-product coke mfg. - equipment leaks	83
By-product coke manufacture - other	94
By-product coke manufacture - oven charging	94
Coke ovens - door and topside leaks	94
Coke oven by-product plants	94
2-Year MACT (national)	
Synthetic Organic Chemical Manufacturing Industry (SOCMI) Hazardous Organic NESHAP (HON)	
-- SOCMI processes	79
-- Volatile organic liquid storage	95
-- SOCMI fugitives (equipment leak detection and repair)	60
-- SOCMI wastewater	0
-- Ethylene oxide manufacture	98
-- Phenol manufacture	98
-- Acrylonitrile manufacture	98
-- Polypropylene manufacture	98
-- Polyethylene manufacture	98
-- Ethylene manufacture	98
Dry Cleaning	
-- Perchloroethylene	95
-- Other	70
4-Year MACT (national)	
TSDFs (offsite waste operations)	96
Shipbuilding and repair	24
Polymers and resins II	78
Polymers and resins IV	70
Styrene-butadiene rubber manufacture (polymers & resins group I)	70
Wood furniture surface coating	30
Aircraft surface coating (aerospace)	60
Petroleum Refineries: other sources	
-- Fixed roof petroleum product tanks	98
-- Fixed roof gasoline tanks	96
-- External floating roof petroleum product tanks	90
-- External floating roof gasoline tanks	95
-- Petroleum refinery wastewater treatment	72
-- Petroleum refinery fugitives	72
-- Petroleum refineries - Blowdown w/o control	78
-- Vacuum distillation	72

Table III-3 (continued)

Source Category	VOC Control Efficiency (%)*
Halogenated Solvent Cleaners	
-- Open top degreasing - halogenated	63
-- In-line (conveyorized) degreasing - halogenated	39
Printing	
-- Flexographic	32
-- Gravure	27
Gasoline Marketing	
-- Storage	5
-- Splash loading	99
-- Balanced loading	87
-- Submerged loading	99
-- Transit	5
-- Leaks	39
7/10-Year MACT (national)	
Paint and varnish manufacture	35
Rubber tire manufacture	70
Green tire spray	90
Automobile surface coating	79
Beverage can surface coating	57
Paper surface coating	78
Flatwood surface coating	90
Fabric printing	80
Metal surface coating	90
Plastic parts surface coating	45
Pulp and paper production	70
Agricultural chemical production	79
Pharmaceutical production	79
Polyesters	70
Fabric coating	70
Petroleum refineries - fluid catalytic cracking	70
Oil and natural gas production	90
Explosives	70
Plywood/particle board	70
Reinforced plastics	70
Publicly-Owned Treatment Works (POTWs)	70
Phthalate plasticizers	70
Polymers and resins III	78
Rayon production	70
Polyvinyl chloride	70
Spandex production	70
Nylon 6 production	70
Alkyd resins	70
Polyester resins	70
Chelating agents	70

NOTE: *From uncontrolled levels.

**Table III-4
Non-VOC Related MACT Assumptions**

Source Category	Pollutant	Percentage Reduction (%)*
Municipal Waste Combustors	PM	30
	SO ₂	50
Cement Manufacturing	PM	90
Secondary Aluminum	PM	90
Medical Waste Incineration	PM	88
	NO _x	20
	SO ₂	20
Hazardous Waste Incineration	PM	36

NOTE: *From uncontrolled levels.

boilers and gas turbines. If boiler capacities were not provided, the default SCC/emission crosswalk utilized in the NO_x SIP Call was applied to determine sources where the boiler capacity is expected to be above 250 million British thermal units (MMBtu) per hour. For internal combustion engines and cement manufacturing, any source which is greater than 1 ton per day (tpd) was designated as large. Once the assignments were completed based on this procedure, a State-by-State comparison of large source emissions was made between the NET inventory and the NO_x SIP Call inventory to identify major differences. Where major differences occurred, emissions were compared at the county level and adjustments were made to align the two data sets better. For some States, the data sets did not align well on a unit basis, so these adjustments were based solely on attempting to adjust the emissions for the large sources, so that the State emissions totals match, to the extent possible. For States where the plant and unit IDs align between the two data sets, designation of large was based on the NO_x SIP Call inventory.

Once the large sources were determined, the following percentages were applied according to the source category affected:

Industrial Boilers	60%
Gas Turbines	60%
Internal Combustion Engines	90%
Cement Manufacturing	30%

NO_x SIP Call controls were applied on an annual basis in this analysis. To truly reflect the effect of NO_x SIP Call requirements, the affected sources should only be controlled during the 5-month ozone season, with no NO_x SIP Call controls in operation during the 7-month winter season. Two files were prepared for the modelers – one without NO_x SIP Call controls and one with NO_x SIP Call controls. The modelers will select the appropriate file depending on what season they are modeling. A third file, which combines the NO_x emissions of the SIP Call and No SIP Call scenarios, was prepared to estimate annual emissions for PM Air Quality modeling. The methodology that was developed applies annual NO_x emission reductions for point sources with controls expected to operate for 12 months/year. Five month reductions were applied to source types with controls expected to operate only during the ozone season. This is necessary to estimate accurate annual emissions since controls such as low NO_x burners can not be turned off in the winter. Below is a listing of the source types and major control technology assumed for each category.

Annual Controls

Industrial boilers (except coal-fired) - low-NO_x burners (LNB), and LNB plus flue-gas recirculation

Turbines - LNB plus water injection

Cement kilns (wet) - mid-kiln firing

Reciprocating internal combustion engines - selective catalytic reduction (SCR)

Seasonal Controls

Industrial boilers (coal-fired) - SCR or SNCR

Cement kilns (wet and coal)- SCR or SNCR

C. MASS EMISSIONS INVENTORY AND PREPROCESSOR INPUT FILES

Three new variables were added to the structures of the mass emissions inventories. Unique 5 character IDs for plant and point, and unique 3 character IDs for stack were added to facilitate the transition from mass to preprocessor input files. Table III-5 documents the names of the non-EGU mass and preprocessor input files.

**Table III-5
Non-EGU Point Source Mass and Preprocessor Input Files**

Year	Mass	EPS-2.5	EMS-95	Comments
1996	PT96MS.DBF	PT96EPS.TXT	PT96EM.TGZ	
2007	PT07MSA.DBF PT07MSB.DBF PT07MSC.DBF	PT07EPA.TXT PT07EPB.TXT	PT07EMB.TGZ	Files ending in "A" exclude NO _x SIP Call controls. Files ending in "B" include NO _x SIP Call controls. Files ending in "C" include annual emissions estimates.
2030	PT30MSA.DBF PT30MSB.DBF PT30MSC.DBF	PT30EPA.TXT PT30EPB.TXT	PT30EMB.TGZ	Files ending in "A" exclude NO _x SIP Call controls. Files ending in "B" include NO _x SIP Call controls. Files ending in "C" include annual emissions estimates.

1. Mass Emission Inventories

The structures for the mass emission inventories are detailed in Tables III-6 and III-7, as the base year and future year inventories differed. Data elements included in the base year file and excluded from the future year files include the pollutant emission factor (-EMF), primary control equipment code (-CPRI), and secondary control equipment code (-CSEC).

2. EPS-2.5 Input Files

Input files for EPS-2.5 limit the width of plant and point IDs to 5 characters, so the unique 5-character IDs were used in the EPS-2.5 mass files. The unique 3-character IDs for stack were also used because of limitations on the data field width for stack ID. The structure for the EPS-2.5 input files is detailed in Table III-8.

**Table III-6
Structure for 1996 Base Year Non-EGU Mass Emissions File**

Variable	Type	Length	Decimals	Description
FIPSST	C	2	0	FIPS State Code
FIPSCNTY	C	3	0	FIPS County Code
PLANTID	C	15	0	State Plant ID
PLANTID5	C	5	0	State Plant ID (5 Digit)
POINTID	C	15	0	Point ID
POINTID5	C	5	0	Point ID (5 Digit)
STACKID	C	12	0	Stack ID
STACKID3	C	3	0	Stack ID (3 Digit)
ORISID	C	6	0	DOE Plant ID
BLRID	C	6	0	Boiler ID
SEGMENT	C	2	0	Segment ID
PLANT	C	40	0	Plant Name
SCC	C	10	0	SCC
STKHGT	N	4	0	Stack Height (ft)
STKDIAM	N	6	2	Stack Diameter (ft)
STKTEMP	N	4	0	Stack Temperature (degrees F)
STKFLOW	N	10	2	Stack Flow Rate (cubic feet per second)
STKVEL	N	9	2	Stack Velocity (ft/sec)
BOILCAP	N	8	2	Boiler Design Capacity
CAP_UNITS	C	1	0	Capacity Unit Code
WINTHRU	N	3	0	Winter Thruput (%)
SPRTHRU	N	3	0	Spring Thruput (%)
SUMTHRU	N	3	0	Summer Thruput (%)
FALTHRU	N	3	0	Fall Thruput (%)
HOURS	N	2	0	Hours per Day
START_HR	N	2	0	Hourly Start Time
DAYS	N	1	0	Days per Week
WEEKS	N	2	0	Weeks per Year
THRUPUT	N	11	1	Throughput Rate (SCC units/year)
MAXRATE	N	12	3	Maximum Ozone Season Rate (units/day)
HEATCON	N	8	2	Heat Content (MMBtu/SCC unit)
SULFCON	N	5	2	Sulfur Content (mass percent)
ASHCON	N	5	2	Ash Content (mass percent)
NETDC	N	9	3	Maximum Nameplate Capacity (MW)
SIC	N	4	0	SIC Code
LATC	N	9	4	Latitude (degrees)
LONC	N	9	4	Longitude (degrees)
VOC_EMF	N	11	4	VOC Emission Factor (SCC units)
NOX_EMF	N	11	4	NO _x Emission Factor (SCC units)
CO_EMF	N	11	4	CO Emission Factor (SCC units)
SO2_EMF	N	11	4	SO ₂ Emission Factor (SCC units)
PM10_EMF	N	11	4	PM ₁₀ Emission Factor (SCC units)
PM25_EMF	N	11	4	PM _{2.5} Emission Factor (SCC units)
NH3_EMF	N	11	4	NH ₃ Emission Factor (SCC units)
VOC_CE	N	7	2	VOC Control Efficiency (%)
NOX_CE	N	7	2	NO _x Control Efficiency (%)

Table III-6 (continued)

Variable	Type	Length	Decimals	Description
CO_CE	N	7	2	CO Control Efficiency (%)
SO2_CE	N	7	2	SO ₂ Control Efficiency (%)
PM10_CE	N	7	2	PM ₁₀ Control Efficiency (%)
PM25_CE	N	7	2	PM _{2.5} Control Efficiency (%)
NH3_CE	N	7	2	NH ₃ Control Efficiency (%)
VOC_CPRI	N	3	0	VOC Primary Control Equipment Code
NOX_CPRI	N	3	0	NO _x Primary Control Equipment Code
CO_CPRI	N	3	0	CO Primary Control Equipment Code
SO2_CPRI	N	3	0	SO ₂ Primary Control Equipment Code
PM10_CPRI	N	3	0	PM ₁₀ Primary Control Equipment Code
PM25_CPRI	N	3	0	PM _{2.5} Primary Control Equipment Code
NH3_CPRI	N	3	0	NH ₃ Primary Control Equipment Code
VOC_CSEC	N	3	0	VOC Secondary Control Equipment Code
NOX_CSEC	N	3	0	NO _x Secondary Control Equipment Code
CO_CSEC	N	3	0	CO Secondary Control Equipment Code
SO2_CSEC	N	3	0	SO ₂ Secondary Control Equipment Code
PM10_CSEC	N	3	0	PM ₁₀ Secondary Control Equipment Code
PM25_CSEC	N	3	0	PM _{2.5} Secondary Control Equipment Code
NH3_CSEC	N	3	0	NH ₃ Secondary Control Equipment Code
VOC_ANN	N	13	4	Annual VOC (tons)
NOX_ANN	N	13	4	Annual NO _x (tons)
CO_ANN	N	13	4	Annual CO (tons)
SO2_ANN	N	13	4	Annual SO ₂ (tons)
PM10_ANN	N	13	4	Annual PM ₁₀ (tons)
PM25_ANN	N	13	4	Annual PM _{2.5} (tons)
SOA_ANN	N	13	4	Annual SOA (tons)
NH3_ANN	N	13	4	Annual NH ₃ (tons)
VOC OSD	N	13	4	Summer Season Daily VOC (tons)
NOX OSD	N	13	4	Summer Season Daily NO _x (tons)
CO OSD	N	13	4	Summer Season Daily CO (tons)
SO2 OSD	N	13	4	Summer Season Daily SO ₂ (tons)
PM10 OSD	N	13	4	Summer Season Daily PM ₁₀ (tons)
PM25 OSD	N	13	4	Summer Season Daily PM _{2.5} (tons)
SOA OSD	N	13	4	Summer Season Daily SOA (tons)
NH3 OSD	N	13	4	Summer Season Daily NH ₃ (tons)
VOC_RE	N	3	0	VOC Rule Effectiveness (%)
NOX_RE	N	3	0	NO _x Rule Effectiveness (%)
CO_RE	N	3	0	CO Rule Effectiveness (%)
SO2_RE	N	3	0	SO ₂ Rule Effectiveness (%)
PM10_RE	N	3	0	PM ₁₀ Rule Effectiveness (%)
PM25_RE	N	3	0	PM _{2.5} Rule Effectiveness (%)
NH3_RE	N	3	0	NH ₃ Rule Effectiveness (%)

**Table III-7
Structure for 2007 and 2030 Future Year Non-EGU Mass Emissions Files**

Variable	Type	Length	Decimals	Description
FIPSST	C	2	0	FIPS State Code
FIPSCNTY	C	3	0	FIPS County Code
PLANTID	C	15	0	State Plant ID
PLANTID5	C	5	0	State Plant ID (5 Digit)
POINTID	C	15	0	Point ID
POINTID5	C	5	0	Point ID (5 Digit)
STACKID	C	12	0	Stack ID
STACKID3	C	3	0	Stack ID (3 Digit)
ORISID	C	6	0	DOE Plant ID
BLRID	C	6	0	Boiler ID
SEGMENT	C	2	0	Segment ID
PLANT	C	40	0	Plant Name
SCC	C	10	0	SCC
STKHGT	N	4	0	Stack Height (ft)
STKDIAM	N	6	2	Stack Diameter (ft)
STKTEMP	N	4	0	Stack Temperature (degrees F)
STKFLOW	N	10	2	Stack Flow Rate (cubic feet per second)
STKVEL	N	9	2	Stack Velocity (ft/sec)
BOILCAP	N	8	2	Boiler Design Capacity
CAP_UNITS	C	1	0	Capacity Unit Code
WINTHRU	N	3	0	Winter Thruput (%)
SPRTHRU	N	3	0	Spring Thruput (%)
SUMTHRU	N	3	0	Summer Thruput (%)
FALTHRU	N	3	0	Fall Thruput (%)
HOURS	N	2	0	Hours per Day
START_HR	N	2	0	Hourly Start Time
DAYS	N	1	0	Days per Week
WEEKS	N	2	0	Weeks per Year
THRUPUT	N	11	1	Throughput Rate (SCC units/year)
MAXRATE	N	12	3	Maximum Ozone Season Rate (units/day)
HEATCON	N	8	2	Heat Content (MMBtu/SCC unit)
SULFCON	N	5	2	Sulfur Content (mass percent)
ASHCON	N	5	2	Ash Content (mass percent)
NETDC	N	9	3	Maximum Nameplate Capacity (MW)
SIC	N	4	0	SIC Code
LATC	N	9	4	Latitude (degrees)
LONC	N	9	4	Longitude (degrees)
VOC_CE	N	7	2	VOC Control Efficiency (%)
NOX_CE	N	7	2	NO _x Control Efficiency (%)
CO_CE	N	7	2	CO Control Efficiency (%)
SO2_CE	N	7	2	SO ₂ Control Efficiency (%)
PM10_CE	N	7	2	PM ₁₀ Control Efficiency (%)
PM25_CE	N	7	2	PM _{2.5} Control Efficiency (%)

Table III-7 (continued)

Variable	Type	Length	Decimals	Description
NH3_CE	N	7	2	NH ₃ Control Efficiency (%)
VOC_ANN	N	13	4	Annual VOC (tons)
NOX_ANN	N	13	4	Annual NO _x (tons)
CO_ANN	N	13	4	Annual CO (tons)
SO2_ANN	N	13	4	Annual SO ₂ (tons)
PM10_ANN	N	13	4	Annual PM ₁₀ (tons)
PM25_ANN	N	13	4	Annual PM _{2.5} (tons)
SOA_ANN	N	13	4	Annual SOA (tons)
NH3_ANN	N	13	4	Annual NH ₃ (tons)
VOC_OSD	N	13	4	Summer Season Daily VOC (tons)
NOX_OSD	N	13	4	Summer Season Daily NO _x (tons)
CO_OSD	N	13	4	Summer Season Daily CO (tons)
SO2_OSD	N	13	4	Summer Season Daily SO ₂ (tons)
PM10_OSD	N	13	4	Summer Season Daily PM ₁₀ (tons)
PM25_OSD	N	13	4	Summer Season Daily PM _{2.5} (tons)
SOA_OSD	N	13	4	Summer Season Daily SOA (tons)
NH3_OSD	N	13	4	Summer Season Daily NH ₃ (tons)
VOC_RE	N	3	0	VOC Rule Effectiveness (%)
NOX_RE	N	3	0	NO _x Rule Effectiveness (%)
CO_RE	N	3	0	CO Rule Effectiveness (%)
SO2_RE	N	3	0	SO ₂ Rule Effectiveness (%)
PM10_RE	N	3	0	PM ₁₀ Rule Effectiveness (%)
PM25_RE	N	3	0	PM _{2.5} Rule Effectiveness (%)
NH3_RE	N	3	0	NH ₃ Rule Effectiveness (%)

**Table III-8
Non-EGU EPS-2.5 Input File Structure**

Variable	Type	Length	Decimals	Description
FIPSST	C	2	0	FIPS State Code
FIPSCNTY	C	3	0	FIPS County Code
PLANTID	C	5	0	State Plant ID (5 digit)
POINTID	C	5	0	Point ID (5 digit)
SIC	N	4	0	SIC Code
STACKID	C	3	0	Stack ID (3 digit)
SEGMENT	C	2	0	Segment ID
SCC	C	8	0	SCC
STKHGT	N	4	0	Stack Height (ft)
STKDIAM	N	6	2	Stack Diameter (ft)
STKTEMP	N	4	0	Stack Temperature (F)
STKFLOW	N	10	2	Stack Flow Rate (cubic ft per second)
WINTHRU	N	3	0	Winter Thruput (%)
SPRTHRU	N	3	0	Spring Thruput (%)
SUMTHRU	N	3	0	Summer Thruput (%)
FALTHRU	N	3	0	Fall Thruput (%)
HOURS	N	2	0	Hours per Day
DAYS	N	1	0	Days per Week
WEEKS	N	2	0	Weeks per Year
LATC	N	9	4	Latitude (degrees)
LONC	N	9	4	Longitude (degrees)
VOC	N	9	3	Annual VOC (tons)
NOX	N	9	3	Annual NO _x (tons)
CO	N	9	3	Annual CO (tons)
SO2	N	9	3	Annual SO ₂ (tons)
PM10	N	9	3	Annual PM ₁₀ (tons)
PM25	N	9	3	Annual PM _{2.5} (tons)
SOA	N	9	3	Annual SOA (tons)
NH3	N	9	3	Annual NH ₃ (tons)

3. EMS-95/SMOKE Input Files

The structures for the EMS-95 and SMOKE emissions preprocessor input files are the same. Universal Transverse Mercator (UTM) coordinates were added to the EMS-95/SMOKE input file, as latitude and longitude coordinates are not accepted. For the future year emission files, the only file modeled for each year contained NO_x SIP Call controls since only SSD emissions are provided in the EMS-95 input files. The structures for the EMS-95 input files is detailed in Table III-9.

A weekly profile code of 8 was utilized for all non-EGU sources, consistent with files prepared for the NO_x SIP Call analysis. This assumes operation 7 days a week, with slightly lower utilization on the weekends.

**Table III-9
Non-EGU EMS-95 Input File Structure**

Field	Type	Length	Description
Facility File:			
STID	N	2.	FIPS state code
CYID	N	3.	FIPS county code
FCID	C	15.	facility ID
SIC	C	4.	standard industrial classification
UTMX	N	9.1	UTM easting (m)
UTMY	N	9.1	UTM northing (m)
UTMZ	N	2.	UTM zone
NAME	C	40.	facility name
Stack File:			
STID	N	2.	FIPS state code
CYID	N	3.	FIPS county code
FCID	C	15.	facility ID
STKID	C	12.	stack ID
DIAM	N	8.4	inside stack diameter (ft)
HEIT	N	7.2	stack height above ground surface (ft)
TEMP	N	7.2	stack exit temperature (F)
VELOC	N	7.2	stack exit velocity (ft/sec)
FLOW	N	10.2	stack exit flow rate (actual cubic ft/min)
UTMX	N	9.1	UTM easting (m)
UTMY	N	9.1	UTM northing (m)
ELEV	N	9.1	elevation of stack base from mean sea level (ft)
Device File:			
STID	N	2.	FIPS state code
CYID	N	3.	FIPS county code
FCID	C	15.	facility ID
STKID	C	12.	stack ID
DVID	C	12.	device ID
SIC	C	4.	standard industrial classification
DEC	N	5.3	fractional December throughput
JAN	N	5.3	fractional January throughput
FEB	N	5.3	fractional February throughput
MAR	N	5.3	fractional March throughput
APR	N	5.3	fractional April throughput
MAY	N	5.3	fractional May throughput
JUN	N	5.3	fractional June throughput
JUL	N	5.3	fractional July throughput
AUG	N	5.3	fractional August throughput
SEP	N	5.3	fractional September throughput
OCT	N	5.3	fractional October throughput
NOV	N	5.3	fractional November throughput
WIN	N	3.	winter throughput (Dec - Feb) (%)
SPR	N	3.	spring throughput (Mar - May) (%)

Table III-9 (continued)

Field	Type	Length	Description
SUM	N	3.	summer throughput (Jun - Aug) (%)
FAL	N	3.	fall throughput (Sep - Nov) (%)
HOURS	N	2.	hours of operation per day (hours/day)
DAYS	N	2.	days of operation per week (days/week)
WEEKS	N	2.	weeks of operation per year (weeks/year)
DAYYEAR	N	3.	days of operation per year (days/year)
HOURYEAR	N	4.	hours of operation per year (hours/year)
Process File:			
STID	N	2.	FIPS state code
CYID	N	3.	FIPS county code
FCID	C	15.	facility ID
STKID	C	12.	stack ID
DVID	C	12.	device ID
PRID	C	12.	process ID
SCC	C	8.	source classification code
PRRT	N	13.	annual process rate (SCC units/year)
PRUN	C	15.	optional process rate units if different from SCC
Emissions File:			
STID	N	2.	FIPS state code
CYID	N	3.	FIPS county code
FCID	C	15.	facility ID
STKID	C	12.	stack ID
DVID	C	12.	device ID
PRID	C	12.	process ID
POLID	C	5.	pollutant ID
ACEF	N	13.	actual emission factor (tons/SCC units)
ALEF	N	13.	allowable emission factor (tons/SCC units)
ACEE	N	13.	actual emissions (tons)
ALEE	N	13.	allowable emissions (tons)
ESTT	C	2.	temporal basis (AA, AD, or DS)
PCEC	C	5.	primary control equipment
SCEC	C	5.	secondary control equipment
CEEF	N	7.4	control equipment efficiency (%)

CHAPTER IV

STATIONARY AREA SOURCES

A. 1996 BASE YEAR EMISSIONS

The 1996 NET inventory was selected as the base year inventory for area sources (EPA, 1998a).

The only adjustment made to the 1996 NET inventory for the purposes of this modeling effort is related to agricultural livestock emission sources, which include animal feedlots (e.g., beef cattle feedlots). Feedlot emissions in the 1996 NET inventory (the version utilized in this effort) are based on projecting 1992 emissions forward to 1996 using historic BEA GSP projections. For 1992, actual head (e.g., head of cattle) data from the Census of Agriculture are used to estimate emissions. The BEA GSP indicates a decline between 1992 and 1996 for this category; however, it is unlikely that the actual head count is decreasing. Because updated Census of Agriculture data were not available in time for the study, the 1992 data were used to represent 1996.

B. 2007 AND 2030 FUTURE YEAR EMISSIONS

Projection year emissions are a function of projected changes (growth or decline) in activity as well as changes in control levels. The following sections describe the growth and control assumptions utilized for this analysis.

1. Growth Assumptions

The BEA GSP growth, including population and combinations of industries (e.g., durable goods manufacturing, total manufacturing) were used to project emissions from 1996 to 2007 and 2030 for the area source sector. The surrogates used for each category were based on the same cross-reference list used in the Ozone/PM National Ambient Air Quality Standard (NAAQS) analysis (Pechan-Avanti, 1997b). Updated factors were applied to prescribed burning (projections of acres of public land burned from EPA and Federal land managers), agricultural sources (acres planted projections), and unpaved road emissions based on work completed for EPA's Section 812 Prospective Analysis (Pechan-Avanti, 1998). Livestock emissions growth was also updated for this analysis, utilizing extrapolations of historical Census of Agriculture data.

Pechan-Avanti matched area source categories with surrogate activity indicators (e.g., GSP by industry, population, or broader BEA categories) in order to utilize the BEA data. The variable chosen as a proxy for emissions growth is shown by source category in Table IV-1. For broad industrial categories such as Industrial Fuel Combustion and Miscellaneous Industrial Processes, BEA GSP growth for the manufacturing sector represents the activity level for projecting emissions. Population was used as a surrogate

Table IV-1
BEA Growth Categories Assigned by Major Source Category: Area Sources

Source Category	BEA Growth Category*
Stationary Source Fuel Combustion:	
Industrial	Total Manufacturing
Commercial/Institutional	Government and Government Enterprises
Residential	Population
Industrial Processes:	
Process Emissions: Synthetic Fiber	Textile Mill Products (SIC 22)
Process Emissions: Pharmaceuticals	Chemicals and Allied Products (SIC 28)
SOCMI Fugitives	Chemicals and Allied Products (SIC 28)
Food & Kindred Products - Bakeries	Food and Kindred Products (SIC 20)
Petroleum Refining	Petroleum and Coal Products (SIC 29)
Oil & Gas Production	Oil and Gas Extraction (SIC 13)
Miscellaneous Industrial Processes	Total Manufacturing
Surface Coating:	
Architectural	Construction (SIC 15, 16, and 17)
Auto Refinishing	Auto Repair, Services, and Garages (SIC 75)
Traffic Markings	Construction (SIC 15, 16, and 17)
Flat Wood Coating	Lumber and Wood Products (SIC 24)
Wood and Metal Furniture	Furniture and Fixtures (SIC 25)
Paper Coating	Printing and Publishing (SIC 27)
Metal Can & Coating	Fabricated Metal Products (SIC 34)
Electrical Insulation	Machinery, except Electrical (SIC 35)
Appliances	Fabricated Metal Products (SIC 34)
Machinery	Electric and Electronic Equipment (SIC 36)
Motor Vehicles (New)	Motor Vehicles and Equipment (SIC 371)
Aircraft Coating	Transportation Equipment, excl. Motor Vehicles (SIC 37)
Marine Paints	Transportation Equipment, excl. Motor Vehicles (SIC 37)
Rail Equipment Coating	Transportation Equipment, excl. Motor Vehicles (SIC 37)
Miscellaneous Manufacturing	Misc. Manufacturing Industries (SIC 39)
Industrial Maintenance	Misc. Manufacturing Industries (SIC 39)
Aerosols, Specific Purpose	Misc. Manufacturing Industries (SIC 39)
Degreasing (Vapor and Cold Cleaning):	
Furniture	Manufacturing - Durable Goods
Metallurgical Process	Manufacturing - Durable Goods
Fabricated Metals	Manufacturing - Durable Goods
Industrial Machinery	Manufacturing - Durable Goods
Electrical Equipment	Manufacturing - Durable Goods
Transportation Equipment	Manufacturing - Durable Goods
Instrument Manufacturing	Manufacturing - Durable Goods
Miscellaneous Manufacturing	Manufacturing - Durable Goods
Automobile Dealers & Repair	Manufacturing - Durable Goods
Other Degreasing Sources	Manufacturing - Durable Goods

Table IV-1 (continued)

Source Category	BEA Growth Category*
Solvent Use:	
Dry Cleaning (all types)	Population
Graphic Arts	Printing and Publishing (SIC 27)
Rubber and Plastics	Rubber and Misc. Plastics Products (SIC 30)
Industrial Adhesives	Total Manufacturing
Cutback Asphalt	Local/Interurban Passenger Transit (SIC 41)
Pesticides - Farm	Population
Personal, Household and Automotive Products	Population
Commercial Adhesives	Population
Petroleum & Petroleum Product Storage & Transport:	
Bulk Stations/Terminals	Trucking and Warehousing (SIC 42)
Gasoline Service Stations (Stage I and II)	Gasoline Consumption**
Gasoline Service Stations (Underground Tank)	Gasoline Consumption**
Waste Disposal, Treatment, & Recovery:	
On-Site Incineration - Industrial	Total Manufacturing
On-Site Incineration - Commercial/Institutional	Government and Government Enterprises
On-Site Incineration - Residential	Population
Open Burning - Industrial	Total Manufacturing
Open Burning - Commercial/Institutional	Government and Government Enterprises
Open Burning - Residential	Population
Wastewater Treatment - Public Owned	Electric, Gas, and Sanitary Services (SIC 49)
TSDFs	Total Manufacturing
Miscellaneous Area Sources:	
Agriculture Production (field burning, tilling)	USDA - Agricultural Baseline Projections
Agricultural Livestock	Extrapolated from historical Census of Agriculture data
Prescribed burning	Reflects expected increases in Federal prescribed burning activity on public lands
Wildfires	Zero Growth
Unpaved Roads	Extrapolated from 1984 to 1996 trend in unpaved road mileage
Paved Roads	Vehicle miles traveled (VMT) from MOBILE4.1 Fuel Consumption Model (FCM)

NOTES: *BEA growth category refers to GSP projections for each industry, unless "Population" is indicated.
 **Gasoline consumption projections are from the MOBILE FCM.

growth indicator for area source categories such as Dry Cleaning, Household Solvent Use, and Residential Fuel Combustion. Projected emissions for each State/area source SCC combination were calculated by multiplying base year emissions by the growth factor for the BEA growth indicator.

The U.S. Department of Agriculture (USDA) has developed baseline projections of farm acres planted (USDA, 1998). These data, combined with historical data back to 1990, for eight major crop types shows an average annual growth of only 0.38 percent per year from 1990 to 2007. The BEA GSP projections for *farm* result in an annual average growth of 2.0 percent per year. Projections of acres planted represent better predictors of future activity than GSP for agricultural tilling, so they were used in this projection. Levels of acres planted were assumed to remain constant between 2010 and 2030.

During an interagency (Department of the Interior/USDA) satellite conference held in April 1998, public forest land managers discussed an annual prescribed burning target of five million acres for 2010, although specific areas for burning were not identified. Using this target figure, public land activity levels were projected to arrive at 2010 public land activity estimates. For private forest lands, it is estimated that the level of prescribed burning activity remains constant at base year levels. Estimates for 2030 were assumed to be the same as 2010. For 2007, data were extrapolated between 2000 and 2010.

Unpaved road emission projections reflect the historical downward trend in miles of unpaved roads. The States were divided into three geographic groups: East, Central, and West. East was defined as EPA Regions 1 through 4, Central as EPA Regions 5 through 8, and West as EPA Regions 9 and 10. Alaska and Hawaii were excluded, since these States are not included in the Prospective emission projections (Pechan-Avanti, 1998). Linear regression was used to estimate the continued decline in unpaved road miles to 2030. For the emission projections, 2007 and 2030 unpaved road emissions were estimated by applying the average annual change between 1984 and 1996 out to the projection year.

For fuel combustion sources, energy adjustment factors were also applied to the baseline projections. These factors, developed from the DOE publication *Annual Energy Outlook 1997*, account for increases in fuel and process efficiency in future years. Basically, less fuel will be needed to provide the same amount of energy (generally in the form of steam) to an industrial process and the amount of energy needed per unit output will also decrease as processes become more efficient. These adjustments are based on those used in the NET projections (EPA, 1998a).

For the seven animal husbandry SCCs displayed in Table IV-2, an alternative method was used to project emissions growth. For these SCCs, emissions growth was based on projections of the number of animals in each category that were developed based on national data from the 1987, 1992, and 1997 Census of Agriculture (USDA, 1997). Growth factors for each SCC were specifically based on the growth in the number of animals between the base year and 2007 and 2030 as estimated from linear extrapolations of the Census data. Because linear extrapolation of the Census' number of sheep and lambs yielded negative growth factors believed to be unrealistic, the number of these animals was projected using an exponential trend function that provided more realistic growth factors. The growth factor for total livestock production (SCC 2805000000) was computed as the median of the growth factors for the individual SCCs that comprise this total category.

**Table IV-2
Animal Husbandry Categories and Growth Assumptions**

Source Classification Code (SCC)	SCC Description	Growth Function
2710020030	Natural Sources Biogenic Horses and Ponies	Linear extrapolation
2805000000	Misc. Area Sources Agric. Prod.-Livestock Total	Median of growth factors from individual SCCs below
2805001000	Misc. Area Sources Agric. Prod. - Livestock Beef Cattle Feedlots Total	Linear extrapolation
2805020000	Misc. Area Sources Agric. Prod. - Animal Husbandry Cattle and Calves Composite	Linear extrapolation
2805025000	Misc. Area Sources Agric. Prod. - Animal Husbandry Hogs and Pigs Composite	Linear extrapolation
2805030000	Misc. Area Sources Agric. Prod. - Animal Husbandry Poultry -Chickens Composite	Linear extrapolation
2805040000	Misc. Area Sources Agric. Prod. - Animal Husbandry Sheep and Lambs Composite	Exponential extrapolation
2805045001	Misc. Area Sources Agric. Prod. - Animal Husbandry Goats Composite	Linear extrapolation

Reference: USDA, 1997

2. Control Assumptions

Since the base year inventory for this effort is 1996, RACT requirements were assumed to have already been implemented. So, for stationary sources, CAA controls under the include any Federal initiatives, such as VOC content limits for consumer solvents. These controls are listed in Table IV-3 for area sources.

MACT assumptions from the Ozone/PM NAAQS analysis were utilized in this analysis for area sources (Pechan-Avanti, 1997b). These assumptions are shown in Table IV-4.

**Table IV-3
Area Source Federal Control Measure Assumptions**

Source Category	Pollutant	Control Efficiency (%)
National Rules		
TSDFs	VOC	96
Consumer solvents	VOC	20
Architectural and industrial maintenance coatings	VOC	20
Onboard refueling vapor recovery systems	VOC	*
Municipal solid waste landfills	VOC	82
Residential wood combustion	VOC, PM	60

NOTE: *The efficiency of onboard vapor recovery systems varies depending on whether stage II vapor recovery systems are in place. It is determined based on MOBILE5b emission factors.

**Table IV-4
Area Source MACT Control Assumptions**

Control Measure	VOC Percentage Reduction
Title III MACT (National)	
Wood Furniture Surface Coating	30
Aerospace Surface Coating	60
Marine Vessel Surface Coating (Shipbuilding)	24
Halogenated Solvent Cleaners (Cold Cleaning)	63
Autobody Refinishing	37
Perchloroethylene Dry Cleaning	44
Petroleum Refinery Fugitives	78
SOCMI Fugitives (SOCMI HON)	60
Synthetic Fiber Manufacture	54
Pharmaceutical Manufacture	37
Petroleum Dry Cleaning	44
Bulk Terminals (Gasoline Distribution)	51
Paper Surface Coating	78
Service Stations - Stage I (Gasoline Distribution)	95
Motor Vehicle Surface Coating	36
Metal Product Surface Coating	36
Wood Product Surface Coating	36
Open Top & Conveyorized Degreasing	31
POTWs	80
Metal Furniture & Appliances Surface Coating	36
Machinery, Railroad Surface Coating	36
Electronic Coating	36

C. MASS EMISSIONS INVENTORY AND PREPROCESSOR INPUT FILES

Table IV-5 shows the mass and modeling files prepared for the Tier 2 analysis. Note that nonroad emissions (discussed in Chapter V) are also included in these inventory files. The Tier 2 control scenario only affects nonroad sources in these files, as discussed in Chapter V.

The structure for the mass emission inventory files is shown in Table IV-6. Several of the data elements are included only in the base year inventory as indicated in the table.

The modeling files were derived from the mass emission inventories. The only change to emissions is the application of the crustal PM factor. This factor accounts for the fact that only a portion of the crustal PM emissions are transportable. For the modeling inventories, a factor of 25 percent was applied to PM₁₀ and PM_{2.5} emissions in the following tier 3 categories to simulate the transportable component of these emissions:

- Miscellaneous: Agriculture & Forestry: agricultural crops
- Miscellaneous: Agriculture & Forestry: agricultural livestock
- Miscellaneous: Fugitive Dust: unpaved roads
- Miscellaneous: Fugitive Dust: paved roads
- Miscellaneous: Fugitive Dust: construction

In addition, PM₁₀ and PM_{2.5} emissions from wind erosion (SCCs 2730100000 and 2730100001) were excluded from the modeling files.

1. EMS-95/SMOKE Modeling Files

The EMS-95/SMOKE input files were prepared for ozone modeling, incorporating SSD VOC, NO_x, and CO emissions. The structure for the area source EMS-95/SMOKE files is given in Table IV-7. Two sets of EMS-95 files were provided as shown in Table IV-5. The second set aggregates the nonroad emissions to the 7-digit SCC detail.

2. EPS-2.5 Modeling Files

Annual emission estimates are provided in the EPS-2.5 input files. An ASCII text file format is used to provide the emissions data to the modelers. The file format is given in Table IV-8.

**Table IV-5
Area/Nonroad Mass and Preprocessor Input Files**

Year	Scenario	Mass	EMS-95	EPS-2.5
1996	Base	AN96MS.DBF	AN96EM.TGZ AN96EM7.TGZ*	AN96EPS.TXT
2007	Base	AN07MSB.DBF	AN07EMB.TGZ AN07EMB7.TGZ*	AN07EPB.TXT
2007	Control (with Tier 2)	AN07MSC.DBF	AN07EMC.TGZ AN07EMC7.TGZ*	AN07EPC.TXT
2030	Base	AN30MSB.DBF	AN30EMB.TGZ AN30EMB7.TGZ*	AN30EPB.TXT
2030	Control (with Tier 2)	AN30MSC.DBF	AN30EMC.TGZ AN30EMC7.TGZ*	AN30EPC.TXT

NOTE: *Uses 7-digit SCC detail for nonroad (e.g., 2265001000 versus 2265001001, 2265001002, . . .)

**Table IV-6
Area/Nonroad Mass Emissions Inventory File Structure**

Field_name	Field_type	Field_len	Field_dec	Description
FIPSST	C	2	0	FIPS State code
FIPSCNTY	C	3	0	FIPS County code
SCC	C	10	0	SCC
VOC_ANN	N	10	4	Annual VOC [tons per year (tpy)]
NOX_ANN	N	10	4	Annual NO _x (tpy)
CO_ANN	N	10	4	Annual CO (tpy)
SO2_ANN	N	10	4	Annual SO ₂ (tpy)
PM10_ANN	N	10	4	Annual PM ₁₀ (tpy)
PM25_ANN	N	10	4	Annual PM _{2.5} (tpy)
NH3_ANN	N	10	4	Annual NH ₃ (tpy)
SOA_ANN	N	10	4	Annual SOA (tpy)
VOC_OSD	N	10	4	Summer Season Day (SSD) VOC (tpd)
NOX_OSD	N	10	4	SSD NO _x (tpd)
CO_OSD	N	10	4	SSD CO (tpd)
SO2_OSD	N	10	4	SSD SO ₂ (tpd)
PM10_OSD	N	10	4	SSD PM ₁₀ (tpd)
PM25_OSD	N	10	4	SSD PM _{2.5} (tpd)
NH3_OSD	N	10	6	SSD NH ₃ (tpd)
SOA_OSD	N	10	6	SSD SOA (tpd)
VOC_EMF*	N	11	4	VOC Emission Factor
NOX_EMF*	N	11	4	NO _x Emission Factor
CO_EMF*	N	11	4	CO Emission Factor
SO2_EMF*	N	11	4	SO ₂ Emission Factor
PM10_EMF*	N	11	4	PM ₁₀ Emission Factor
PM25_EMF*	N	11	4	PM _{2.5} Emission Factor
NH3_EMF*	N	11	4	NH ₃ Emission Factor
VOC_CE	N	7	2	VOC Control Efficiency
NOX_CE	N	7	2	NO _x Control Efficiency
CO_CE	N	7	2	CO Control Efficiency
SO2_CE	N	7	2	SO ₂ Control Efficiency
PM10_CE	N	7	2	PM ₁₀ Control Efficiency
PM25_CE	N	7	2	PM _{2.5} Control Efficiency
NH3_CE	N	7	2	NH ₃ Control Efficiency
VOC_RE	N	3	0	VOC Rule Effectiveness

Table IV-6 (continued)

Field_name	Field_type	Field_len	Field_dec	Description
NOX_RE	N	3	0	NO _x Rule Effectiveness
CO_RE	N	3	0	CO Rule Effectiveness
SO2_RE	N	3	0	SO ₂ Rule Effectiveness
PM10_RE	N	3	0	PM ₁₀ Rule Effectiveness
PM25_RE	N	3	0	PM _{2.5} Rule Effectiveness
NH3_RE	N	3	0	NH ₃ Rule Effectiveness
VOC_RP	N	6	2	VOC Rule Penetration
NOX_RP	N	6	2	NO _x Rule Penetration
CO_RP	N	6	2	CO Rule Penetration
SO2_RP	N	6	2	SO ₂ Rule Penetration
PM10_RP	N	6	2	PM ₁₀ Rule Penetration
PM25_RP	N	6	2	PM _{2.5} Rule Penetration
NH3_RP	N	6	2	NH ₃ Rule Penetration

NOTE: *Not included in 2007 and 2030 files.

**Table IV-7
Area/Nonroad EMS-95 Input File Structure**

Field	Type	Length	Description
Area File:			
STID	N	2.	FIPS state code
CYID	N	3.	FIPS county code
ASCT	C	15.	area source category
PRRT	N	13.	annual process rate (process units/year)
ACUN	C	15.	activity units
DEC	N	5.3	fractional December throughput
JAN	N	5.3	fractional January throughput
FEB	N	5.3	fractional February throughput
MAR	N	5.3	fractional March throughput
APR	N	5.3	fractional April throughput
MAY	N	5.3	fractional May throughput
JUN	N	5.3	fractional June throughput
JUL	N	5.3	fractional July throughput
AUG	N	5.3	fractional August throughput
SEP	N	5.3	fractional September throughput
OCT	N	5.3	fractional October throughput
NOV	N	5.3	fractional November throughput
WIN	N	3.	winter throughput (Dec - Feb) (%)
SPR	N	3.	spring throughput (Mar - May) (%)
SUM	N	3.	summer throughput (Jun - Aug) (%)
FAL	N	3.	fall throughput (Sep - Nov) (%)
HOURS	N	2.	code value for hourly operation
DAYS	N	2.	code value for daily operation
WEEKS	N	2.	weeks of operation per year (weeks/year)
DAYYEAR	N	3.	days of operation per year (days/year)
HOURYEAR	N	4.	hours of operation per year (hours/year)
Area File:			
STID	N	2.	FIPS state code
CYID	N	3.	FIPS county code
ASCT	C	15.	area source category
POLID	C	5.	pollutant ID
ACEF	N	13.	actual emission factor (tons/process unit)
ALEF	N	13.	allowable emission factor (tons/process unit)
ACEE	N	13.	actual emissions (tons)
ALEE	N	13.	allowable emissions (tons)
PCEC	C	5.	primary control equipment
SCEC	C	5.	secondary control equipment
CEEF	N	7.4	control equipment efficiency (%)
ESTT	C	2.	temporal basis (AA or AD)

**Table IV-8
Area/Nonroad EPS-2.5 Input File Structure**

Variable	Type	Length	Decimals	Description
FIPSST	C	2	0	FIPS State Code
FIPSCNTY	C	3	0	FIPS County Code
SCC	C	10	0	AMS Source Category Code
VOC	N	12	4	Annual VOC Emissions (tpy)
NOX	N	12	4	Annual NO _x Emissions (tpy)
CO	N	12	4	Annual CO Emissions (tpy)
SO2	N	12	4	Annual SO ₂ Emissions (tpy)
PM10	N	12	4	Annual PM ₁₀ Emissions (tpy)
PM25	N	12	4	Annual PM _{2.5} Emissions (tpy)
SOA	N	12	4	Annual SOA Emissions (tpy)
NH3	N	12	4	Annual NH ₃ Emissions (tpy)

CHAPTER V NONROAD SOURCES

A. 1996 BASE YEAR MASS EMISSIONS INVENTORY

County-level emission estimates for 1996 for the majority of nonroad sources were derived from EPA's April 1999 draft version of the NONROAD model. Emission estimates for VOC, NO_x, CO, SO₂, PM₁₀, and PM_{2.5} are available from the model. NONROAD does not estimate NH₃ and SOA emissions; therefore, these emissions were calculated outside the model. Aircraft, commercial marine, and locomotives are not presently included in the NONROAD model, and the procedures to develop emission estimates for these categories are discussed in a separate section.

1. NONROAD Model Equipment Categories

The NONROAD model estimates pollutant emissions for the following general equipment categories: (1) agricultural; (2) airport service; (3) light commercial; (4) construction and mining; (5) industrial; (6) lawn and garden; (7) logging; (8) pleasure craft; (9) railway maintenance; and (10) recreational equipment. These applications are further classified according to fuel and engine type [diesel, gasoline 2-stroke, gasoline 4-stroke, compressed natural gas (CNG), and liquid petroleum gas (LPG)]. NONROAD model input files were prepared for each State to account for the average statewide temperatures and Reid vapor pressure (RVP) for four seasons, including summer, fall, winter, and spring. Input files were also generated to account for county-level differences in RVP, fuel characteristics due to reformulated gasoline (RFG) and oxygenated fuel programs, and Stage II controls.

The statewide seasonal default RVP values used as input to the NONROAD model are presented in Table V-1. For areas subject to Phase 1 of the Federal RFG program, separate RVP values were modeled in the 1996 NONROAD inputs for May through September. Oxygenated fuel was also modeled in the areas participating in this program in 1996. Areas participating in the RFG program and oxygenated fuels program are consistent with the areas as presented in Chapter 6 of this report, "On-Highway Vehicle Sources."

Emissions calculated for counties with fuel characteristic and control data that varied from statewide average values replaced emissions for these same counties generated by running the default input files. Summer season daily emissions were estimated by dividing summer season (June through August) emissions by 92 days.

**Table V-1
Seasonal RVP Values Modeled for 1996 NONROAD Model Runs**

State	Applicable Counties	Winter	Spring	Summer	Autumn
AL	Entire State	12.4	8.9	7.8	8.9
AK	Entire State	14.1	13.7	13.0	13.7
AZ	Entire State	8.2	7.1	6.8	6.9
AR	Entire State	13.7	8.9	7.1	10.2
CA	Los Angeles Region	11.9	9.3	6.9	7.6
CA	San Francisco Region	11.7	10.8	6.9	7.6
CO	Entire State	12.5	10.1	7.8	9.4
CT	Entire State	13.0	10.1	8.6	10.1
DE	Entire State	13.5	10.2	8.5	9.2
DC	Entire State	12.0	8.3	7.5	8.3
FL	Entire State	11.8	7.4	7.4	7.4
GA	Entire State	12.4	8.8	7.6	8.8
HI	Entire State	10.0	10.0	9.8	10.0
ID	Entire State	12.8	10.4	8.6	9.1
IL	Madison, Monroe, St. Clair	14.1	10.0	7.1	8.8
IL	Rest of State	14.1	10.4	8.4	9.2
IN	Entire State	14.5	11.0	9.0	9.9
IA	Entire State	14.9	11.2	9.0	11.2
KS	Entire State	12.7	8.8	7.4	8.2
KY	Boone, Campbell, Kenton	13.4	9.8	9.3	9.8
KY	Rest of State	13.4	9.6	8.6	9.6
LA	Entire State	12.4	8.8	7.3	8.8
ME	Entire State	13.2	10.2	8.6	10.2
MD	Entire State	13.2	9.8	7.8	8.7
MA	Entire State	12.9	10.0	8.6	10.0
MI	Entire State	14.1	10.4	8.9	10.4
MN	Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, Washington, Wright	14.9	11.5	9.3	10.5
MN	Rest of State	14.9	11.4	9.0	10.4
MS	Entire State	13.7	8.9	7.1	8.9
MO	Franklin, Jefferson, St. Charles, St. Louis, St. Louis City	12.6	9.4	7.1	9.4
MO	Rest of State	12.6	9.5	7.3	9.5
MT	Entire State	13.8	10.4	8.7	10.4
NE	Entire State	13.9	10.5	8.4	9.1
NV	Entire State	9.6	8.0	7.6	7.8
NH	Entire State	12.9	10.0	8.6	10.0
NJ	Entire State	13.7	10.4	8.6	10.4
NM	Entire State	11.7	9.2	7.8	9.0
NY	Entire State	14.3	10.8	8.7	10.8
NC	Entire State	12.4	9.8	7.6	9.8

Table V-1 (continued)

State	Applicable Counties	Winter	Spring	Summer	Autumn
ND	Entire State	14.9	11.9	9.0	11.2
OH	Butler, Cuyahoga, Hamilton, Lake, Lorain	14.6	11.2	9.3	10.0
OH	Rest of State	14.6	11.1	9.0	9.9
OK	Entire State	13.9	9.2	7.4	8.2
OR	Entire State	12.3	9.8	7.7	8.7
PA	Clarion, Crawford, Elk, Erie, Forest, Jefferson, Lawrence, McKean, Mercer, Venango, Warren	14.4	11.1	9.3	11.1
PA	Rest of State	14.4	10.8	8.5	10.8
RI	Entire State	12.9	10.0	8.6	10.0
SC	Entire State	12.4	9.8	7.6	9.8
SD	Entire State	14.4	11.2	9.0	9.9
TN	Entire State	12.7	9.9	7.5	9.9
TX	El Paso	12.2	9.4	8.2	8.8
TX	Hardin, Harris, Jefferson, Orange	12.2	9.1	7.4	8.6
TX	Rest of State	12.2	9.2	7.7	8.7
UT	Entire State	12.5	10.6	7.8	9.4
VT	Entire State	14.9	11.4	9.0	11.4
VA	Entire State	11.8	8.3	7.5	8.3
WA	Entire State	14.0	10.6	8.5	9.5
WV	Entire State	14.6	11.0	8.8	9.9
WI	Entire State	14.6	11.1	9.0	10.1
WY	Entire State	13.0	10.4	8.8	9.3

Note: For areas receiving reformulated gasoline, appropriate May through September RVP values were modeled in place of the values shown here.

2. Emission Estimates for Aircraft, Commercial Marine Vessels, and Locomotives

Base year aircraft emissions were taken from the existing 1996 NET inventory (EPA, 1998a). Locomotive emissions for 1996 were also based on existing NET estimates.

Revised VOC, NO_x, CO, and total PM national emission estimates for commercial marine diesel engines were provided by EPA's Office of Mobile Sources (OMS). PM₁₀ was assumed to be equivalent to PM, and PM_{2.5} was estimated by multiplying PM₁₀ emissions by a factor of 0.92. These new national estimates were distributed to counties using the geographic distribution in the existing 1996 NET data base. It was determined that all States did not report commercial marine emissions under the same SCC. For example, some States reported commercial marine diesel emissions under the SCC 2280000000, which could potentially include other fuel types (e.g., residual, gasoline). Therefore, a distribution was established based on emissions for all commercial marine SCCs. In addition, records for several States had emissions for some pollutants, including SO₂ and PM₁₀, but no VOC, NO_x, or CO emissions. In order to estimate the emissions data for these pollutants, national average ratios of VOC/PM₁₀, NO_x/PM₁₀, and CO/PM₁₀ were calculated from the available inventory data. These ratios were then applied to the PM₁₀ emissions to estimate the missing VOC, NO_x, and CO emissions.

3. Methodologies for NH₃ and SOA

Ammonia emissions were based on county-level fuel consumption estimates obtained from 1996 NONROAD model runs. Fuel consumption estimates were not available for LPG and CNG-fueled equipment. Emission factors provided by OMS were then applied to these activity data to estimate NH₃ emissions for gasoline equipment (without catalysts) and diesel-fueled equipment. The emission factors were derived primarily from light-duty on-road vehicle emission measurements, and extrapolated to nonroad engines on a fuel consumption basis.

For aircraft, commercial marine, and locomotive categories, national fuel consumption estimates for 1996 were obtained from various sources. Jet fuel and aviation gasoline consumption for general aviation and commercial aircraft were obtained from the "FAA Aviation Forecasts Fiscal Years, 1998-2009," (FAA, 1998a). For aircraft categories, NH₃ emission factors developed for diesel engines were applied 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 broken down by fuel type. Diesel consumption estimates for locomotives were obtained from "Locomotive Emission Standards - Regulatory Support Document (RSD)," (EPA, 1997). For commercial marine, data for distillate and residual fuel oil were reported in "Fuel Oil and Kerosene Sales," (EIA, 1996). Table V-2 lists national fuel consumption estimates, as well as NH₃ emissions for all nonroad source categories.

Secondary organic aerosol emissions were calculated by applying the appropriate fractional aerosol coefficient to annual and SSD VOC emissions (Grosjean and Seinfeld, 1989). Default assignments were made to new nonroad SCCs that had not been previously assigned SOA fractions.

**Table V-2
1996 Fuel Consumption Estimates and NH₃ Emissions
for Nonroad Source Categories**

	Fuel Type	Fuel Consumption (million gallons)	NH₃ Emissions¹
NONROAD Model Categories	Diesel	16,337	2,987
	Gasoline	6,607	1,118
Aircraft	Jet Fuel ²	18,433	3,370
Commercial Marine	Diesel	2,108	385
	Residual	4,790	876
Locomotives	Diesel	3,948	722
Total			9,458

NOTES: ¹NH₃ emissions were calculated by multiplying diesel fuel consumption by an emission factor of 165.86 milligrams/gallon. NH₃ emissions from gasoline engines were calculated by multiplying gasoline consumption by an emission factor of 153.47 milligrams/gallon.
²Also includes minimal consumption of aviation gasoline by aircraft.

B. 2007 AND 2030 FUTURE YEAR MASS EMISSIONS INVENTORIES

The methods for developing base case and control scenario projection year inventories for nonroad sources are described in this section. Table V-3 provides a summary of the growth factors and projection methods used for each nonroad equipment category.

1. Nonroad Model Equipment Categories

For NONROAD model categories, emission estimates for projection years were developed using the following method. First, three seasonal (i.e., summer, winter, and fall/spring combined) NONROAD model runs were performed at the national level. Seasonal runs were performed to account for differences in average seasonal temperature, as well as RVP. Second, year-specific ratios were calculated by dividing national SCC-level emission estimates for 2007 and 2030 by the 1996 national values. County-level estimates were then calculated for 2007 and 2030 by multiplying each ratio times the 1996 county-level emissions inventory. In this manner, the county-level distribution assumed for the 1996 inventory is normalized to the national, SCC-level totals for each projection year. As with the base year, SSD emissions for projection years were estimated by dividing summer season emissions by 92 days.

a. Growth Assumptions

Nonroad category emissions have typically been projected using economic indicators that are believed to correlate to nonroad equipment activity. For example, nonroad agricultural equipment emissions have been grown in the past using BEA GSP projections for SIC code 01, which corresponds to the farm industry. However, instead of using economic indicators to project emissions or nonroad activity, the current version of the NONROAD model predicts future year nonroad equipment populations by extrapolating

**Table V-3
Growth Factors/Projection Methods for Nonroad Sources**

Nonroad SCC	SCC Description	Growth Factor
2260	2-stroke gasoline	Not applicable ¹
2265	4-stroke gasoline	
2267	CNG	
2268	LPG	
2270	Diesel	
2282	Recreational marine	
2285xxx015	Railroad support	
2275050, 2275060	General Aviation and Air Taxis	Landing-Takeoff Operations (LTOs) for General Aviation
2275020, 2275070	Commercial Aircraft and Auxiliary Power Units (APUs)	LTOs for Commercial Aviation
2275001	Military Aircraft	LTOs for Military Aviation
2275085	Unpaved Airstrips	SIC 45 - Air Transportation
2275900	Aircraft Refueling	SIC 45 - Air Transportation
2280002	Commercial Marine - Diesel Vessels	SIC 44 - Water Transportation ²
2280001, 2280003, 2280004	Commercial Marine - Coal, Residual, and Gas-fired Vessels	SIC 44 - Water Transportation
2283	Military Marine Vessels	992 - Federal, Military
2285	Locomotives	No growth ³

NOTES: ¹Projection year emission estimates were derived from national NONROAD model runs allocated to the county level based on the geographic distribution for the 1996 base year inventory.
²SO₂ and NH₃ emissions were projected using growth factor; projection year estimates for all other pollutants provided by OMS.
³SO₂ and NH₃ emissions for projection years assumed to remain constant at 1996 uncontrolled levels; controlled projection year estimates for all other pollutants provided by OMS.

from a linear regression of historical equipment populations. Because total activity is never directly measured, the historical trend in population must be used as a surrogate. A time-series analysis using historic equipment populations is believed to better reflect market trends within each sector (e.g., a shift from gasoline-fueled equipment to diesel-fueled equipment). Accurately estimating the relative distribution of different engine types in the future is important since diesel and gasoline engines have distinct emission characteristics. This approach, however, is not likely to be used for all equipment types in the final version of the NONROAD model. Some exceptions include oil field equipment and aircraft ground support equipment, which will rely on BEA GSP data and Federal Aviation Administration (FAA) LTO data, respectively.

b. Control Assumptions

The NONROAD model accounts for the effect of Federal nonroad engine emission standards which are final, or proposed standards soon expected to be final. The emission levels associated with compression-ignition (CI) and spark-ignition (SI) engine standards are incorporated into emission factors, which are then applied to future year nonroad equipment populations. The control programs accounted for by the NONROAD model include: (1) Tier 1, Tier 2 and Tier 3 CI standards for diesel engines greater than 50 horsepower (hp); (2) Tier 1 and Tier 2 CI standards for diesel engines below 50 hp; (3) Phase I and Phase 2 of the SI standards for gasoline engines less than 25 hp; (4) recreational SI marine engine controls.

Base year and controlled steady-state emission factors for various horsepower ranges of CI engines subject to the Tier 1, Tier 2, and Tier 3 standards are presented in Table V-4. Base year and controlled steady-state emission factors for SI engines below 25 hp (19 kilowatts) are presented in Table V-5. Additional details on the control levels reflected in NONROAD for future years for these categories, as well as SI recreational marine engines, are presented in technical reports that serve as supporting documentation for NONROAD model inputs (EPA, 1998b and EPA, 1998c).

The impact of RFG in the appropriate counties is reflected in the 1996 base year county-level inventory, in that the fuel RVP and percent oxygen were adjusted, as described in section V.A.1, for counties subject to RFG and oxygenated fuels requirements. No further adjustments were made to account for the use of RFG in future years.

2. Emission Estimates for Aircraft, Commercial Marine Vessels, and Locomotives

Aircraft emissions for 2007 were based on the existing NET projections, which used FAA LTO data as the growth surrogate for commercial and civil aircraft. Military aircraft were projected from 1996 using BEA GSP corresponding to Federal and military activity. Aircraft estimates for the year 2030 were updated based on commercial and general aviation growth rates from the FAA. Forecasts were only available up to the year 2020 in "Long Range Aviation Forecasts Fiscal Years 2010, 2015, and 2020," (FAA, 1998b). The annual average growth rate for the period 2015 to 2020 was assumed for estimating growth out to the year 2030. Military aviation activity was assumed to remain constant starting in 2010, so 2010 emissions from the NET were used for 2030 estimates for this category. The EPA has promulgated NO_x and CO emission standards for commercial aircraft, but the impacts from these standards are not accounted for in this analysis.

Commercial marine projections were developed similar to the 1996 base year estimates, with national commercial marine diesel emissions for 2007 and 2030 provided by OMS being distributed to the county based on the existing 1996 county-level distribution in the NET. Since the standards are not final, the effect of the proposed commercial marine diesel regulations was not taken into account. Commercial gasoline, commercial coal, and military marine emissions were grown from 1996 using BEA GSP growth factors.

**Table V-4
Steady-State Emission Factors for CI Engines in the NONROAD Model**

Engine Power (hp)	Model Year	Regulation	Emission Factors (g/hp-hr)			
			HC	CO	NO _x	PM
>0 to 11	88-99	–	1.5	5.0	10.0	1.0
	00-04	Tier 1	1.6	5.6	5.9	0.75
	05-	Tier 2	0.6	5.6	5.0	0.75
>11 to 16	88-99	–	1.5	5.0	10.0	1.0
	00-04	Tier 1	0.7	2.0	5.2	0.6
	05-	Tier 2	0.6	2.0	5.0	0.6
>16 to 25	88-99	–	1.8	5.0	6.9	0.8
	00-04	Tier 1	0.7	2.0	5.2	0.6
	05-	Tier 2	0.6	2.0	5.0	0.6
>25 to 50	88-98	–	1.8	5.0	6.9	0.8
	99-03	Tier 1	0.8	2.5	5.5	0.6
	04-	Tier 2	0.6	2.5	5.0	0.6
>50 to 100	88-97	–	0.99	3.49	8.30	0.72
	98-03	Tier 1	0.7	1.0	6.9	0.72
	04-07	Tier 2	0.4	1.0	5.2	0.72
	08-	Tier 3	0.2	1.0	3.3	Same as Tier 2
>100 to 175	88-96	–	0.68	2.70	8.38	0.40
	97-02	Tier 1	0.4	1.0	6.9	0.40
	03-06	Tier 2	0.4	1.0	4.5	0.40
	07-	Tier 3	0.2	1.0	2.8	Same as Tier 2
>175 to 300	88-95	–	0.68	2.70	8.38	0.40
	96-02	Tier 1	0.4	1.0	6.9	0.40
	03-05	Tier 2	0.4	1.0	4.5	0.40
	06-	Tier 3	0.2	1.0	2.8	Same as Tier 2
>300 to 600	88-95	–	0.68	2.70	8.38	0.40
	96-00	Tier 1	0.3	1.0	6.9	0.40
	01-05	Tier 2	0.3	1.0	4.5	0.40
	06-	Tier 3	0.2	1.0	2.8	Same as Tier 2
>600 to 750	88-95	–	0.68	2.70	8.38	0.40
	96-01	Tier 1	0.3	1.0	6.9	0.40
	02-05	Tier 2	0.3	1.0	4.5	0.40
	06-	Tier 3	0.2	1.0	2.8	Same as Tier 2
>750	88-99	–	0.68	2.70	8.38	0.40
	00-05	Tier 1	0.3	1.0	6.9	0.40
	06-	Tier 2	0.3	1.0	4.5	0.40

**Table V-5
Emission Factors for SI Engines Below 25 hp**

Engine Tech Type	HC	CO	NO_x	PM	BSFC
<i>Class III Engine Emissions for New Engines (g/kW-hr)</i>					
Gas 2-stroke handheld Class III, baseline	350	964	1.3	7.7	830
Phase 1	295	805	1.05	7.7	720
Phase 1 with catalyst	295	805	1.05	7.7	720
Phase 2	190	732	1.05	7.7	600
Phase 2 with catalysts	190	732	1.05	7.7	600
<i>Class IV Handheld New Engine Emissions (g/kW-hr)</i>					
Gas 2-stroke handheld Class IV, baseline	350	964	1.26	7.7	830
Phase 1	241	805	0.688	7.7	720
Phase 1 with catalyst	241	805	0.688	7.7	720
Phase 1 4-stroke	37.5	492	3.96	0.06	515
Phase 2	155.7	732	0.688	7.7	600
Phase 2 with catalysts	155.7	732	0.688	7.7	600
Phase 2 4-stroke	37.5	492	3.96	0.06	515
<i>Class V Handheld New Engine Emissions (g/kW-hr)</i>					
Gas 2-stroke handheld Class V, baseline	214	696	1.3	7.7	560
Phase 1	161	603	2.436	7.7	529
Phase 1 with catalyst	161	603	2.436	7.7	529
Phase 2	103	548	2.436	7.7	500
Phase 2 with catalysts	103	548	2.436	7.7	500
<i>Class I Nonhandheld New Engine Emissions (g/kW-hr)</i>					
Gas 2-stroke nonhandheld Class I, baseline	278.8	651.5	0.39	7.7	529
Gas, side-valved, 4-stroke nonhandheld Class I, baseline	52.3	577.8	2.68	0.06	830
Gas, overhead-valved, 4-stroke nonhandheld Class I, baseline	17.96	548.3	2.41	0.06	603
2-stroke, Phase 1	161	603	5.36	7.7	529
Phase 1 side-valved, 4-stroke	11.27	519	4.83	0.06	560
Phase 1 overhead valved 4-stroke	11.27	519	4.34	0.06	475
Phase 1 side-valved, 4-stroke with catalyst	11.27	519	4.83	0.06	560
Phase 2 side-valved	10.63	519	3.18	0.06	560
Phase 2 overhead valved	11.27	519	4.34	0.06	475
<i>Class II Nonhandheld New Engine Emissions (g/kW-hr)</i>					
Gas 2-stroke nonhandheld Class II, baseline	278.8	651.5	0.39	7.7	529
Gas, side-valved, 4-stroke nonhandheld Class II, baseline	12.96	578	2.76	0.06	570
Gas, overhead-valved, 4-stroke nonhandheld Class II, baseline	6.97	681	4.69	0.06	570
Phase 1 side-valved, 4-stroke	7.37	519	6.03	0.06	528
Phase 1 overhead valved 4-stroke	6.97	519	4.69	0.06	450
Phase 2 side-valved	7.37	519	6.03	0.06	528
Phase 2 overhead valved	5.58	519	3.72	0.06	450

Locomotive emission estimates for 2007 and 2030 were based on the Regulatory Support Document for locomotive emission standards for all projection years (EPA, 1997). This report contained emission projections for all criteria pollutants except for SO₂; therefore, SO₂ estimates from the current NET inventory were used. For the rulemaking support analysis, EPA assumed that future year fuel consumption will remain constant at 1996 levels. It was thought that improvements in the fuel efficiency of locomotives will offset the increase in ton-miles of freight hauled; therefore, no growth was assumed. The national emission estimates also accounted for future, phased-in controls that will primarily reduce NO_x and PM emissions. These new national estimates were distributed to the county-level using the existing county allocation in the 1996 NET data base.

3. Tier 2/Low Sulfur Fuel Adjustment Factors

Control case emission inventories were developed for 2007 and 2030 to account for the effects of proposed Tier 2 reductions in gasoline sulfur content. A sulfur correction factor was applied to base case SO₂ emission estimates for those SCCs representing 2-stroke and 4-stroke gasoline-fueled engines. The NONROAD model runs were performed using a default gasoline sulfur content of 339 parts per million (ppm) (i.e., 0.034 percent by weight). EPA has proposed a gasoline sulfur content of 30 ppm for the Tier 2 rule. Therefore, SO₂ emissions from gasoline-fueled nonroad equipment were multiplied by a correction factor of 0.088 (i.e., 30/339 ppm) to estimate the impact of the Tier 2 rule on SO₂ emissions from nonroad gasoline engines.

4. Methodologies for NH₃ and SOA

National diesel and gasoline fuel consumption, as obtained from the NONROAD model for 2007 and 2030, were distributed to the county level using the 1996 county-level distribution. Fuel consumption estimates were then multiplied by the appropriate emission factor to estimate NH₃ emissions for the projection years. For aircraft, commercial marine, and locomotive categories, 1996 base year NH₃ emissions were projected to 2007 and 2030 using the growth factors listed in Table V-3.

SOA emissions were calculated for projection years using the same method used for the base year. Projected VOC emission estimates were multiplied by the appropriate fractional aerosol coefficient for each SCC.

C. MASS EMISSIONS INVENTORY AND PREPROCESSOR INPUT FILES

Nonroad emissions are combined with area sources to produce the final mass and preprocessor input files. Refer to Chapter IV for the preprocessor input file names and structures.

CHAPTER VI ON-HIGHWAY VEHICLE SOURCES

A. 1996 BASE YEAR MASS EMISSIONS INVENTORY

This section summarizes the inputs and control programs that were modeled and adjustments that were made to the 1996 on-highway vehicle emissions inventory. The starting point for the 1996 on-highway vehicle emission inventory was the 1996 National Emission Trends database created in 1998. The Trends Procedures report provides more detail on the inputs contained in that analysis, but some of the key elements of that inventory are summarized here.

The 1996 VMT data is based on historical 1996 Highway Performance Monitoring System (HPMS) data obtained from the Federal Highway Administration. The HPMS database contains State-level summaries of average annual daily VMT by functional system and by rural, small urban, and individual urban areas. Based on population data from the Bureau of Census, the HPMS data were distributed to counties at the functional system level. A conversion was then made at the national functional system level to convert the national VMT from the HPMS vehicle categories to the MOBILE5b vehicle type categories. This conversion was made based on a breakdown provided by EPA that reconciles the vehicle class categories used in HPMS to those used in MOBILE (Wolcott, 1994).

Speeds modeled in this analysis, both in 1996 and the projection years, were consistent by vehicle class and functional road class throughout the nation. In other words, the same speeds were modeled in all analysis years, and the speeds depended upon the vehicle type and road type. The origin of these speed data is an analysis performed on output from the HPMS impact analysis for 1990 (FHWA, 1990). Speeds from this analysis year were consistent with speeds from earlier analysis years. Table VI-1 shows the speeds modeled.

Vehicle registration distributions used in the 1996 NET include distributions provided by States through OTAG and the NO_x SIP Call. Areas with no specified registration distribution were modeled with registration distributions by vehicle type developed based on national sales and registration data. The same registration distributions used in 1996 were also applied in both projection years.

Temperatures for 1996 were based on the average historical 1996 monthly maximum and minimum daily temperatures reported in a city selected to be representative of temperatures within a given State. Emission factors were calculated at the monthly level using these monthly temperatures. Monthly RVP data were also used in the MOBILE5b inputs. These inputs were based on January and July RVP data from American Automobile Manufacturers Association's (AAMA's) fuel surveys (AAMA, 1996), and then allocated by month and area.

**Table VI-1
Average Speeds by Road Type and Vehicle Type
(Miles per Hour)**

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

In addition to the inputs described above, control programs were modeled in 1996, as discussed below.

1. Inspection and Maintenance (I/M) Programs

Inspection and maintenance (I/M) programs were modeled in areas with such programs in place in 1996. Data on these programs includes the data collected in the OTAG process, as well as State-level I/M program summary information provided by OMS.

2. Reformulated Gasoline (RFG)

Phase 1 of the Federal RFG program was modeled in the 1996 MOBILE5b inputs. The areas and counties that were modeled with RFG are shown in Table VI-2. Data on the RFG coverage was provided by OMS. The summertime RFG benefits were applied from May through September, while the winter RFG benefits were applied in the remaining months. For 1996 only, California was modeled with the benefits of the California RFG program. This program was modeled Statewide, with Phase I benefits applied from January through May and Phase 2 benefits applied from June through December, using the CALI5 model in place of MOBILE5b.

**Table VI-2
Counties Modeled with Federal Reformulated Gasoline (RFG)**

State (American Society for Testing and Materials (ASTM) Class)/		State (ASTM Class)/	
Nonattainment Area	County	Nonattainment Area	County
Arizona (B)		Maine (C)	
Phoenix		Knox & Lincoln Counties	
	Maricopa Co		Knox Co
Connecticut (C)			Lincoln Co
Greater Connecticut		Lewiston-Auburn	
	Hartford Co		Androscoggin Co
	Litchfield Co		Kennebec Co
	Middlesex Co	Portland	
	New Haven Co		Cumberland Co
	New London Co		Sagadahoc Co
	Tolland Co		York Co
	Windham Co	Maryland (B)	
New York-Northern New Jersey-Long Island		Baltimore	
Fairfield Co			Anne Arundel Co
District of Columbia (B)			Baltimore
Washington DC			Baltimore Co
	Washington		Carroll Co
Delaware (C)			Harford Co
Philadelphia-Wilmington-Trenton			Howard Co
	Kent Co	Kent & Queen Annes Counties	
	New Castle Co		Kent Co
Sussex County			Queen Annes Co
	Sussex Co	Philadelphia-Wilmington-Trenton	
Illinois (C)			Cecil Co
Chicago-Gary-Lake County		Washington DC	
	Cook Co		Calvert Co
	Du Page Co		Charles Co
	Grundy Co		Frederick Co
	Kane Co		Montgomery Co
	Kendall Co		Prince Georges Co
	Lake Co	Massachusetts (C)	
	McHenry Co	Boston-Lawrence-Worcester-Eastern MA	
	Will Co		Barnstable Co
Indiana (C)			Bristol Co
Chicago-Gary-Lake County			Dukes Co
	Lake Co		Essex Co
	Porter Co		Middlesex Co
Kentucky (C)			Nantucket Co
Cincinnati-Hamilton			Norfolk Co
	Boone Co		Plymouth Co
	Campbell Co		Suffolk Co
	Kenton Co		Worcester Co
Louisville		Springfield/Pittsfield-Western MA	
	Bullitt Co		Berkshire Co

Table VI-2 (continued)

State (American Society for Testing and Materials (ASTM) Class)/		State (ASTM Class)/			
Nonattainment Area	County	Nonattainment Area	County		
	Jefferson Co		Franklin Co		
	Oldham Co		Hampden Co		
New Hampshire (C)		New York (C)	Hampshire Co		
	Manchester		Poughkeepsie		
Portsmouth-Dover-Rochester	Hillsborough Co	Pennsylvania (C)	Dutchess Co		
	Merrimack Co		Putnam Co		
New Jersey (C)	Rockingham Co	Philadelphia-Wilmington-Trenton	Bucks Co		
	Strafford Co		Chester Co		
Allentown-Bethlehem-Easton	Warren Co	Delaware Co	Montgomery Co		
Atlantic City		Philadelphia Co			
New York-Northern New Jersey-Long Island	Atlantic Co	Rhode Island (C)	Providence		
	Cape May Co				
	Bergen Co			Bristol Co	
	Essex Co			Kent Co	
	Hudson Co			Newport Co	
	Hunterdon Co			Providence Co	
	Middlesex Co			Washington Co	
	Monmouth Co				
	Morris Co				
	Ocean Co				
	Passaic Co				
	Somerset Co				
	Sussex Co				
Union Co					
Philadelphia-Wilmington-Trenton	Burlington Co	Texas (B)	Dallas-Fort Worth		
	Camden Co				
	Cumberland Co			Collin Co	
	Gloucester Co			Dallas Co	
	Mercer Co			Denton Co	
	Salem Co			Tarrant Co	
				Houston-Galveston-Brazoria	
				Brazoria Co	
	Chambers Co				
	Fort Bend Co				
	Galveston Co				
	Harris Co				
	Liberty Co				
	Montgomery Co				
	Waller Co				
New York (C)	New York-Northern New Jersey-Long Island	Virginia (B)	Norfolk-Virginia Beach-Newport News		
				Bronx Co	Chesapeake
				Kings Co	Hampton
				Nassau Co	James City Co
				New York Co	Newport News
				Orange Co	Norfolk
				Queens Co	Poquoson
				Richmond Co	Portsmouth
				Rockland Co	Suffolk

Table VI-2 (continued)

State (American Society for Testing and Materials (ASTM) Class)/		State (ASTM Class)/	
Nonattainment Area	County	Nonattainment Area	County
Virginia (B) Richmond-Petersburg	Suffolk Co	Wisconsin (C) Milwaukee-Racine	Virginia Beach
	Westchester Co		Williamsburg
			York Co
	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.

3. Oxygenated Fuel

Oxygenated fuel was modeled in the areas participating in this program in 1996. A listing of these areas was provided by OMS (Somers, 1997), along with the months that the oxygenated fuel program was in place in these areas and the market share of ether and alcohol blends. The average oxygen content of ether blend fuels was assumed to be 2.7 percent in all oxygenated fuel areas and the average oxygen content of alcohol blend fuels was assumed to be 3.5 percent in all oxygenated fuel areas. Table VI-3 lists the counties modeled with oxygenated fuel and the corresponding fuel parameters.

4. Low Emission Vehicle (LEV) Programs

In the 1996 analysis year, LEV programs were modeled in California, Massachusetts, and New York. The California program was modeled with a 1994 start year, using the CALI5 default LEV schedule. The LEV programs in Massachusetts and New York were modeled with start years of 1995 and 1996, respectively, with 15 percent of 1995 model

**Table VI-3
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	3.5	NOV-FEB (2007 & 2030)
Alaska	Anchorage Ed	0	100	2.7	3.5	NOV-DEC (1996 only)
Arizona	Maricopa Co	80	20	2.7	3.5	OCT-FEB
Colorado	Adams Co	75	25	2.7	3.5	NOV-FEB
Colorado	Arapahoe Co	75	25	2.7	3.5	NOV-FEB
Colorado	Boulder Co	75	25	2.7	3.5	NOV-FEB
Colorado	Douglas Co	75	25	2.7	3.5	NOV-FEB
Colorado	Jefferson Co	75	25	2.7	3.5	NOV-FEB
Colorado	Denver Co	75	25	2.7	3.5	NOV-FEB
Colorado	El Paso Co	75	25	2.7	3.5	NOV-FEB
Colorado	Larimer Co	75	25	2.7	3.5	NOV-FEB
Connecticut	Fairfield Co	90	10	2.7	3.5	NOV-FEB
Minnesota	Anoka Co	10	90	2.7	3.5	OCT-JAN
Minnesota	Carver Co	10	90	2.7	3.5	OCT-JAN
Minnesota	Dakota Co	10	90	2.7	3.5	OCT-JAN
Minnesota	Hennepin Co	10	90	2.7	3.5	OCT-JAN
Minnesota	Ramsey Co	10	90	2.7	3.5	OCT-JAN
Minnesota	Scott Co	10	90	2.7	3.5	OCT-JAN
Minnesota	Washington Co	10	90	2.7	3.5	OCT-JAN
Minnesota	Wright Co	10	90	2.7	3.5	OCT-JAN
Minnesota	Chisago Co	10	90	2.7	3.5	OCT-JAN
Minnesota	Isanti Co	10	90	2.7	3.5	OCT-JAN
Montana	Missoula Co	0	100	2.7	3.5	NOV-FEB
Nevada	Clark Co	0	100	2.7	3.5	OCT-MAR
Nevada	Washoe Co	95	5	2.7	3.5	OCT-JAN
New Jersey	Bergen Co	95	5	2.7	3.5	NOV-FEB
New Jersey	Essex Co	95	5	2.7	3.5	NOV-FEB
New Jersey	Hudson Co	95	5	2.7	3.5	NOV-FEB
New Jersey	Hunterdon Co	95	5	2.7	3.5	NOV-FEB
New Jersey	Mercer Co	95	5	2.7	3.5	JAN-FEB (1996 only)
New Jersey	Middlesex Co	95	5	2.7	3.5	NOV-FEB
New Jersey	Monmouth Co	95	5	2.7	3.5	NOV-FEB
New Jersey	Morris Co	95	5	2.7	3.5	NOV-FEB
New Jersey	Ocean Co	95	5	2.7	3.5	NOV-FEB
New Jersey	Passaic Co	95	5	2.7	3.5	NOV-FEB
New Jersey	Somerset Co	95	5	2.7	3.5	NOV-FEB
New Jersey	Sussex Co	95	5	2.7	3.5	NOV-FEB
New Jersey	Union Co	95	5	2.7	3.5	NOV-FEB
New Mexico	Bernalillo Co	15	85	2.7	3.5	JAN-FEB (1996 only)
New York	Bronx Co	95	5	2.7	3.5	NOV-FEB
New York	Kings Co	95	5	2.7	3.5	NOV-FEB

Table VI-3 (continued)

State	County	Market Shares (%)		Oxygen Content (%)		Oxygenated
		MTBE	Alcohol Blends	MTBE	Alcohol Blends	Fuel Season
New York	Nassau Co	95	5	2.7	3.5	NOV-FEB
New York	New York Co	95	5	2.7	3.5	NOV-FEB
New York	Queens Co	95	5	2.7	3.5	NOV-FEB
New York	Richmond Co	95	5	2.7	3.5	NOV-FEB
New York	Rockland Co	95	5	2.7	3.5	NOV-FEB
New York	Suffolk Co	95	5	2.7	3.5	NOV-FEB
New York	Westchester Co	95	5	2.7	3.5	NOV-FEB
New York	Orange Co	95	5	2.7	3.5	NOV-FEB
New York	Putnam Co	95	5	2.7	3.5	NOV-FEB
Oregon	Clackamas Co	1	99	2.7	3.5	NOV-FEB
Oregon	Jackson Co	1	99	2.7	3.5	NOV-FEB
Oregon	Multnomah Co	1	99	2.7	3.5	NOV-FEB
Oregon	Washington Co	1	99	2.7	3.5	NOV-FEB
Oregon	Josephine Co	1	99	2.7	3.5	NOV-FEB
Oregon	Klamath Co	1	99	2.7	3.5	NOV-FEB
Oregon	Yamhill Co	1	99	2.7	3.5	NOV-FEB
Texas	El Paso Co	15	85	2.7	3.5	NOV-FEB
Utah	Utah Co	20	80	2.7	3.5	NOV-FEB
Washington	Clark Co	1	99	2.7	3.5	NOV-FEB
Washington	King Co	1	99	2.7	3.5	JAN-FEB (1996 only)
Washington	Snohomish Co	1	99	2.7	3.5	JAN-FEB (1996 only)
Washington	Spokane Co	1	99	2.7	3.5	SEP-FEB
Wisconsin	St. Croix Co	10	90	2.7	3.5	OCT-JAN

year new vehicle sales (in Massachusetts only) meeting the intermediate Transitional LEV (TLEV) emission standards, 20 percent of 1996 model year new vehicle sales meeting the TLEV emission standards, and the remaining new vehicle sales meeting the Federal Tier I emission standards.

5. MOBILE5 to MOBILE6 Correction Factors

VOC, NO_x, and CO on-highway vehicle emission factors were calculated using the above inputs and EPA's MOBILE5b emission factor model. Emission factors for on-highway SO₂, PM₁₀, and PM_{2.5} were calculated using EPA's PART5 model and NH₃ emission factors for on-highway vehicles were calculated national vehicle-specific emission factors (Harvey, 1983). Various correction factors were then applied to the MOBILE5b VOC and NO_x emission factors to simulate emission factors that would result from using MOBILE6, as well as accounting for issues not included in MOBILE5b. Each of these adjustments are discussed below. All of the correction factors discussed in these sections were provided by OMS.

a. VOC and NO_x Exhaust Adjustments

Adjustment factors to convert the MOBILE5b emission factors to MOBILE6 emission factors were applied to the VOC exhaust and NO_x MOBILE5b output emission factors. These factors varied by vehicle type (with no corrections applied to HDDVs or motorcycles) and by control combination. The control combination included the following distinctions: conventional gasoline with no I/M, conventional gasoline with I/M, RFG with no I/M, and RFG with I/M. Each county in the nation was assigned one of these four control combinations. The corresponding adjustment factor was then applied to each monthly, vehicle type emission factor for each county in the nation. Table VI-4 lists the exhaust VOC MOBILE5b to MOBILE6 adjustment factors applied in 1996 and Table VI-5 lists the NO_x MOBILE5b to MOBILE6 adjustment factors. Both tables are by vehicle type and control combination.

b. Air Conditioning Usage Factors

An additional adjustment was applied to the NO_x LDGV, LDGT1, and LDGT2 emission factors (already adjusted, as above to MOBILE6 emission rates) in 1996. This adjustment accounted for the additional NO_x emissions that would occur with air conditioning usage that is not included in the MOBILE5 emission factors. The air conditioning usage factors consist of two components: a factor simulating full air conditioning usage and a temperature dependent factor that adjusts the full usage factor for usage at the given temperature. These two factors were multiplied and then added to the MOBILE6-adjusted NO_x emission factors. The full usage factor is dependent upon vehicle type and the same four control combinations listed with the MOBILE6 adjustments. Table VI-6 lists the full usage NO_x air conditioning usage factors. The air conditioning adjustment becomes 0 below temperatures of 68°F. Above temperatures of 109°F, the full usage factor is applied directly. The temperatures used to calculate this adjustment were the ambient temperatures calculated by MOBILE5b and included in the MOBILE5b output files. The temperature dependent equation is as follows:

$$\text{Temp Adj} = -3.631541 + 0.072465 * \text{AMBTEMP} - 0.000276 * (\text{AMBTEMP}^2)$$

This temperature adjustment was then multiplied by the corresponding full usage factor and the result was added to the MOBILE6-adjusted NO_x emission factors.

c. Heavy-Duty Diesel Vehicle (HDDV) NO_x Defeat Device Factors

The final adjustment factor applied to the 1996 on-highway vehicle emission inventories is the HDDV NO_x defeat device adjustment factor. This factor applies only to NO_x and only to HDDVs. The factor varies by speed and roadway type, as shown in Table VI-7.

**Table VI-4
Exhaust VOC MOBILE5b to MOBILE6 Adjustment Factors**

Year	Case	Control Combination	Adjustment Factor by Vehicle Type (unitless)					
			LDGV	LDGT1	LDGT2	HDGV	LDDV	LDDT
1996	BASELINE	IM CG	0.724	0.773	0.874	0.899	1.231	1.385
		IM RFG	0.789	0.827	0.927	0.913	1.231	1.385
		NO IM CG	0.681	0.777	0.840	0.899	1.231	1.385
		NO IM RFG	0.744	0.811	0.882	0.913	1.231	1.385
	CONTROL	IM CG	n/a	n/a	n/a	n/a	n/a	n/a
		IM RFG	n/a	n/a	n/a	n/a	n/a	n/a
		NO IM CG	n/a	n/a	n/a	n/a	n/a	n/a
		NO IM RFG	n/a	n/a	n/a	n/a	n/a	n/a
2007	BASELINE	APP IM CG	0.492	0.540	0.502	0.431	1.224	1.345
		APP IM RFG	0.494	0.539	0.502	0.399	1.224	1.345
		IM CG	0.398	0.417	0.502	0.431	1.224	1.345
		IM RFG	0.395	0.413	0.502	0.399	1.224	1.345
		NO IM CG	0.333	0.370	0.461	0.444	1.224	1.345
		NO IM RFG	0.344	0.373	0.461	0.413	1.224	1.345
	CONTROL	APP IM CG	0.424	0.463	0.416	0.383	0.917	0.874
		APP IM RFG	0.457	0.493	0.446	0.377	0.907	0.853
		IM CG	0.343	0.357	0.416	0.383	0.917	0.874
		IM RFG	0.366	0.377	0.446	0.377	0.907	0.853
		NO IM CG	0.298	0.326	0.391	0.396	0.939	0.907
		NO IM RFG	0.325	0.351	0.420	0.391	0.905	0.881
2030	BASELINE	APP IM CG	1.525	1.539	0.445	0.096	0.355	0.779
		APP IM RFG	1.506	1.564	0.433	0.090	0.288	0.609
		IM CG	0.255	0.263	0.445	0.096	0.355	0.779
		IM RFG	0.251	0.267	0.433	0.090	0.288	0.609
		NO IM CG	0.221	0.242	0.313	0.137	0.561	1.018
		NO IM RFG	0.223	0.253	0.319	0.134	0.452	0.818
	CONTROL	APP IM CG	1.222	1.217	0.155	0.080	0.285	0.266
		APP IM RFG	1.321	1.234	0.162	0.078	0.253	0.222
		IM CG	0.204	0.208	0.155	0.080	0.285	0.266
		IM RFG	0.220	0.211	0.162	0.078	0.253	0.222
		NO IM CG	0.195	0.208	0.154	0.122	0.355	0.494
		NO IM RFG	0.209	0.219	0.167	0.122	0.422	0.424

**Table VI-5
NO_x MOBILE5b to MOBILE6 Adjustment Factors**

Year	Case	Control Combination	Adjustment Factor by Vehicle Type (unitless)					
			LDGV	LDGT1	LDGT2	HDGV	LDDV	LDDT
1996	BASELINE	IM CG	0.849	0.823	0.855	1.169	1.104	1.152
		IM RFG	0.861	0.832	0.861	1.171	1.104	1.152
		NO IM CG	0.796	0.761	0.812	1.169	1.104	1.152
		NO IM RFG	0.807	0.769	0.817	1.171	1.104	1.152
	CONTROL	IM CG	n/a	n/a	n/a	n/a	n/a	n/a
		IM RFG	n/a	n/a	n/a	n/a	n/a	n/a
		NO IM CG	n/a	n/a	n/a	n/a	n/a	n/a
		NO IM RFG	n/a	n/a	n/a	n/a	n/a	n/a
2007	BASELINE	APP IM CG	0.883	0.983	0.786	0.897	1.095	1.132
		APP IM RFG	0.809	0.937	0.777	0.848	1.095	1.132
		IM CG	0.720	0.805	0.786	0.897	1.095	1.132
		IM RFG	0.659	0.768	0.777	0.848	1.095	1.132
		NO IM CG	0.651	0.716	0.700	0.902	1.095	1.132
		NO IM RFG	0.602	0.686	0.695	0.866	1.095	1.132
	CONTROL	APP IM CG	0.594	0.703	0.598	0.784	0.740	0.694
		APP IM RFG	0.626	0.732	0.620	0.795	0.739	0.688
		IM CG	0.485	0.575	0.598	0.784	0.740	0.694
		IM RFG	0.511	0.599	0.620	0.795	0.739	0.688
		NO IM CG	0.454	0.524	0.542	0.793	0.741	0.719
		NO IM RFG	0.476	0.547	0.564	0.804	0.740	0.714
2030	BASELINE	APP IM CG	1.997	1.657	0.796	0.313	1.084	1.140
		APP IM RFG	1.614	1.508	0.792	0.284	1.084	1.140
		IM CG	0.624	0.690	0.796	0.313	1.084	1.140
		IM RFG	0.504	0.627	0.792	0.284	1.084	1.140
		NO IM CG	0.600	0.635	0.663	0.328	1.084	1.140
		NO IM RFG	0.490	0.583	0.652	0.335	1.084	1.140
	CONTROL	APP IM CG	0.377	0.321	0.127	0.230	0.118	0.161
		APP IM RFG	0.397	0.341	0.133	0.231	0.116	0.159
		IM CG	0.118	0.134	0.127	0.230	0.118	0.161
		IM RFG	0.124	0.142	0.133	0.231	0.116	0.159
		NO IM CG	0.167	0.190	0.167	0.256	0.219	0.303
		NO IM RFG	0.173	0.199	0.174	0.260	0.210	0.298

**Table VI-6
NO_x Full Usage Air Conditioning Adjustment Factors**

Year	Case	Control Combination	Adjustment Factor by Vehicle Type (unitless)			
			LDGV	LDGT1	LDGT2	HDGV
1996	BASELINE	IM CG	0.282	0.298	0.334	0.000
		IM RFG	0.282	0.298	0.334	0.000
		NO IM CG	0.301	0.315	0.353	0.000
		NO IM RFG	0.301	0.315	0.353	0.000
	CONTROL	IM CG	n/a	n/a	n/a	n/a
		IM RFG	n/a	n/a	n/a	n/a
		NO IM CG	n/a	n/a	n/a	n/a
		NO IM RFG	n/a	n/a	n/a	n/a
2007	BASELINE	IM CG	0.194	0.161	0.237	0.080
		IM RFG	0.166	0.145	0.223	0.060
		NO IM CG	0.206	0.176	0.258	0.070
		NO IM RFG	0.178	0.159	0.245	0.070
	CONTROL	IM CG	0.141	0.131	0.194	0.050
		IM RFG	0.138	0.129	0.191	0.050
		NO IM CG	0.153	0.145	0.214	0.060
		NO IM RFG	0.150	0.142	0.211	0.050
2030	BASELINE	IM CG	0.083	0.044	0.146	0.197
		IM RFG	0.062	0.036	0.127	0.176
		NO IM CG	0.107	0.070	0.162	0.195
		NO IM RFG	0.081	0.059	0.156	0.174
	CONTROL	IM CG	0.038	0.027	0.033	0.145
		IM RFG	0.037	0.026	0.032	0.145
		NO IM CG	0.052	0.047	0.059	0.145
		NO IM RFG	0.051	0.046	0.058	0.144

**Table VI-7
NO_x HDDV Defeat Device Adjustment Factors**

Year	Facility	Description	Defeat Device Adjustment Factors by Speed (unitless)												
			5 mph	10 mph	15 mph	20 mph	25 mph	30 mph	35 mph	40 mph	45 mph	50 mph	55 mph	60 mph	65 mph
1996	Interstate	Rural Interstate	1.1058	1.2254	1.3400	1.4402	1.5168	1.5622	1.5719	1.5447	1.4836	1.3946	1.2863	1.1682	1.0494
	Interstate	Rural Other Prin Arterial	1.1059	1.2255	1.3401	1.4403	1.5170	1.5624	1.5721	1.5449	1.4837	1.3948	1.2864	1.1683	1.0494
	Interstate	Urban Interstate	1.1076	1.2278	1.3430	1.4438	1.5208	1.5665	1.5762	1.5489	1.4874	1.3980	1.2891	1.1703	1.0509
	Interstate	Urban Other Freeways	1.1066	1.2264	1.3412	1.4416	1.5183	1.5638	1.5735	1.5463	1.4850	1.3959	1.2874	1.1691	1.0500
	Arterial	Rural Minor Arterial	0.9085	0.9462	0.9823	1.0139	1.0380	1.0524	1.0554	1.0468	1.0276	0.9995	0.9654	0.9282	0.8907
	Arterial	Rural Major Collector	0.9085	0.9462	0.9823	1.0139	1.0380	1.0523	1.0553	1.0468	1.0275	0.9995	0.9654	0.9282	0.8908
	Arterial	Rural Minor Collector	0.9076	0.9448	0.9805	1.0117	1.0355	1.0497	1.0527	1.0442	1.0252	0.9975	0.9638	0.9270	0.8900
	Arterial	Rural Local	0.9081	0.9459	0.9821	1.0138	1.0380	1.0524	1.0554	1.0468	1.0275	0.9994	0.9651	0.9278	0.8902
	Urban	Urban Other Prin Arterial	0.8113	0.8140	0.8166	0.8189	0.8207	0.8217	0.8219	0.8213	0.8199	0.8179	0.8154	0.8127	0.8100
	Urban	Urban Minor Arterial	0.8119	0.8146	0.8172	0.8195	0.8213	0.8223	0.8225	0.8219	0.8205	0.8185	0.8160	0.8133	0.8106
	Urban	Urban Collector	0.8098	0.8126	0.8153	0.8176	0.8193	0.8204	0.8206	0.8200	0.8186	0.8165	0.8140	0.8113	0.8085
	Urban	Urban Local	0.8118	0.8146	0.8172	0.8195	0.8213	0.8223	0.8225	0.8219	0.8205	0.8185	0.8160	0.8133	0.8105
2007	Interstate	Rural Interstate	0.8623	0.9233	0.9818	1.0329	1.0720	1.0952	1.1001	1.0863	1.0550	1.0097	0.9544	0.8941	0.8335
	Interstate	Rural Other Prin Arterial	0.8623	0.9233	0.9818	1.0330	1.0721	1.0953	1.1002	1.0863	1.0551	1.0097	0.9544	0.8942	0.8335
	Interstate	Urban Interstate	0.8626	0.9239	0.9827	1.0341	1.0733	1.0967	1.1016	1.0877	1.0563	1.0107	0.9551	0.8946	0.8336
	Interstate	Urban Other Freeways	0.8624	0.9235	0.9821	1.0333	1.0724	1.0957	1.1006	1.0867	1.0555	1.0100	0.9546	0.8943	0.8335
	Arterial	Rural Minor Arterial	0.8398	0.8583	0.8760	0.8915	0.9034	0.9104	0.9119	0.9077	0.8982	0.8845	0.8677	0.8495	0.8311
	Arterial	Rural Major Collector	0.8399	0.8584	0.8761	0.8916	0.9035	0.9105	0.9120	0.9078	0.8983	0.8846	0.8678	0.8496	0.8312
	Arterial	Rural Minor Collector	0.8406	0.8589	0.8764	0.8917	0.9034	0.9104	0.9118	0.9077	0.8983	0.8847	0.8682	0.8501	0.8320
	Arterial	Rural Local	0.8394	0.8579	0.8757	0.8912	0.9031	0.9102	0.9117	0.9074	0.8980	0.8842	0.8674	0.8491	0.8306
	Urban	Urban Other Prin Arterial	0.8189	0.8199	0.8208	0.8216	0.8222	0.8226	0.8227	0.8225	0.8220	0.8212	0.8204	0.8194	0.8184
	Urban	Urban Minor Arterial	0.8194	0.8204	0.8213	0.8221	0.8227	0.8231	0.8232	0.8230	0.8225	0.8218	0.8209	0.8199	0.8190
	Urban	Urban Collector	0.8170	0.8179	0.8189	0.8197	0.8203	0.8207	0.8208	0.8205	0.8200	0.8193	0.8184	0.8175	0.8165
	Urban	Urban Local	0.8190	0.8199	0.8209	0.8217	0.8223	0.8227	0.8228	0.8225	0.8220	0.8213	0.8204	0.8195	0.8185
2030	Interstate	Rural Interstate	0.9474	0.9474	0.9474	0.9474	0.9474	0.9474	0.9474	0.9474	0.9474	0.9474	0.9474	0.9474	0.9474
	Interstate	Rural Other Prin Arterial	0.9474	0.9474	0.9474	0.9474	0.9474	0.9474	0.9474	0.9474	0.9474	0.9474	0.9474	0.9474	0.9474
	Interstate	Urban Interstate	0.9477	0.9477	0.9477	0.9477	0.9477	0.9477	0.9477	0.9477	0.9477	0.9477	0.9477	0.9477	0.9477
	Interstate	Urban Other Freeways	0.9475	0.9475	0.9475	0.9475	0.9475	0.9475	0.9475	0.9475	0.9475	0.9475	0.9475	0.9475	0.9475
	Arterial	Rural Minor Arterial	0.9488	0.9488	0.9488	0.9488	0.9488	0.9488	0.9488	0.9488	0.9488	0.9488	0.9488	0.9488	0.9488
	Arterial	Rural Major Collector	0.9488	0.9488	0.9488	0.9488	0.9488	0.9488	0.9488	0.9488	0.9488	0.9488	0.9488	0.9488	0.9488
	Arterial	Rural Minor Collector	0.9494	0.9494	0.9494	0.9494	0.9494	0.9494	0.9494	0.9494	0.9494	0.9494	0.9494	0.9494	0.9494
	Arterial	Rural Local	0.9485	0.9485	0.9485	0.9485	0.9485	0.9485	0.9485	0.9485	0.9485	0.9485	0.9485	0.9485	0.9485
	Urban	Urban Other Prin Arterial	0.9375	0.9375	0.9375	0.9375	0.9375	0.9375	0.9375	0.9375	0.9375	0.9375	0.9375	0.9375	0.9375
	Urban	Urban Minor Arterial	0.9380	0.9380	0.9380	0.9380	0.9380	0.9380	0.9380	0.9380	0.9380	0.9380	0.9380	0.9380	0.9380
	Urban	Urban Collector	0.9358	0.9358	0.9358	0.9358	0.9358	0.9358	0.9358	0.9358	0.9358	0.9358	0.9358	0.9358	0.9358
	Urban	Urban Local	0.9377	0.9377	0.9377	0.9377	0.9377	0.9377	0.9377	0.9377	0.9377	0.9377	0.9377	0.9377	0.9377

B. 2007 AND 2030 FUTURE YEAR MASS EMISSIONS INVENTORIES

This section summarizes the growth assumptions made and control programs applied to calculate the 2007 and 2030 on-highway vehicle emission inventories. As discussed above, the registration distributions and speeds modeled in 1996 were also used in the projection years. The temperatures modeled in the projection years represented State-specific average monthly maximum and minimum daily temperatures averaged from 1970 through 1997 using data from the National Climatic Data Center. The same temperatures were modeled in both 2007 and 2030.

1. Growth Assumptions

The VMT used in 2007 and 2030 were projected from 1996, using data supplied by OMS on the fraction of VMT by vehicle type. The data provided by OMS included the VMT fraction for LDGVs, LDGT1s, LDGT2s, light-duty diesel vehicles (LDDVs), and light-duty diesel trucks (LDDTs). The VMT fraction for the remaining vehicle types was calculated to be in the same relative distribution as in the 1996 VMT file. Table VI-8 shows the resulting VMT fractions by vehicle type for 2007 and 2030. Once these fractions were determined, the total VMT by vehicle type was determined using national VMT projections from the 2007 NET and by linearly extrapolating the national VMT totals from the MOBILE4.1 Fuel Consumption Model from 2020 to 2030. The 1996 VMT at the county/vehicle type/roadway type level of detail was then projected to 2007 and 2030 by allocating the VMT for each vehicle type according to population growth factors by metropolitan statistical areas and rest-of-State areas.

**Table VI-8
National VMT Fractions by Vehicle Type for Tier 2 Analysis**

Vehicle Type	2007 VMT Fractions	2030 VMT Fractions
LDGV	0.396	0.291
LDGT1	0.384	0.450
LDGT2	0.126	0.148
HDGV	0.024	0.028
LDDV	0.000	0.000
LDDT	0.002	0.002
HDDV	0.063	0.075
MC	0.005	0.005
Total	1.000	1.000

2. Control Assumptions

This section summarizes the control programs that were modeled for highway vehicles in 2007 and 2030. Differences between the Base Case and the Control Case (Tier 2 plus low sulfur fuel) were modeled by applying different adjustment factors. Both cases started with the same unadjusted MOBILE5b (and PART5) emission factors.

a. Inspection and Maintenance (I/M) Programs

I/M program inputs were the same in both of the projection years. The default program parameters for counties expected to have I/M programs in place in the projection years are the EPA performance standard I/M program inputs. The specific inputs modeled for each of the I/M program performance standards are shown in Table VI-9. I/M program coverage by county or area was based on data collected by EPA and Pechan-Avanti for the OTAG and Section 812 emission projections. During this data collection process, each State was contacted to confirm which counties in that State would be implementing an I/M program in the future. Each State was also asked to indicate which of the EPA I/M program types the program would most closely resemble - high enhanced, low enhanced, basic, or Ozone Transport Region (OTR) low enhanced. Responses were collected from each State with a planned CAA I/M program. Any additional I/M-specific information collected during comment periods for EPA's NO_x SIP Call, and accepted by EPA, superseded the default and OTAG I/M data.

b. Reformulated Gasoline (RFG)

Phase II of this Federal RFG program was modeled in 2007 and 2030. Coverage of RFG in the projection years was the same as that in 1996, with the following exceptions: all Maine counties and Orange County, NY were removed from the 1996 list, shown in Table VI-2. In addition, since California was modeled with MOBILE5b for the projection years, the entire State of California was modeled with Federal Phase II RFG (ASTM Class B) in the projection years. Areas not participating in the RFG program were modeled during the ozone season months with Phase II RVP values of either 8.7 pounds per square inch (psi) or 7.8 psi. Areas that provided SIP Call comments documenting the presence of a low RVP program were modeled at that RVP during the ozone season.

c. Oxygenated Fuel

The oxygenated fuel program inputs and county coverages modeled are the same as those described for 1996, with the specific changes listed in Table VI-3 for several of the areas for 2007 and 2030.

**Table VI-9
I/M Performance Standard Program Inputs**

I/M Program Name	Basic I/M Performance Standard	Low Enhanced I/M Performance Standard	High Enhanced I/M Performance Standard
I/M Program Parameters			
Program Start Year	1983	1983	1983
Stringency Level (Percent)	20	20	20
Model Years Covered	1968-2020	1968-2020	1968-1985
Waiver Rate For Pre-1981 Model Years (%)	0	3	3
Waiver Rate For 1981 and Later Models (%)	0	3	3
Compliance Rate (%)	100	96	96
Program Type	TO	TO	TO
Inspection Frequency	Annual	Annual	Annual
Vehicle Types Inspected			
LDGV	YES	YES	YES
LDGT1	NO	YES	YES
LDGT2	NO	YES	YES
HDGV	NO	NO	NO
Test Type	IdleTest	IdleTest	2500/IdleTest
I/M Cutpoints	220/1.2/999	220/1.2/999	220/1.2/999
Effectiveness Rates (% hydrocarbon (HC)/CO/NO _x)	1.00/1.00/1.00	1.00/1.00/1.00	1.00/1.00/1.00
Program Start Year			
Stringency Level (Percent)			1983
Model Years Covered			1986-2020
Waiver Rate For Pre-1981 Model Years (%)			3
Waiver Rate For 1981 and Later Models (%)			3
Compliance Rate (%)			96
Program Type			TO
Inspection Frequency			Annual
Vehicle Types Inspected			
LDGV			YES
LDGT1			YES
LDGT2			YES
HDGV			NO
Test Type			TransientTest
I/M Cutpoints (g/mi HC/CO/NO _x)			0.80/20.0/2.00
Effectiveness Rates (% HC/CO/NO _x)			1.00/1.00/1.00
Anti-Tampering Program Parameters			
Program Start Year		1995	1995
Model Years Covered		1972-2020	1984-2020
Vehicle Types Inspected			
LDGV		YES	YES
LDGT1		YES	YES
LDGT2		YES	YES
HDGV		NO	NO
Program Type		TO	TO
Effectiveness Rate		1.00	1.00
Inspection Frequency		Annual	Annual
Compliance Rate (%)		96	96

Table VI-9 (continued)

I/M Program Name	Basic I/M Performance Standard	Low Enhanced I/M Performance Standard	High Enhanced I/M Performance Standard
I/M Program Parameters			
Inspections Performed			
Air Pump System		NO	NO
Catalyst		NO	YES
Fuel Inlet Restrictor		NO	YES
Tailpipe Lead Deposit Test		NO	NO
EGR System		YES	NO
Evaporative Emission Control System		NO	NO
PCV System		NO	NO
Gas Cap		NO	NO
Functional Pressure Test Program Parameters			
Program Start Year			1995
Model Years Covered			1983-2020
Effectiveness Rate			1.00
Vehicle Types Tested			
LDGV			YES
LDGT1			YES
LDGT2			YES
HDGV			NO
Program Type			TO
Inspection Frequency			Annual
Compliance Rate (%)			96
Purge Test Program Parameters			
Program Start Year			1995
Model Years Covered			1986-2020
Effectiveness Rate			1.00
Vehicle Types Tested			
LDGV			YES
LDGT1			YES
LDGT2			YES
HDGV			NO
Program Type			TO
Inspection Frequency			Annual
Compliance Rate (%)			96

NOTES: TO=Test Only
TRC=Test And Repair (Computerized)

d. NLEV Program

The National LEV (NLEV) program was included for all States in the projection year modeling. This program starts with the 2001 model year nationwide, and in 1999 in the Northeast Ozone Transport Commission (OTC) States. The implementation schedule of the NLEV program in the OTC States 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%

States in the OTC that have adopted a LEV program on their own were modeled with the characteristics of their programs. These States include Massachusetts, New York, Vermont, and Maine.

California's LEV program began in 1994. This was modeled using the MOBILE5b default LEV implementation schedule, along with a start year of 1994 for this program. California's LEV program now includes LDGT2s which are not included in the default LEV modeling in MOBILE5b. As discussed below, this was accounted for by applying the Control Case Tier 2 and low sulfur fuel adjustment factors in the Base Case in California.

The following table shows the emission standards of the Federal Tier I program, the transitional LEV (TLEV) standards, the LEV standards, and the Ultra-Low Emission Vehicle (ULEV) standards. These standards apply to the LDGV and LDGT1a classes of vehicles. The LDGT1b category is also included in the NLEV program, but the emission standards for these vehicles are slightly less stringent than those listed below for the lighter vehicles.

Emission Standard	Nonmethane Organic Gas (NMOG)	CO	NO _x
Federal Tier 1	0.250 grams/mile nonmethane hydrocarbon (NMHC)	3.4 grams/mile	0.40 grams/mile
TLEV	0.125 grams/mile	3.4 grams/mile	0.40 grams/mile
LEV	0.075 grams/mile	3.4 grams/mile	0.20 grams/mile
ULEV	0.040 grams/mile	1.7 grams/mile	0.20 grams/mile

e. 2004 NO_x Standard for Heavy-Duty Diesel Engines

EPA determined that additional reductions in NO_x and NMHC emissions are needed at the national level from heavy-duty vehicles and promulgated a new standard, referred to as the HDDV 2.0 grams per brake horsepower-hour (g/bhp-hr) NO_x standard. This standard was modeled in the MOBILE5b input files following the guidance provided in "MOBILE5 Information Sheet #5, Inclusion of New 2004 NO_x Standard for Heavy-Duty Diesel Engines in MOBILE5a and MOBILE5b Modeling." This guidance was issued on

January 30, 1998. In effect, this modeling reduces the HDDV emission factors starting with the 2004 model year to be consistent with the new standard, and is applied nationally.

f. 2007 and 2030 Adjustment Factors

The 1996 section of this chapter discusses the VOC exhaust and NO_x MOBILE5b to MOBILE 6 adjustment factors, the air conditioning usage adjustment factors, and the HDDV NO_x defeat device adjustment factors. The actual factors applied, including those applied in 2007 and 2030 were shown in Tables VI-4 through VI-7. Separate factors were applied to produce a Base Case (without Tier 2 and low sulfur fuel) and a Control Case (with Tier 2 and low sulfur fuel). Each of these cases is labeled separately in the tables. No air conditioning usage factors were applied to HDGVs in 1996, but are applied in the projection years. Also, some of the factors add a separate category for areas implementing an “appropriate I/M” program (i.e., a program that meets EPA’s requirements to be modeled with the maximum LEV benefits). In general, areas modeled with the EPA high enhanced performance standard, or an equivalent I/M program, were grouped in this category, labeled “APP IM CG” or “APP IM RFG” in the tables. Several exceptions to this general rule occurred for areas that indicated through comments, that were accepted by EPA, to the NO_x SIP Call specifically indicating that the area should or should not be modeled with the maximum LEV benefits.

i. VOC Evaporative Adjustments

An additional set of MOBILE5b to MOBILE6 adjustment factors was applied to the VOC evaporative emission factors in 2007 and 2030 that were not applied in 1996. In effect, these account for the new Tier 2 and low sulfur fuel controls, as all of the Base Case adjustment factors are 1. These factors were applied to the evaporative portion of the VOC emission factors and apply only to LDGVs, LDGT1s, and LDGT2s. Table VI-10 shows these factors.

ii. On-board Diagnostics

To simulate the effects of on-board diagnostic (OBD) devices in the projection years, adjustments were made to the MOBILE5b input files for areas modeled with an I/M program. This was modeled by adding or modifying pressure and purge test input lines, such that 1996 and later model year LDGVs and LDGTs would receive the full benefits of a test-only pressure test and purge test.

iii. PM and SO₂ Adjustment Factors

An additional set of factors was applied to PM and SO₂ emission factors in the projection years. These factors are only relevant in the Control Case (i.e., the factors are 1 in the Base Case). The PM factors are shown in Table VI-11 and apply to all vehicle types except HDDVs (the motorcycle factors are all 1). These factors were applied only to the exhaust portion of the PM₁₀ and PM_{2.5} emission factors. The brake wear and tire wear portions of the PM factors were not adjusted. Table VI-12 lists the SO₂ factors applied. These factors apply to all gasoline vehicle types and account for the lower levels of sulfur in gasoline under EPA’s proposal.

iv. HDDV VOC Adjustment Factors

An adjustment was also made to the HDDV exhaust VOC emission factors to account for the MOBILE5b to MOBILE6 adjustments. This was accounted for by multiplying all VOC HDDV emission factors in both the Base Case and Control Case by 0.413 in 2007 and 0.316 in 2030.

v. California

MOBILE5b was used in the projection years to estimate the unadjusted emission factors for California, since CALI5 only projects emission factors to 2020. To account for the fact that California's LEV2 program comes fairly close to the benefits expected from EPA's proposed Tier 2 and low sulfur fuel program, the Control Case adjustment factors (including the PM and SO₂ adjustment factors) were applied to the California emission factors in both the Base Case and Control Case.

**Table VI-10
Evaporative VOC MOBILE5b to MOBILE6 Adjustment Factors**

Year	Case	Control Combination	Adjustment Factor by Vehicle Type (unitless)					
			LDGV	LDGT1	LDGT2	HDGV	LDDV	LDDT
2007	BASELINE	IM CG	1.000	1.000	1.000	1.000	1.000	1.000
		IM RFG	1.000	1.000	1.000	1.000	1.000	1.000
		NO IM CG	1.000	1.000	1.000	1.000	1.000	1.000
		NO IM RFG	1.000	1.000	1.000	1.000	1.000	1.000
	CONTROL	IM CG	0.970	0.963	1.000	1.000	1.000	1.000
		IM RFG	0.975	0.961	1.000	1.000	1.000	1.000
		NO IM CG	0.985	0.985	1.000	1.000	1.000	1.000
		NO IM RFG	0.983	0.986	1.000	1.000	1.000	1.000
2030	BASELINE	IM CG	1.000	1.000	1.000	1.000	1.000	1.000
		IM RFG	1.000	1.000	1.000	1.000	1.000	1.000
		NO IM CG	1.000	1.000	1.000	1.000	1.000	1.000
		NO IM RFG	1.000	1.000	1.000	1.000	1.000	1.000
	CONTROL	IM CG	0.796	0.778	0.857	1.000	1.000	1.000
		IM RFG	0.818	0.766	0.828	1.000	1.000	1.000
		NO IM CG	0.902	0.923	0.958	1.000	1.000	1.000
		NO IM RFG	0.911	0.927	0.961	1.000	1.000	1.000

**Table VI-11
PM Adjustment Factors**

Year	Case	Control Combination	Adjustment Factor by Vehicle Type (unitless)						MC
			LDGV	LDGT1	LDGT2	HDGV	LDDV	LDDT	
2007	BASELINE	IM CG	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		IM RFG	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		NO IM CG	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		NO IM RFG	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	CONTROL	IM CG	0.415	0.342	0.370	0.767	0.826	0.800	1.000
		IM RFG	0.624	0.563	0.591	0.848	0.826	0.800	1.000
		NO IM CG	0.415	0.342	0.370	0.767	0.826	0.800	1.000
		NO IM RFG	0.624	0.563	0.591	0.848	0.826	0.800	1.000
2030	BASELINE	IM CG	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		IM RFG	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		NO IM CG	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		NO IM RFG	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	CONTROL	IM CG	0.417	0.333	0.333	0.767	0.109	0.107	1.000
		IM RFG	0.625	0.556	0.556	0.848	0.109	0.107	1.000
		NO IM CG	0.417	0.333	0.333	0.767	0.109	0.107	1.000
		NO IM RFG	0.625	0.556	0.556	0.848	0.109	0.107	1.000

**Table VI-12
SO₂ Adjustment Factors**

Year	Case	Control Combination	Adjustment Factor by Vehicle Type (unitless)				
			LDGV	LDGT1	LDGT2	HDGV	MC
2007	BASELINE	IM CG	1.000	1.000	1.000	1.000	1.000
		IM RFG	1.000	1.000	1.000	1.000	1.000
		NO IM CG	1.000	1.000	1.000	1.000	1.000
		NO IM RFG	1.000	1.000	1.000	1.000	1.000
	CONTROL	IM CG	0.088	0.088	0.088	0.088	0.088
		IM RFG	0.224	0.224	0.224	0.224	0.224
		NO IM CG	0.088	0.088	0.088	0.088	0.088
		NO IM RFG	0.224	0.224	0.224	0.224	0.224
2030	BASELINE	IM CG	1.000	1.000	1.000	1.000	1.000
		IM RFG	1.000	1.000	1.000	1.000	1.000
		NO IM CG	1.000	1.000	1.000	1.000	1.000
		NO IM RFG	1.000	1.000	1.000	1.000	1.000
	CONTROL	IM CG	0.088	0.088	0.088	0.088	0.088
		IM RFG	0.224	0.224	0.224	0.224	0.224
		NO IM CG	0.088	0.088	0.088	0.088	0.088
		NO IM RFG	0.224	0.224	0.224	0.224	0.224

C. MODELING INVENTORIES INPUTS FOR EMISSIONS PREPROCESSOR

1. EMS-95/SMOKE - File Structures

The on-highway vehicle-related files submitted as inputs to EMS-95 and SMOKE consist of MOBILE5b input shells, three VMT-related files, and an adjustment factor file. The MOBILE5b input shells are a set of MOBILE5b input files that correspond to each of the MOBILE5b input files developed in calculating the mass emissions inventory, but with only one scenario, representing July controls and at a single speed and temperature combination. The EMS-95 and SMOKE models then use these MOBILE5b shells to generate emission factors at all of the temperature and speed combinations necessary for the hourly meteorological conditions being modeled. The three VMT files include a file with the total VMT by county and road type. The format of these files is shown in Table VI-13. These models then break the VMT down by vehicle type using the VMT mix by hour, county, road type, and vehicle type. The file structure of these VMT mix files are shown in Table VI-14. (It should be noted that for this analysis, there is no difference in the VMT mixes by hour of the day.) The third VMT-related file provided for each year includes a file with average speed information by county and road type. The format of these files is shown in Table VI-15. Each of these three VMT-related files varies only by year, and not by control case. The last file included for the EMS-95 and SMOKE modeling related to the on-highway vehicle modeling varies by year and control case and includes the adjustment factors to be applied by county and vehicle type. The format of these files is shown in Table VI-16. The factors for the HDDV NO_x HDDV defeat device, the HDDV VOC adjustments, and the air conditioning temperature-dependent equation were applied separately in the modeling code and were not included in the adjustment factor files.

2. EPS-2.5 and Mass Emission Inventory - File Structures

The EPS-2.5 files for on-highway vehicle sources consist of monthly emissions data by county, vehicle type, and roadway type. The EPS-2.5 modeling files were assembled from detailed monthly emission files, developed as discussed in the sections above. Separate EPS-2.5 files were created for 1996, 2007 Base Case, 2007 Control Case, 2030 Base Case, and 2030 Control Case. All of the on-highway EPS-2.5 emission files have the same format. This format is shown in Table VI-17. The format of the final mass emissions file, which contain annual and summer season day emissions for each pollutant are shown in Table VI-18. The same set of years and cases applies to the mass emissions files. It should be noted that the summer season day values for the on-highway vehicle emissions are calculated by dividing July emissions by 31.

**Table VI-13
Structure for VMT Files (OFNVMTyy.TXT)**

Variable	Type	Length	Decimals	Description
FIPSST	C	2	0	FIPS State Code
FIPSCNTY	C	3	0	FIPS County Code
ROADTYPE	C	2	0	Roadway Type as Defined by Codes Below: R1-Rural Interstates R2-Rural Other Principal Arterials R6-Rural Minor Arterials R7-Rural Major Collectors R8-Rural Minor Collectors R9-Rural Locals U1-Urban Interstates U2-Urban Other Freeways and Expressways U4-Urban Other Principal Arterials U6-Urban Minor Arterials U7-Urban Collectors U9-Urban Locals
VMT	N	15	3	Annual Average Daily VMT (miles)

**Table VI-14
Structure for VMT Vehicle Mix Files (NTVMIXyy.TXT)**

Variable	Type	Length	Decimals	Description
FIPSST	C	2	0	FIPS State Code
FIPSCNTY	C	3	0	FIPS County Code
ROADTYPE	C	2	0	Roadway Type as Defined by Codes Below: 01-Rural Interstates 02-Rural Other Principal Arterials 06-Rural Minor Arterials 07-Rural Major Collectors 08-Rural Minor Collectors 09-Rural Locals 11-Urban Interstates 12-Urban Other Freeways and Expressways 14-Urban Other Principal Arterials 16-Urban Minor Arterials 17-Urban Collectors 19-Urban Locals
LINKID	C	10	0	Not Used
HOUR	N	2	0	Hour of Day (1 through 24)
VEHMIX01	N	5	3	VMT Mix Fraction for Light-Duty Gas Vehicles
VEHMIX02	N	5	3	VMT Mix Fraction for Light-Duty Gas Trucks 1
VEHMIX03	N	5	3	VMT Mix Fraction for Light-Duty Gas Trucks 2
VEHMIX04	N	5	3	VMT Mix Fraction for Heavy-Duty Gas Vehicles
VEHMIX05	N	5	3	VMT Mix Fraction for Light-Duty Diesel Vehicles
VEHMIX06	N	5	3	VMT Mix Fraction for Light-Duty Diesel Trucks
VEHMIX07	N	5	3	VMT Mix Fraction for Heavy-Duty Diesel Vehicles
VEHMIX08	N	5	3	VMT Mix Fraction for Motorcycles

**Table VI-15
Structure for VMT Vehicle Mix Files (OFNSPyy.TXT)**

Variable	Type	Length	Decimals	Description
FIPSST	C	2	0	FIPS State Code
FIPSCNTY	C	3	0	FIPS County Code
ROADTYPE	C	2	0	Roadway Type as Defined by Codes Below: 01-Rural Interstates 02-Rural Other Principal Arterials 06-Rural Minor Arterials 07-Rural Major Collectors 08-Rural Minor Collectors 09-Rural Locals 11-Urban Interstates 12-Urban Other Freeways and Expressways 14-Urban Other Principal Arterials 16-Urban Minor Arterials 17-Urban Collectors 19-Urban Locals
AVESPEED	N	4	1	Average Vehicle Speed (miles per hour)

**Table VI-16
Structure for Adjustment Factor Files**

Variable	Type	Length	Decimals	Description
FIPSST	C	2	0	FIPS State Code
FIPSCNTY	C	3	0	FIPS County Code
V_TYPE	C	1	0	Vehicle Type : 1 = LDGV, 2 = LDGT1, 3 = LDGT2, 4 = HDGV, 5 = MC, 6 = LDDV, 7 = LDDT, 8 = HDDV
EXHVOCADJ	N	10	3	Multiplicative Exhaust VOC Adjustment Factor
EXHNOXADJ	N	10	3	Multiplicative NO _x Adjustment Factor
NOXACADJ	N	10	3	Additive NO _x Full Air Conditioning Usage Adjustment Factor (to be multiplied by temperature-dependent equation)
EVAPVOCADJ	N	10	3	Multiplicative Evaporative VOC Adjustment Factor
EXHPM10ADJ	N	10	3	Multiplicative Exhaust PM ₁₀ Adjustment Factor
EXHPM25ADJ	N	10	3	Multiplicative Exhaust PM _{2.5} Adjustment Factor
EXHSO2ADJ	N	10	3	Multiplicative SO ₂ Adjustment Factor

**Table VI-17
Structure for On-Highway Mobile Source EPS Data Files**

Variable	Type	Length	Decimals	Description
FIPSST	C	2	0	FIPS state code
FIPSCNTY	C	3	0	FIPS county code
SCC	C	10	0	AMS Source Category Code
V_TYPE	C	5	0	Vehicle Type
VOC	N	12	4	Annual VOC Emissions [tons per year (tpy)]
NOX	N	12	4	Annual NO _x Emissions (tpy)
CO	N	12	4	Annual CO Emissions (tpy)
SO2	N	12	4	Annual SO ₂ Emissions (tpy)
PM10	N	12	4	Annual PM ₁₀ Emissions (tpy)
PM25	N	12	4	Annual PM _{2.5} Emissions (tpy)
SOA	N	12	4	Annual SOA Emissions (tpy)
NH3	N	12	4	Annual NH ₃ Emissions (tpy)
VOC_JAN	N	12	4	Monthly VOC Emissions (tons per month)
VOC_FEB	N	12	4	Monthly VOC Emissions (tons per month)
VOC_MAR	N	12	4	Monthly VOC Emissions (tons per month)
VOC_APR	N	12	4	Monthly VOC Emissions (tons per month)
VOC_MAY	N	12	4	Monthly VOC Emissions (tons per month)
VOC_JUN	N	12	4	Monthly VOC Emissions (tons per month)
VOC_JUL	N	12	4	Monthly VOC Emissions (tons per month)
VOC_AUG	N	12	4	Monthly VOC Emissions (tons per month)
VOC_SEP	N	12	4	Monthly VOC Emissions (tons per month)
VOC_OCT	N	12	4	Monthly VOC Emissions (tons per month)
VOC_NOV	N	12	4	Monthly VOC Emissions (tons per month)
VOC_DEC	N	12	4	Monthly VOC Emissions (tons per month)
NOX_JAN	N	12	4	Monthly NO _x Emissions (tons per month)
NOX_FEB	N	12	4	Monthly NO _x Emissions (tons per month)
NOX_MAR	N	12	4	Monthly NO _x Emissions (tons per month)
NOX_APR	N	12	4	Monthly NO _x Emissions (tons per month)
NOX_MAY	N	12	4	Monthly NO _x Emissions (tons per month)
NOX_JUN	N	12	4	Monthly NO _x Emissions (tons per month)
NOX_JUL	N	12	4	Monthly NO _x Emissions (tons per month)
NOX_AUG	N	12	4	Monthly NO _x Emissions (tons per month)
NOX_SEP	N	12	4	Monthly NO _x Emissions (tons per month)
NOX_OCT	N	12	4	Monthly NO _x Emissions (tons per month)
NOX_NOV	N	12	4	Monthly NO _x Emissions (tons per month)
NOX_DEC	N	12	4	Monthly NO _x Emissions (tons per month)
CO_JAN	N	12	4	Monthly CO Emissions (tons per month)
CO_FEB	N	12	4	Monthly CO Emissions (tons per month)
CO_MAR	N	12	4	Monthly CO Emissions (tons per month)
CO_APR	N	12	4	Monthly CO Emissions (tons per month)
CO_MAY	N	12	4	Monthly CO Emissions (tons per month)

Table VI-17 (continued)

Variable	Type	Length	Decimals	Description
CO_JUN	N	12	4	Monthly CO Emissions (tons per month)
CO_JUL	N	12	4	Monthly CO Emissions (tons per month)
CO_AUG	N	12	4	Monthly CO Emissions (tons per month)
CO_SEP	N	12	4	Monthly CO Emissions (tons per month)
CO_OCT	N	12	4	Monthly CO Emissions (tons per month)
CO_NOV	N	12	4	Monthly CO Emissions (tons per month)
CO_DEC	N	12	4	Monthly CO Emissions (tons per month)
SO2_JAN	N	12	4	Monthly SO ₂ Emissions (tons per month)
SO2_FEB	N	12	4	Monthly SO ₂ Emissions (tons per month)
SO2_MAR	N	12	4	Monthly SO ₂ Emissions (tons per month)
SO2_APR	N	12	4	Monthly SO ₂ Emissions (tons per month)
SO2_MAY	N	12	4	Monthly SO ₂ Emissions (tons per month)
SO2_JUN	N	12	4	Monthly SO ₂ Emissions (tons per month)
SO2_JUL	N	12	4	Monthly SO ₂ Emissions (tons per month)
SO2_AUG	N	12	4	Monthly SO ₂ Emissions (tons per month)
SO2_SEP	N	12	4	Monthly SO ₂ Emissions (tons per month)
SO2_OCT	N	12	4	Monthly SO ₂ Emissions (tons per month)
SO2_NOV	N	12	4	Monthly SO ₂ Emissions (tons per month)
SO2_DEC	N	12	4	Monthly SO ₂ Emissions (tons per month)
PM10_JAN	N	12	4	Monthly PM ₁₀ Emissions (tons per month)
PM10_FEB	N	12	4	Monthly PM ₁₀ Emissions (tons per month)
PM10_MAR	N	12	4	Monthly PM ₁₀ Emissions (tons per month)
PM10_APR	N	12	4	Monthly PM ₁₀ Emissions (tons per month)
PM10_MAY	N	12	4	Monthly PM ₁₀ Emissions (tons per month)
PM10_JUN	N	12	4	Monthly PM ₁₀ Emissions (tons per month)
PM10_JUL	N	12	4	Monthly PM ₁₀ Emissions (tons per month)
PM10_AUG	N	12	4	Monthly PM ₁₀ Emissions (tons per month)
PM10_SEP	N	12	4	Monthly PM ₁₀ Emissions (tons per month)
PM10_OCT	N	12	4	Monthly PM ₁₀ Emissions (tons per month)
PM10_NOV	N	12	4	Monthly PM ₁₀ Emissions (tons per month)
PM10_DEC	N	12	4	Monthly PM ₁₀ Emissions (tons per month)
PM25_JAN	N	12	4	Monthly PM _{2.5} Emissions (tons per month)
PM25_FEB	N	12	4	Monthly PM _{2.5} Emissions (tons per month)
PM25_MAR	N	12	4	Monthly PM _{2.5} Emissions (tons per month)
PM25_APR	N	12	4	Monthly PM _{2.5} Emissions (tons per month)
PM25_MAY	N	12	4	Monthly PM _{2.5} Emissions (tons per month)
PM25_JUN	N	12	4	Monthly PM _{2.5} Emissions (tons per month)
PM25_JUL	N	12	4	Monthly PM _{2.5} Emissions (tons per month)
PM25_AUG	N	12	4	Monthly PM _{2.5} Emissions (tons per month)
PM25_SEP	N	12	4	Monthly PM _{2.5} Emissions (tons per month)
PM25_OCT	N	12	4	Monthly PM _{2.5} Emissions (tons per month)
PM25_NOV	N	12	4	Monthly PM _{2.5} Emissions (tons per month)

Table VI-17 (continued)

Variable	Type	Length	Decimals	Description
PM25_DEC	N	12	4	Monthly PM _{2.5} Emissions (tons per month)
SOA_JAN	N	12	4	Monthly SOA Emissions (tons per month)
SOA_FEB	N	12	4	Monthly SOA Emissions (tons per month)
SOA_MAR	N	12	4	Monthly SOA Emissions (tons per month)
SOA_APR	N	12	4	Monthly SOA Emissions (tons per month)
SOA_MAY	N	12	4	Monthly SOA Emissions (tons per month)
SOA_JUN	N	12	4	Monthly SOA Emissions (tons per month)
SOA_JUL	N	12	4	Monthly SOA Emissions (tons per month)
SOA_AUG	N	12	4	Monthly SOA Emissions (tons per month)
SOA_SEP	N	12	4	Monthly SOA Emissions (tons per month)
SOA_OCT	N	12	4	Monthly SOA Emissions (tons per month)
SOA_NOV	N	12	4	Monthly SOA Emissions (tons per month)
SOA_DEC	N	12	4	Monthly SOA Emissions (tons per month)
NH3_JAN	N	12	4	Monthly NH ₃ Emissions (tons per month)
NH3_FEB	N	12	4	Monthly NH ₃ Emissions (tons per month)
NH3_MAR	N	12	4	Monthly NH ₃ Emissions (tons per month)
NH3_APR	N	12	4	Monthly NH ₃ Emissions (tons per month)
NH3_MAY	N	12	4	Monthly NH ₃ Emissions (tons per month)
NH3_JUN	N	12	4	Monthly NH ₃ Emissions (tons per month)
NH3_JUL	N	12	4	Monthly NH ₃ Emissions (tons per month)
NH3_AUG	N	12	4	Monthly NH ₃ Emissions (tons per month)
NH3_SEP	N	12	4	Monthly NH ₃ Emissions (tons per month)
NH3_OCT	N	12	4	Monthly NH ₃ Emissions (tons per month)
NH3_NOV	N	12	4	Monthly NH ₃ Emissions (tons per month)
NH3_DEC	N	12	4	Monthly NH ₃ Emissions (tons per month)

**Table VI-18
Structure for On-Highway Mobile Source Mass Emissions Data Files**

Variable	Type	Length	Decimals	Description
fipsst	C	2	0	FIPS State code
fipscty	C	3	0	FIPS county code
scc	C	10	0	Source Category Classification Code
voc_ann	N	10	4	Annual VOC emissions from highway vehicles (tons per year)
nox_ann	N	10	4	Annual NO _x emissions from highway vehicles (tons per year)
co_ann	N	10	4	Annual CO emissions from highway vehicles (tons per year)
so2_ann	N	10	4	Annual SO ₂ emissions from highway vehicles (tons per year)
pm10_ann	N	10	4	Annual PM ₁₀ emissions from highway vehicles (tons per year)
pm25_ann	N	10	4	Annual PM _{2.5} emissions from highway vehicles (tons per year)
nh3_ann	N	10	4	Annual NH ₃ emissions from highway vehicles (tons per year)
soa_ann	N	10	4	Annual SOA emissions from highway vehicles (tons per year)
voc_osd	N	10	4	Summer season day VOC emissions from highway vehicles [tons per day (tpd)]
nox_osd	N	10	4	Summer season day NO _x emissions from highway vehicles (tpd)
co_osd	N	10	4	Summer season day CO emissions from highway vehicles (tpd)
so2_osd	N	10	4	Summer season day SO ₂ emissions from highway vehicles (tpd)
pm10_osd	N	10	4	Summer season day PM ₁₀ emissions from highway vehicles (tpd)
pm25_osd	N	10	4	Summer season day PM _{2.5} emissions from highway vehicles (tpd)
nh3_osd	N	10	4	Summer season day NH ₃ emissions from highway vehicles (tpd)
soa_osd	N	10	4	Summer season day SOA emissions from highway vehicles (tpd)
vmt_ann	N	20	7	Annual VMT from highway vehicles using 8 vehicle types (million miles)

CHAPTER VII

EMISSION SUMMARIES AND COMPARISONS

Tables VII-1 through VII-5 present summaries of national annual emissions and emissions reductions by pollutant and source category as defined by the Tier 2-level emission summary for the 1996, 2007, and 2030 inventories. Table VII-1 summarizes national annual emissions for the 1996 Base Year inventory. Table VII-2 summarizes national annual emissions for the 2007 Base Case inventory, and Table VII-3 summarizes the mobile and nonroad emissions reductions associated with the 2007 Control Case relative to the 2007 Base Case. Table VII-4 summarizes national annual emissions for the 2030 Base Case inventory, and Table VII-5 summarizes the mobile and nonroad emissions reductions associated with the 2030 Control Case relative to the 2030 Base Case.

Tables VII-6 through VII-10 present summaries of annual emissions and emissions reductions by State and pollutant for each of the major source categories (i.e., EGU, non-EGU point, stationary area, nonroad, and on-highway mobile sources). Table VII-6 summarizes annual emissions for the 1996 Base Year inventory. Table VII-7 summarizes national annual emissions for the 2007 Base Case inventory, and Table VII-8 summarizes the mobile and nonroad emissions reductions associated with the 2007 Control Case relative to the 2007 Base Case. Table VII-9 summarizes national annual emissions for the 2030 Base Case inventory, and Table VII-10 summarizes the mobile and nonroad emissions reductions associated with the 2030 Control Case relative to the 2030 Base Case. Table VII-11 summarizes the total annual emissions in each of the years and cases for all eight pollutants.

The remainder of this chapter presents two types of pollutant density maps for the 48-contiguous States and the District of Columbia. Separate maps are presented for each inventory and pollutant. One type of density map is presented in units of tons of pollutant per square mile, and the other type of density map is presented in units of tons of pollutant per 1,000 people. Figures VII-1 through VII-16 present the maps for the 1996 Base Year inventory, Figures VII-17 through VII-32 present the maps for the 2007 Base Case inventory, Figures VII-33 through VII-44 present maps of the emissions reductions associated with the 2007 Control Case versus the 2007 Base Case inventory, Figures VII-45 through VII-60 present the maps for the 2030 Base Case inventory, and Figures VII-61 through VII-72 present maps of the emissions reductions associated with the 2030 Control Case versus the 2030 Base Case inventory. For each inventory, maps in units of tons of pollutant per square mile are presented first followed by the maps in units of tons of pollutant per 1,000 people. For the 1996, 2007, and 2030 Base Case inventories, the maps are presented in the following order: VOC, NO_x, CO, SOA, SO₂, PM₁₀, PM_{2.5}, and NH₃. For the 2007 and 2030 Control Cases, the maps show emission reductions associated with mobile and nonroad sources for the following pollutants: VOC, NO_x, SOA, SO₂, PM₁₀, and PM_{2.5}. There are no emissions reductions for CO or NH₃.

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