APPENDIX C

References

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Appendix C

Documentation of the Revised 2002 Base Year, Revised 2018, and Initial 2009 Inventories for VISTAS

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Documentation of the Revised 2002 Base Year, Revised 2018, and

Initial 2009 Emission Inventories for VISTAS

Prepared for:

Visibility Improvement State and Tribal Association of the Southeast (VISTAS)

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Acronyms and Abbreviations

APCD	Air Pollution Control District
ATP	Anti-Tampering Program
CEER	Consolidated Emissions Reporting Rule
CERR	Consolidated Emission Reporting Rule
CMU	Carnegie Mellon University
EGU	Electric Generating Unit
FIP	Federal Implementation Plan
HDD	Heavy Duty Diesel
HDD RULE	Heavy Duty Diesel Rule
LTO	Landing and take off
MOBILE 6	MOBILE emissions estimation model version 6
NH_3	Ammonia
NIF	National Emission Inventory Format
NONROAD	no acronym (model name)
NO_x	Oxides of nitrogen
PM10-FIL	Particulate matter less than or equal to 10 microns in diameter that can be captured on a filter
PM10-PRI	Particulate matter less than or equal to 10 microns in diameter that includes both the filterable and condensable components of particulate matter
PM25-FIL	Particulate matter less than or equal to 2.5 microns in diameter that can be captured on a filter
PM25-PRI	Particulate matter less than or equal to 2.5 microns in diameter that includes both the filterable and condensable components of particulate matter
PM-CON	Particulate matter created by the condensation of hot materials to form particulates, usually less than 2.5 microns in diameter
RFG	Reformulated gasoline
RVP	Reid Vapor Pressure
SCC	Source Classification Code
SIWG	Special Interest Workgroup
SMOKE	Sparse Matrix Operator Kernel Emissions (SMOKE) Modeling System
SO_2	Oxides of sulfur
VISTAS	Visibility Improvement State and Tribal Association of the Southeast
VMT	Vehicle Miles Traveled
VOC	Volatile organic compounds

Documentation of the Revised 2002 Base Year, Revised 2018, and Initial 2009 Emission Inventories for VISTAS

1.0 Revised 2002 Base Year Inventory Development

1.1 Point Sources

This section details the development of the revised 2002 base year inventory for point sources. There were two major components to the development of the point source sector of the inventory. The first component was the incorporation of data submitted by the VISTAS States and local (S/L) agencies to the United States Environmental Protection Agency (EPA) as part of the Consolidated Emissions Reporting Rule (CERR). Work on incorporating the CERR data into the revised base year involved: 1) obtaining the data from EPA or the S/L agency, 2) evaluating the emissions and pollutants reported in the submittal, 3) augmenting CERR data with annual emission estimates for PM10-PRI and PM25-PRI; 4) evaluating the emissions from electric generating units, and 5) completing quality assurance reviews for each component of the point source inventory. The processes used to perform those operations are described in the first portion of this section.

The second component was the development of a "typical" year inventory for electric generating units (EGUs). VISTAS determined that a typical year EGU inventory was necessary to smooth out any anomalies in emissions from the EGU sector due to meteorology, economic, and outage factors in 2002. The typical year EGU inventory is intended to represent the five year (2000-2004) period that will be used for regional haze regulatory purposes. The second part of this section of the report discusses the development of the typical year EGU inventory. VISTAS developed a typical year 2002 emission inventory to avoid anomalies in emissions due to variability in meteorology, economic, and outage factors in 2002 and to represent the five year (2000-2004) starting period that would be used to determine the regional haze reasonable progress goals.

1.1.1 Development of 2002 Point Source Inventory

The first task in preparing the point source component of the revised 2002 base year inventory was the incorporation of data submitted by the VISTAS S/L agencies as part of the CERR. The revised 2002 point source inventory included both EGUs and non-EGUs.

1.1.1.1 Data Sources

Data from several sources were used: 1) the inventories that the S/L submitted to EPA from May through July 2004; 2) supplemental data supplied by the S/L agencies that may have been revised or finalized after submittal to EPA, and 3) the original VISTAS 2002 inventory in cases where S/L CERR data were not available. Table 1.1-1 summarizes the data used as the starting point for the updated 2002 inventory. Once all of the files were obtained, MACTEC ran the files through the EPA NIF Basic Format and Content checking tool to ensure that the files were submitted in standard NIF format and that there were no referential integrity issues with those files. In a couple of cases small errors were found. For example, in one case non-standard pollutant designations were used for PM and ammonia emissions. MACTEC contacted each VISTAS State point source contact person to resolve the issues with the files and corrections were made. Once all corrections to the native files were made, MACTEC continued with the incorporation of the data into the VISTAS point source files.

Table 1.1-1. Summary of State Data Submittals for the Revised 2002 VISTAS Point Source Inventory.

State / Local Program	Point Source Emissions Data Source
AL	C
FL	B
GA	B
KY	C
MS	B
NC	C
SC	C
TN	C
VA	B
WV	B
Davidson County, TN	B
Hamilton County, TN	A
Memphis/Shelby County, TN	B
Knox County, TN	B
Jefferson County, AL	B
Jefferson County, KY	B
Buncombe County, NC	B
Forsyth County, NC	B
Mecklenburg County, NC	B

Key
A = VISTAS 2002 (version 3.1)
B = CERR Submittal from EPA's ftp site
C = Other (CERR or other submittal sent directly from State to MACTEC)

1.1.1.2 Initial Data Evaluation

We conducted an initial review of the 2002 point source CERR data in accordance with the QA procedures specified in the QAPP for this project. The following evaluations were completed to identify potential data quality issues associated with the CERR data:

- Compared the number of sites in the CERR submittal to the number of sites in the VISTAS draft 2002 inventory; for all States, the number of sites in the CERR submittal was less than in the VISTAS draft 2002 inventory, since the CERR data was limited to major sources, while the VISTAS draft 2002 inventory contained data for both major and minor sources; verified with S/L contacts that minor sources not included in the CERR point source inventory were included in the CERR area source inventory.
- Checked for correct pollutant codes and corrected to make them NIF-compliant; for example, some S/L agencies reported ammonia emissions using the CAS Number or as “ammonia”, rather than the NIF-compliant “NH_3” code.
- Checked for types of particulate matter codes reported (i.e., PM-FIL, PM-CON, PM-PRI, PM10-PRI, PM10-FIL, PM25-PRI, PM25-FIL); corrected codes with obvious errors (i.e., changed PMPRI to PM-PRI). (The PM augmentation process for filling in missing PM pollutants is discussed later in Section 1.1.1.3)
- Converted all emission values that weren’t in tons to tons to allow for preparation of emission summaries using consistent units.
- Checked start and end dates in the PE and EM tables to confirm consistency with the 2002 base year.
- Compared annual and daily emissions when daily emissions were reported; in some cases, the daily value was non-zero (but very small) but the annual value was zero. This was generally the result of rounding in a S/L agency’s submittal.
- Compared ammonia emissions as reported in the CERR submittals and the 2002 Toxics Release Inventory; worked with S/L agencies to resolve any outstanding discrepancies.
- Compared SO_2 and NO_x emissions for EGUs to EPA’s Clean Air Markets Division continuous emission monitoring (CEM) database to identify any outstanding discrepancies. (A full discussion of the EGU emissions analysis is discussed later in Section 1.1.1.4)

- Prepared State-level emission summaries by pollutant for both the EGU and non-EGU sectors to allow S/L agencies to compare emissions as reported in the 1999 NEI Version 2, the VISTAS draft 2002 inventory, and the CERR submittals.
- Prepared facility-level emission summaries by pollutant to allow S/L agencies to review facility level emissions for reasonableness and accuracy.

We communicated the results of these analyses through email/telephone exchanges with the S/L point source contacts as well as through Excel summary spreadsheets.

1.1.1.3 PM Augmentation

Particulate matter emissions can be reported in many different forms, as follows:

PM Category	**Description**
PM-PRI	Primary PM (includes filterable and condensable)
PM-CON	Primary PM, condensable portion only (all less than 1 micron)
PM-FIL	Primary PM, filterable portion only
PM10-PRI	Primary PM10 (includes filterable and condensable)
PM10-FIL	Primary PM10, filterable portion only
PM25-PRI	Primary PM25 (includes filterable and condensable)
PM25-FIL	Primary PM25, filterable portion only

State/local agencies did not report PM emissions in a consistent manner. The State/local inventories submitted for VISTAS included emissions data for either PM-FIL, PM-PRI, PM10-FIL, PM10-PRI, PM25-FIL, PM25-PRI, and/or PM-CON. From any one of these pollutants, EPA has developed augmentation procedures to estimate PM10-PRI, PM10-FIL, PM25-PRI, PM25-FIL, and PM-CON. If not included in a State/local inventory, PM10-PRI and PM25-PRI were calculated by adding PM10-FIL and PM-CON or PM25-FIL and PM-CON, respectively.

The procedures for augmenting point source PM emissions are documented in detail in Appendix C of *Documentation for the Final 1999 National Emissions Inventory {Version 3} for Criteria Air Pollutants and Ammonia – Point Sources*, January 31, 2004). Briefly, the PM data augmentation procedure includes the following five steps:

- Step 1: Prepare S/L/T PM and PM10 Emissions for Input to the PM Calculator
- Step 2: Develop and Apply Source-Specific Conversion Factors

- Step 3: Prepare Factors from PM Calculator
- Step 4: Develop and Apply Algorithms to Estimate Emissions from S/L/T Inventory Data
- Step 5: Review Results and Update the NEI with Emission Estimates and Control Information.

Please refer to the EPA documentation for a complete description of the PM augmentation procedures

Table 1.1-2 compares the original PM emission estimates from the S/L CERR submittals and the revised 2002 VISTAS emissions estimates calculated using the above methodology. This table is intended to show that we took whatever States provided in the way of PM and filled in gaps to add in PM-CON where emissions were missing in order to calculate PM10-PRI and PM25-PRI for all processes to get a complete set of particulate data. We did not compare any other pollutants besides PM, since for other pollutants CERR emissions equal VISTAS emissions.

Table 1.1-2. Comparison of Particulate Matter Emissions from the S/L Data Submittals and the Revised 2002 VISTAS Point Source Inventory

State	Database	PM-PRI	PM-FIL	PM-CON	PM10-PRI	PM10-FIL	PM25-PRI	PM25-FIL
AL	CERR	28,803	9,174	0	16,522	6,548	8,895	4,765
	VISTAS	43,368	33,336	10,129	32,791	22,661	23,290	13,328
FL	CERR	0	33,732	0	0	32,254	0	0
	VISTAS	61,728	37,325	24,403	57,243	32,840	46,147	21,744
GA	CERR	42,846	0	0	27,489	0	15,750	0
	VISTAS	44,835	37,088	7,799	33,202	25,403	22,777	15,085
KY	CERR	0	3,809	0	19,748	1,360	0	0
	VISTAS	27,719	22,349	5,329	21,326	15,963	14,173	8,749
MS	CERR	23,925	0	0	20,968	0	10,937	0
	VISTAS	23,928	17,632	6,296	21,089	14,793	11,044	5,739
NC	CERR	48,110	0	0	36,222	0	24,159	0
	VISTAS	48,114	41,407	6,708	36,992	30,284	27,512	21,113
SC	CERR	0	43,837	0	0	32,656	0	21,852
	VISTAS	50,663	42,289	8,375	41,572	33,198	32,727	24,352
TN	CERR	1,660	25,500	21,482	43,413	22,164	34,167	12,140
	VISTAS	56,797	32,085	24,715	50,937	26,269	41,442	16,774
VA	CERR	0	0	0	17,065	0	12,000	0
	VISTAS	40,856	36,414	4,442	17,065	12,623	12,771	8,607
WV	CERR	0	29,277	0	0	14,778	0	8445
	VISTAS	36,188	29,392	6,795	22,053	15,258	15,523	8,733

Note 1: CERR refers to data as submitted by S/L agencies; VISTAS refers to data calculated by MACTEC using the PM augmentation methodologies described in this document.

Note 2: KY DEP's initial CERR submittal reported particulate matter emissions using only PM-PRI pollutant code. MACTEC used this pollutant code during the PM augmentation routine. In February 2005, KY DEP indicated that data reported using the PM-PRI code should actually have been reported using the PM10-PRI code. MACTEC performed a subsequent PM augmentation in April 2005 using the PM10-PRI code. The numbers in the above table reflect the current VISTAS inventory as of May 2005.

After the PM augmentation process was performed, we executed a series of checks to identify potential inconsistencies in the PM inventory. These checks included:

- PM-PRI less than PM10-PRI, PM25-PRI, PM10-FIL, PM25-FIL, or PM-CON;
- PM-FIL less than PM10-FIL, PM25-FIL;
- PM10-PRI less than PM25-PRI, PM10-FIL, PM25-FIL or PM-CON;
- PM10-FIL less than PM25-FIL;

- PM25-PRI less than PM25-FIL or PM-CON;
- The sum of PM10-FIL and PM-CON not equal to PM10-PRI; and
- The sum of PM25-FIL and PM-CON not equal to PM25-PRI.

S/L agencies were asked to review this information and provide corrections where the inconsistencies were significant. In general, corrections (or general directions) were provided in the case of the potential inconsistency issues. In other cases, the agency provided specific process level pollutant corrections.

1.1.1.4 EGU Analysis

We made a comparison of the annual SO_2 and NO_x emissions for EGUs as reported in the S/L agencies CERR submittals and the data from EPA's Clean Air Markets Division (CAMD) continuous emission monitoring (CEM) database to identify any outstanding discrepancies. Facilities report hourly CEM data to EPA for units that are subject to CEM reporting requirements of the NO_x SIP Call rule and Title IV of the Clean Air Act (CAA). EPA sums the hourly CEM emissions to the annual level, and we compared these annual CEM emissions to those in the S/L inventories. The 2002 CEM inventory containing NO_x and SO_2 emissions and heat input data were downloaded from the EPA/Clean Air Markets Division's (CAMD) web site (www.epa.gov/airmarkets). The data were provided by quarter and emission unit.

The first step in the EGU analysis involved preparing a crosswalk file to match facilities and units in the CAMD inventory to facilities and units in the S/L inventories. In the CAMD inventory, the Office of Regulatory Information Systems (ORIS) identification (ID) code identifies unique facilities and the unit ID identifies unique boilers and internal combustion engines (i.e., turbines and reciprocating engines). In the S/L inventories, the State and county FIPS and State facility ID together identify unique facilities and the emission unit ID identifies unique boilers or internal combustion engines. In most cases, there is a one-to-one correspondence between the CAMD identifiers and the S/L identifiers. However, in some of the S/L inventories, the emissions for multiple emission units are summed and reported under one emission unit ID. We created an Excel spreadsheet that contained an initial crosswalk with the ORIS ID and unit ID in the CEM inventory matched to the State and county FIPS, State facility ID, and emission unit ID in the S/L inventory. The initial crosswalk contained both the annual emissions summed from the CAMD database as well as the S/L emission estimate. It should be noted that the initial matching of the IDs in both inventories was based on previous crosswalks that had been developed for the preliminary VISTAS 2002 inventory and in-house information compiled by MACTEC and Alpine Geophysics. The matching at the facility level was nearly complete. In some cases, however, S/L agency or stakeholder assistance was needed to match some of the CEM units to emission units in the S/L inventories.

The second step in the EGU analysis was to prepare an Excel spreadsheet that compared the annual emissions from the hourly CAMD inventory to the annual emissions reported in the S/L inventory. The facility-level comparison of CEM to emission inventory NO_x and SO_2 emissions found that for most facilities, the annual emissions from the S/L inventory equaled the CAMD CEM emissions. Minor differences could be explained because the facility in the S/L inventory contained additional small or emergency units that were not included in the CAMD database.

The final step in the EGU analysis was to compare the SO_2 and NO_x emissions for select Southern Company units in the VISTAS region. Southern Company is a super-regional company that owns EGUs in four VISTAS States – Alabama, Florida, Georgia, and Mississippi – and participates in VISTAS as an industry stakeholder. Southern Company independently provided emission estimates for 2002 as part of the development of the preliminary VISTAS 2002 inventory. In most cases, these estimates were reviewed by the States and incorporated into the States CERR submittal. The exception to this was a decision made by Georgia's Department of Environmental Protection to utilize CEM-based emissions for the actual 2002 emissions inventory for sources within the State when Southern Company also provided data. There were no major inconsistencies between the Southern Company data, the CAMD data, and the S/L CERR data.

The minor inconsistencies found included small differences in emission estimates (<2% difference), exclusion/inclusion of small gas-fired units in the different databases, and grouping of emission units in S/L CERR submittals where CAMD listed each unit individually. We compared SO_2 and NO_x emissions on a unit by unit basis and did not find any major inconsistencies.

1.1.1.5 QA Review of Final Inventory

Final QA checks were run on the revised point source inventory data set to ensure that all corrections provided by the S/L agencies and stakeholders were correctly incorporated into the S/L inventories and that there were no remaining QA issues. After exporting the inventory to ASCII text files in NIF 3.0, the EPA QA program was run on the ASCII files and the QA output was reviewed to verify that all QA issues that could be addressed were resolved

Throughout the inventory development process, QA steps were performed to ensure that no double counting of emissions occurred, and to ensure that a full and complete inventory was developed for VISTAS. QA was an important component to the inventory development process and MACTEC performed the following QA steps on the point source component of the VISTAS revised 2002 base year inventory:

1. Facility level emission summaries were prepared and evaluated to ensure that emissions were consistent and that there were no missing sources.
2. State-level EGU and non-EGU comparisons (by pollutant) were developed between the revised 2002 base year inventory, the preliminary VISTAS 2002 inventory, and the 1999 NEI Version 2 inventory.
3. Data product summaries and raw NIF 3.0 data files were provided to the VISTAS Emission Inventory Technical Advisor and to the Point Source, EGU, and non-EGU Special Interest Work Group representatives for review and comment. Changes based on these comments were reviewed and approved by the S/L point source contact prior to implementing the changes in the files.
4. Version numbering was used for all inventory files developed. The version numbering process used a decimal system to track major and minor changes. For example, a major change would result in a version going from 1.0 to 2.0. A minor change would cause a version number to go from 1.0 to 1.1. Minor changes resulting from largely editorial changes would result in a change from 1.00 to 1.01.

1.1.1.6 Summary of Revised 2002 Base Year Inventory

Tables 1.1-3 through 1.1-9 summarize the revised 2002 base year inventory. All values are in tons.

Table 1.1-3. Revised 2002 VISTAS Point Source Inventory for SO_2.

	All Point Sources	EGUs	Non-EGUs
AL	544,309	447,862	96,447
FL	518,721	448,046	70,675
GA	575,310	513,266	62,044
KY	518,086	484,059	34,027
MS	103,388	67,339	36,049
NC	522,112	471,030	51,082
SC	259,916	203,587	56,329
TN	424,309	333,934	90,375
VA	305,107	232,747	72,360
WV	570,153	516,109	54,044
Total	**4,341,411**	**3,717,979**	**623,432**

Table 1.1-4. Revised 2002 VISTAS Point Source Inventory for NO_x.

	All Point Sources	EGUs	Non-EGUs
AL	244,348	160,480	83,868
FL	306,679	244,541	62,138
GA	198,531	146,143	52,388
KY	237,209	198,726	38,483
MS	104,661	29,976	74,685
NC	196,782	146,465	50,317
SC	130,393	86,264	44,129
TN	229,193	155,762	73,431
VA	147,300	82,435	64,865
WV	277,660	230,950	46,710
Total	**2,072,756**	**1,481,742**	**591,014**

Table 1.1-5. Revised 2002 VISTAS Point Source Inventory for VOC.

	All Point Sources	EGUs	Non-EGUs
AL	49,331	1,438	47,893
FL	40,995	2,295	38,700
GA	34,914	1,178	33,736
KY	46,320	1,464	44,856
MS	43,852	473	43,379
NC	73,987	1,042	72,945
SC	38,927	434	38,493
TN	88,892	833	88,059
VA	43,906	679	43,227
WV	15,775	1,176	14,599
Total	**476,899**	**11,012**	**465,887**

Table 1.1-6. Revised 2002 VISTAS Point Source Inventory for CO.

	All Point Sources	EGUs	Non-EGUs
AL	185,549	11,243	174,306
FL	141,248	51,278	89,970
GA	140,661	9,248	131,413
KY	122,555	12,374	110,181
MS	59,872	2,714	57,158
NC	64,461	11,922	52,539
SC	63,304	3,699	59,605
TN	125,867	6,414	119,453
VA	70,689	6,294	64,395
WV	100,220	10,303	89,917
Total	**1,074,426**	**125,489**	**948,937**

Table 1.1-7. Revised 2002 VISTAS Point Source Inventory for PM10-PRI.

	All Point Sources	EGUs	Non-EGUs
AL	32,791	7,834	24,957
FL	57,243	26,912	30,331
GA	33,203	11,148	22,055
KY	21,326	5,711	15,615
MS	21,089	1,467	19,622
NC	36,991	22,480	14,511
SC	41,572	23,423	18,149
TN	50,937	14,954	35,983
VA	17,066	3,824	13,242
WV	22,053	7,188	14,865
Total	**334,271**	**124,941**	**209,330**

Table 1.1-8. Revised 2002 VISTAS Point Source Inventory for PM25-PRI.

	All Point Sources	EGUs	Non-EGUs
AL	23,290	4,274	19,016
FL	46,147	20,305	25,842
GA	22,778	4,888	17,890
KY	14,173	3,443	10,730
MS	11,044	912	10,132
NC	27,512	16,305	11,207
SC	32,727	19,162	13,565
TN	41,442	12,311	29,131
VA	12,771	2,560	10,211
WV	15,523	3,369	12,154
Total	**247,407**	**87,529**	**159,878**

Table 1.1-9. Revised 2002 VISTAS Point Source Inventory for NH_3.

	All Point Sources	EGUs	Non-EGUs
AL	1,973	90	1,883
FL	1,490	58	1,432
GA	3,618	5	3,613
KY	674	0	674
MS	1,233	64	1,169
NC	1,207	36	1,171
SC	1,411	0	1,411
TN	1,628	0	1,628
VA	3,231	127	3,104
WV	344	13	331
Total	**16,809**	**393**	**16,416**

1.1.2 Development of Typical Year EGU inventory

VISTAS developed a typical year 2002 emission inventory to avoid anomalies in emissions due to variability in meteorology, economic, and outage factors in 2002 and to represent the five year (2000-2004) starting period that would be used to determine the regional haze reasonable progress goals.

Data from EPA's CAMD were used to develop normalization factors for producing a 2002 typical year inventory for electric generating units (EGUs). The approach used the ratio of the 2002 actual heat input to the 2000-2002 heat input to normalize the 2002 actual emissions. MACTEC obtained data from EPA's CAMD for utilities regulated by the Acid Rain program. Annual data for the period 1997 to 2002 were obtained from the CAMD web site (www.epa.gov/airmarkets). The parameters available were the SO_2 and NO_x emission rates, heat input, and operating hours.

We used the actual 2002 heat input and the average heat input for the 3-year period from 2000-2002 as the normalization factor, as follows:

$$\text{Normalization Factor: } \frac{\text{2000-2002 average heat input}}{\text{2002 actual heat input}}$$

If the unit did not operate for all three years, then the 2000-2002 average heat input was calculated for the one or two years in which the unit did operate. For example, if the unit operated only during 2002, then the normalization factor would be 1.0.

The annual actual emissions were multiplied by the normalization factor to determine the typical emissions for 2002, as follows:

Typical Emissions = 2002 actual emissions x Normalization Factor

After applying the normalization factor, some adjustments were needed for special circumstances. For example, a unit may not have operated in 2002 and thus have zero emissions. If the unit had been permanently retired prior to 2002, then we used zero emissions for the typical year. If the unit had not been permanently retired and would normally operate in a typical year, then we used the 2001 (or 2000) heat input and emission rate to calculate the typical year emissions.

The Southern Company provided "typical year" data for their sources. Hourly emissions data for criteria pollutants were provided. MACTEC aggregated the hourly emissions into annual values. Further documentation of how Southern Company created the typical year inventory for their units can be found in *Developing Southern Company Emissions and Flue Gas Characteristics for VISTAS Regional Haze Modeling (April 2005, presented at 14th International Emission Inventory Conference)*. A copy of this paper can be found at http://www.epa.gov/ttn/chief/conference/ei14/session9/kandasamy.pdf

Since Southern Company only supplied filterable particulate emissions, we ran the PM10/PM2.5 augmentation routine to calculate annual emission estimates for PM10-PRI and PM25-PRI.

The final step was to merge the "typical year" data described above with the final version of the 2002 VISTAS emission inventory which was completed in September, 2004. This step replaced the actual 2002 emissions data with the "typical year" emissions values developed in the previous steps.

Table 1.1-10 summarizes emissions by State and pollutant for the actual 2002 EGU inventory and the "typical year" inventory.

Table 1.1-10. Comparison of SO_2 and NO_x Emissions for EGUs from the Actual 2002 Inventory and Typical 2002 Inventory.

	SO_2 Emissions (tons/year)		NO_x Emissions (tons/year)	
State	**Actual 2002**	**Typical 2002**	**Actual 2002**	**Typical 2002**
AL	447,862	421,734	160,480	153,349
FL	448,046	443,152	244,541	247,099
GA	513,266	433,513	146,143	120,785
KY	484,059	508,139	198,726	209,802
MS	67,339	57,263	29,976	27,254
NC	471,030	472,192	146,465	144,730
SC	203,587	203,978	86,264	85,555
TN	333,934	325,779	155,762	155,028
VA	232,747	234,714	82,435	82,911
WV	516,109	497,991	230,950	222,090
Total	**3,717,979**	**3,598,455**	**1,481,742**	**1,448,603**

The biggest differences shown in this table appear to be in AL, GA, and MS, where Southern Company provided "typical" year data using a different methodology than what MACTEC used for non-Southern Company units. This probably explains the majority of the differences shown in Table 1.1-10.

1.2 Area Sources

This section details the development of the revised 2002 base year inventory for area sources. There were three major components to the development of the area source sector of the inventory. The first component was the development of a "typical" year fire inventory. That development covered wildfire, prescribed burning, agricultural fires and land clearing fires. Since fire emissions are not easily grown or projected, in order to effectively represent fires in both the base and future year inventories, VISTAS determined that a typical year fire inventory was necessary. The first part of this section of the report discusses the development of the typical year fire inventory.

The second component of the area source inventory was the incorporation of data submitted by the VISTAS States to the United States Environmental Protection Agency (EPA) as part of the CERR. Work on incorporating the CERR data into the revised base year involved: 1) obtaining the data from EPA, 2) evaluating the emissions and pollutants reported in order to avoid double counting and 3) backfilling from the existing VISTAS 2002 base year inventory for missing sources/pollutants. The processes used to perform those operations are described in the second portion of this section.

The final component was related to the development of NH_3 emission estimates for livestock and fertilizers and paved road PM emissions. For the NH_3 emission estimates for livestock and fertilizers we used version 3.6 of the Carnegie Mellon University (CMU) NH_3 model. For the paved road PM emissions, we used the most recent estimates developed by EPA as part of the National Emission Inventory (NEI) development effort. EPA had developed an improved methodology for estimating paved road emissions so those values were substituted directly into the inventory after receiving consensus from all of the VISTAS States to perform the replacement. Details on these methods are provided in the third portion of this section of the document.

Finally, quality assurance steps for each component of the area source inventory are discussed.

1.2.1 Development of a "typical" year fire inventory

In order to effectively characterize fire emissions in the VISTAS region, a typical (as opposed to strictly 2002 year based inventory) was required. Development of a typical year fire inventory provided the capability of using a comparable data set for both the base year and future years. Thus fire emissions would remain the same for air quality and visibility modeling in both the base and any future years. MACTEC originally proposed five different methods for developing the typical fire year to the VISTAS Fire Special Interest Work Group (SIWG) and requested their feedback and preference for developing the final typical year inventory. The method that was selected by SIWG members was to use a method similar to that used for the 2018 preliminary inventory. For that inventory, State level ratios of acres over a longer term record (three or more years) were developed for each fire type relative to 2002. The 2002 acreage was then scaled up or down based on these ratios to develop a typical year for use in the preliminary 2018 inventory. For this work, the decision of the VISTAS Fire SIWG was to base the ratio on county level data for States that supplied long term fire-by-fire acreage data rather than State-level ratios. Where States did not supply long term fire-by-fire acreage data, MACTEC would maintain the data in the preliminary 2018 inventory (which was based on State-level ratios) or would update the State ratios if longer term updated State level acreage estimates were provided. With one broad exception (wildfires) this method was implemented for all fires. MACTEC solicited long term fire-by-fire acreage data by fire type from each VISTAS State. A minimum of three or more years of data were used to develop the ratios. Those data were then used to develop a ratio for each county based on the number of acres burned in each county for each fire type relative to 2002.

Thus if we had long term county prescribed fire data from a State, we developed a county acreage ratio of:

$$Ratio = \frac{\text{Long term average county level Rx acres}}{\text{2002 actual county level Rx acreage}}$$

This ratio was then multiplied times the actual 2002 acreage to get a typical value (basically the long term average county level acres). Wherever possible this calculation was performed on a fire by fire basis. The acreage calculated using the ratio was then used with the fuel loading and emission factor values that we already had (and had been reviewed by the SIWG) to calculate emissions using the same method used for the 2002 actual values (which were previously documented).

There were three exceptions to this method.

Exception 1: Use of State Ratios for Wildfires

The first exception was that wildfires estimates were developed using State ratios rather than county ratios. This change was made after initial quality assurance of the draft estimates revealed that some counties were showing unrealistic values created by very short term data records or missing data that created unrealistic ratios. In addition, exceptionally large and small fires were removed from the database since they were felt to be atypical. For example the Blackjack Complex fire in Georgia was removed from the dataset because the number of acres burned was “atypical” in that fire. We also removed all fires less than 0.1 acres from the dataset.

Exception 2: Correction for Blackened Acres on Forest Service Lands

Following discussions with the United States Forest Service (Forest Service), it was determined that the acres submitted by the Forest Service for wildfires and prescribed fires represented perimeter acres rather than “blackened” acres. Thus for wildfires and prescribed fires on Forest Service lands, a further correction was implemented to correct the perimeter acre values to blackened acres. The correction was made based on the size of the fire. For prescribed fires over 100 acres in size the acreage was adjusted to be 80 percent of the initial reported value. For prescribed fires of 100 acres or less the acreage values were maintained as reported. For wildfires, all reported acreage values were adjusted to be 66 percent of their initially reported values. These changes were made to all values reported for Forest Service managed lands.

Exception 3: Missing/Non-reported data

When we did not receive data from a VISTAS State for a particular fire type, a composite average for the entire VISTAS region was used to determine the typical value for that type fire. For example, if no agricultural burning long term acreage data was reported for a particular State, MACTEC determined an overall VISTAS regional average ratio that was used to multiply times the 2002 values to produce the "typical" values. This technique was applied to all fire types when data was missing.

In addition, for wildfires and prescribed burning, ratios were developed for "northern" and "southern" tier States within the VISTAS region and those ratios were applied to each State with missing data depending upon whether they were considered a "northern" or "southern" tier State. Development of "southern" and "northern" tier data was an attempt to account for a change from a predominantly pine/evergreen ecosystem (southern) to a pine/deciduous ecosystem (northern).

Finally for land clearing and agricultural fires, there are now NH_3 and SO_2 emissions. This is due to the lack of emission factors for these pollutants for these fire types.

Table 1.2-1 shows fire emissions from the original base year emission inventory (VISTAS 3.1), the actual 2002 emissions and the typical year emissions for the entire VISTAS region.

Figures 1.2-1 through 1.2-4 show the State by State changes in emissions between the original 2002 base year fire inventories, the actual 2002 and the typical year inventories for carbon monoxide (CO) by fire type. Due to the relative magnitude of CO emissions compared to other criteria and PM pollutants from fires, this pollutant is normally chosen to represent the distribution of fires in the example plots.

Table 1.2-1. Emissions from Fires in the VISTAS Region – Comparison between Original Base Year 2002, 2002 Actual, and 2002 Typical Year Emissions.

		CO	NH_3	NO_X	PM_{10}-FIL	PM_{10}-PRI	$PM_{2.5}$-FIL	$PM_{2.5}$-PRI	SO_2	VOC
Total LC	Actual	492,409	0	14,568	62,146	62,146	62,146	62,146	0	33,799
	Typical	675,838	0	19,995	80,598	80,598	80,598	80,598	0	46,389
	VISTAS 3.1	484,240	0	14,327	61,325	61,325	61,325	61,325	0	33,238
Total Ag	Actual	164,273	0	903	30,958	30,958	30,385	30,385	0	21,946
	Typical	161,667	0	903	30,465	30,465	29,892	29,892	0	21,595
	VISTAS 3.1	331,073	0	903	41,480	41,480	40,192	40,192	0	41,875
Total WF	Actual	298,835	1,333	6,628	28,923	28,923	24,926	24,926	1,611	16,804
	Typical	547,174	2,451	11,955	53,070	53,070	45,635	45,635	3,072	28,491
	VISTAS 3.1	275,766	1,230	6,133	26,680	26,680	23,002	23,002	1,476	15,718
Total RX	Actual	1,678,216	7,616	36,561	168,938	168,938	145,175	145,175	9,839	78,988
	Typical	1,635,776	7,425	35,650	164,811	164,811	141,636	141,636	9,590	76,990
	VISTAS 3.1	1,724,940	7,822	37,556	173,590	173,590	149,181	149,181	10,101	81,188

Key: LC = Land Clearing; Ag = Agricultural burning; WF = wildfires; RX = prescribed burning

Figure 1.2-1. CO Emissions from Agricultural Burning for the Original Base Year, 2002 Actual, and 2002 Typical Inventories.

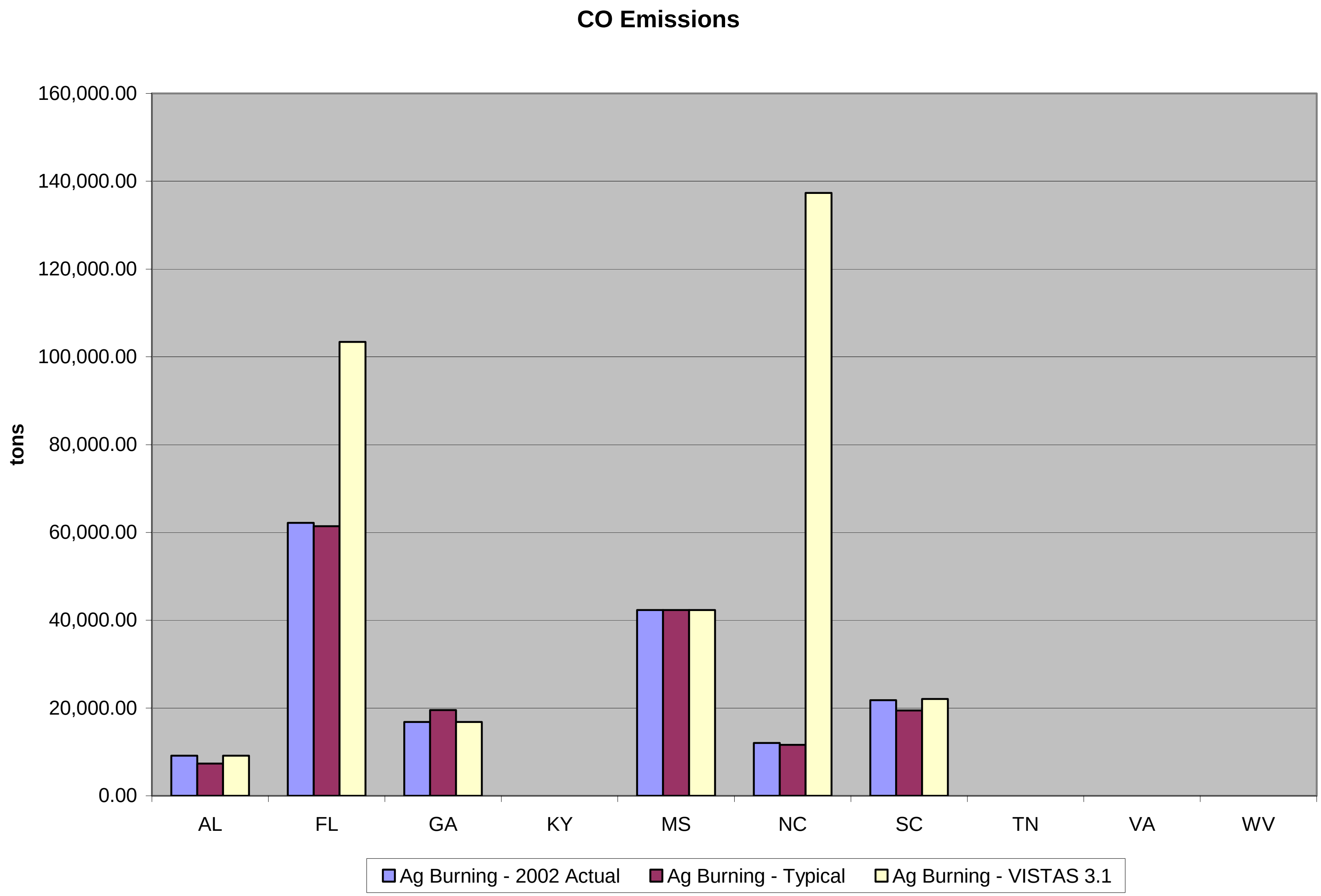


Figure 1.2-2. CO Emissions from Land Clearing Burning for the Original Base Year, 2002 Actual and 2002 Typical Inventories.

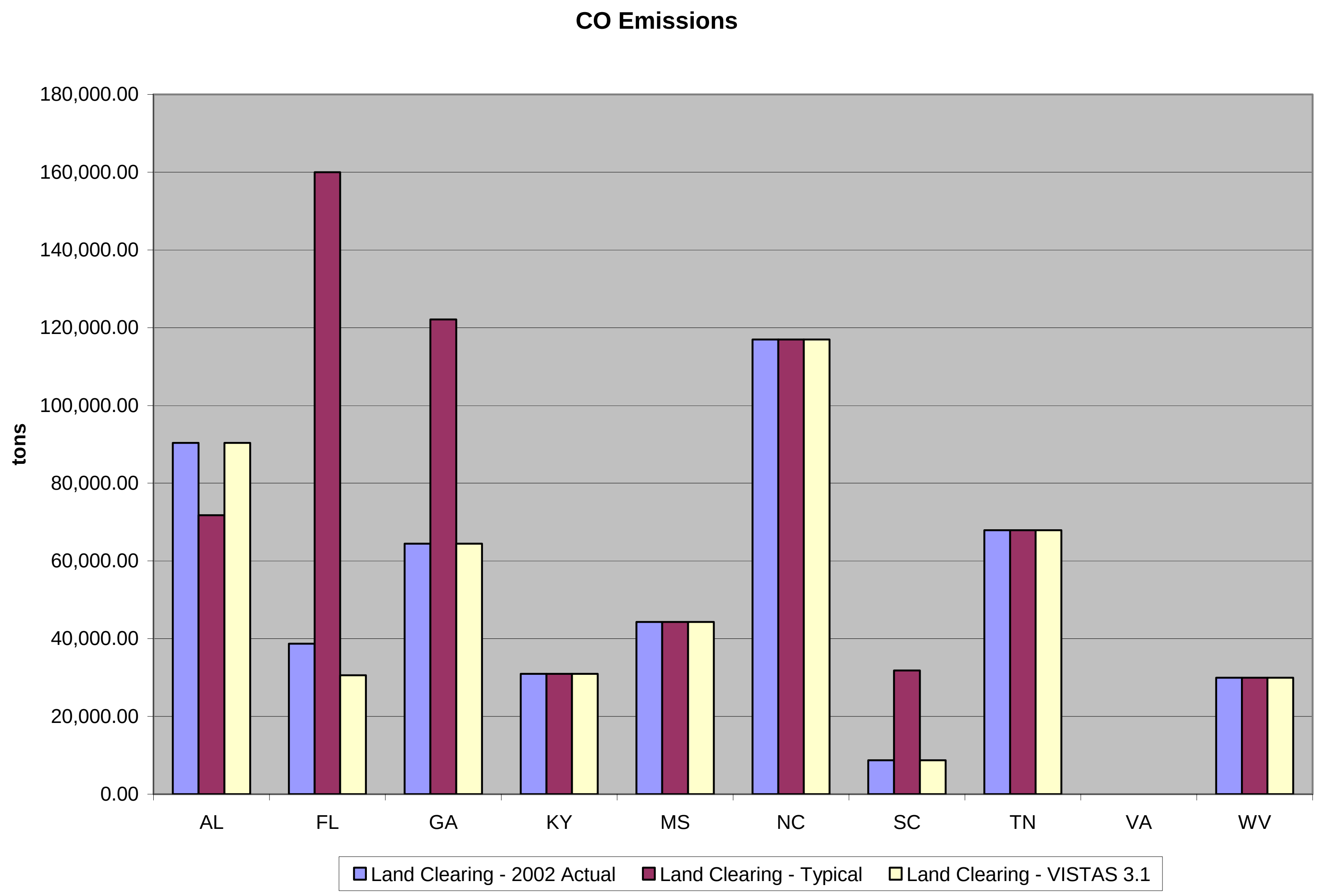


Figure 1.2-3. CO Emissions from Prescribed Burning for the Original Base Year, 2002 Actual and 2002 Typical Inventories.

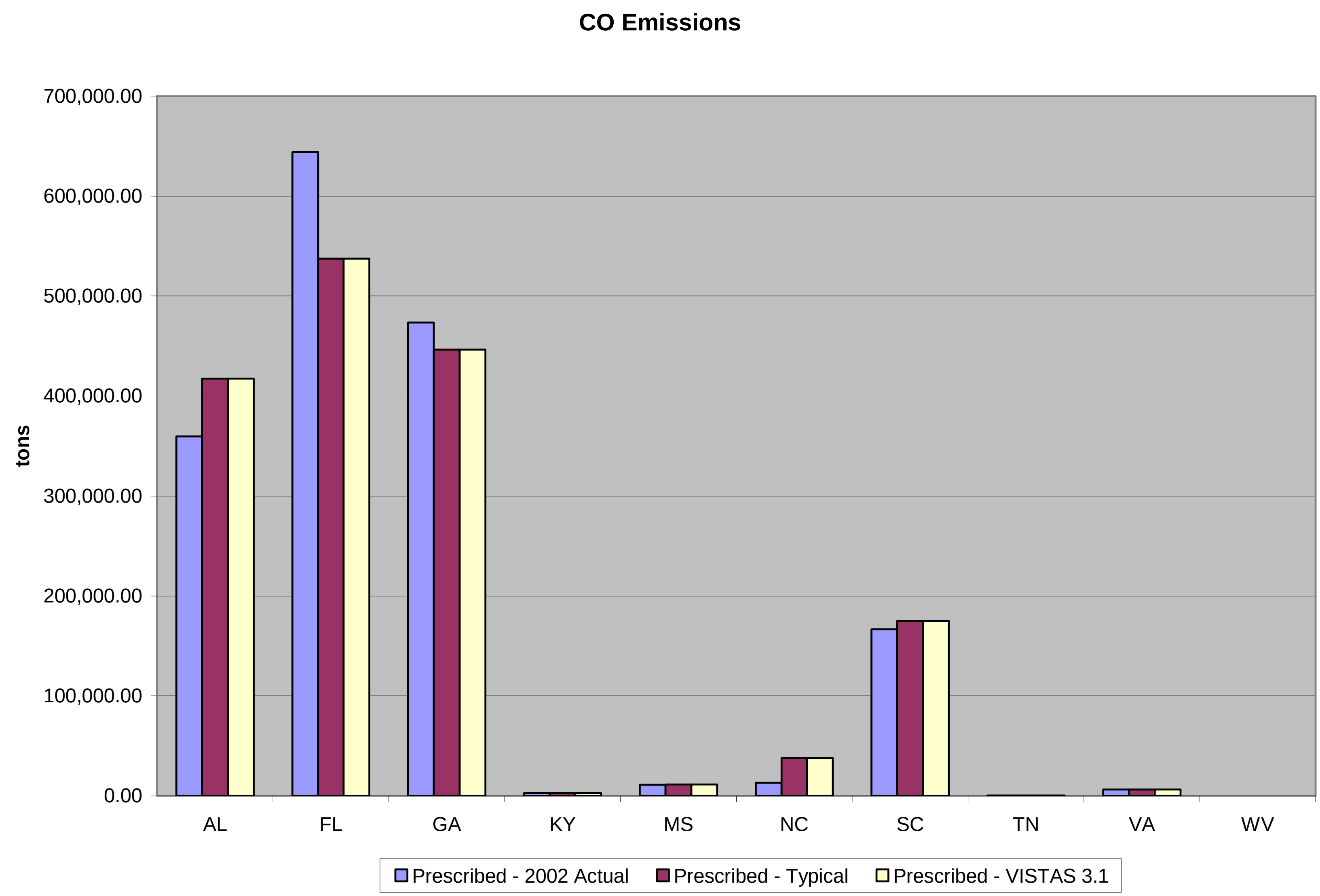
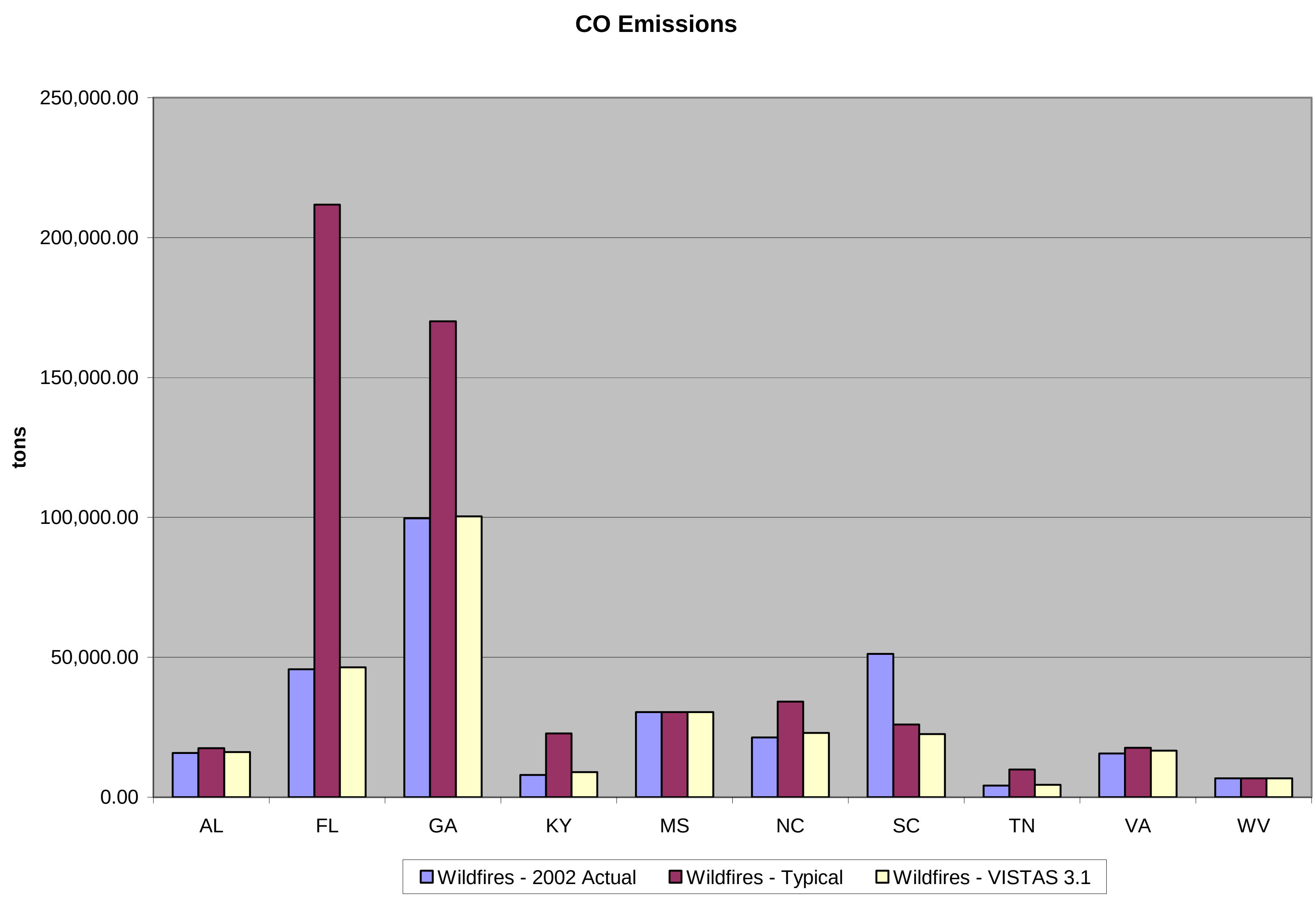


Figure 1.2-4. CO Emissions from Wildfire Burning for the Original Base Year, 2002 Actual and 2002 Typical Inventories.



1.2.2 Development of non-fire inventory

The second task in preparing the area source component of the updated 2002 base year inventory was the incorporation of data submitted by the VISTAS States to the EPA as part of the CERR. Work on incorporating the CERR data into the revised base year involved: 1) obtaining the data from EPA, 2) evaluating the emissions and pollutants reported in order to avoid double counting and 3) backfilling from the earlier version of the VISTAS 2002 base year inventory for missing sources/pollutants. The processes used to perform those operations are described below. This work did not include any of the fire emission estimates described above. In addition it did not include emission estimates for ammonia from agricultural and fertilizer sources. Finally it did not include PM emissions from paved roads. Each of those categories was estimated separately.

Data on the CERR submittals was obtained from EPA's FTP site. The data submitted in National Emission Inventory Format (NIF) was downloaded from that site. Once all of the files were obtained, MACTEC ran the files through the EPA NIF Format and Content checking tool to ensure that the files were submitted in standard NIF format and that there were no issues with those files. In a couple of cases small errors were found. For example, in one case a county FIPs code that was no longer in use was found. MACTEC contacted each VISTAS State area source contact person to resolve the issues with the files and corrections were made. Once all corrections to the native files were made, MACTEC continued with the incorporation of the data into the VISTAS area source files.

Our general assumption was that unless we determined otherwise, the CERR submittals represented full and complete inventories. Where a State submitted a complete inventory, our plan was to simply delete the previous 2002 base year data and replace it with the CERR submittal. Prior to this replacement however, we stripped out the following emissions:

1. All wildfire, prescribed burning, land clearing and agricultural burning emissions submitted to EPA by the States as part of the CERR process were removed since they were to be replaced with emissions estimated using methods described earlier.

2. All fertilizer and agricultural ammonia emission records submitted to EPA by the States as part of the CERR process were removed. These were to be replaced with the estimates developed using the CMU Ammonia model.

3. All emissions from paved roads submitted to EPA by the States as part of the CERR process were removed. These emissions were to be replaced with updated emissions developed by U.S. EPA as part of their 2002 NEI development effort.

This approach was used for most State and Local emission submittals. There were a few cases where alternative data was used. In general, these alternatives involved submittal of alternative files to the CERR data. Table 1.2-2 below summarizes the data used. In general the data were derived from one of the following sources:

1. CERR submittal obtained from EPA FTP site as directed by VISTAS States;
2. State submitted file (either revised from CERR submittal or separate format);
3. VISTAS original 2002 base year (VISTAS version 3.1 base year file); or
4. EPA's preliminary 2002 NEI.

Table 1.2-2. Summary of State Data Submittals for the Revised 2002 VISTAS Area Source Inventory

State / Local Program	Area Source Emissions Data Source
AL	B
FL	B
GA	C
KY	A
MS	B
NC	C
SC	B
TN	B
VA	B
WV	A/C
Davidson County, TN	B
Hamilton County, TN	C
Memphis/Shelby County, TN	A
Knox County, TN	B
Jefferson County, AL	* so B from State
Jefferson County, KY	B
Buncombe County, NC	* so C from State
Forsyth County, NC	* so C from State
Mecklenburg County, NC	* so C from State

A = VISTAS 2002 (version 3.1)
B = CERR Submittal from EPA's ftp site
C = Other (CERR or other submittal sent directly from State to MACTEC)
* = No response

In order to track the sources of data in the final NIF files, a field was added to the NIF format files developed for VISTAS to track each data source. A field named Data_Source was added to the EM table. A series of codes were added to this field to mark the source of each emissions value. Values in this field are detailed in Table 1.2-3.

Table 1.2-3: Data Source Codes and Data Sources for VISTAS Revised 2002 Area Source Emissions Inventory.

Data Source Codes	Data Source
CMU Model	CMU Ammonia model v 3.6
E-02-X or E-99-F or L-02-X or S-02-X	EPA CERR submittal (from FTP site)
EPA Paved	EPA Paved Road emissions estimates
EPAPRE02NEI	EPA Preliminary 2002 NEI
STATEFILE	State submitted file
VISTBASYR31	VISTAS 2002 Base Year version 3.1
VISTRATIO	Developed from VISTAS Ratios (used only for missing pollutants)

Most States submitted complete inventories. Virginia's inventory required a two stage update. Virginia's CERR submittal only contained ozone precursor pollutants (including CO). For Virginia, MACTEC's original plan was to maintain the previous 2002 VISTAS base year emissions for non-ozone pollutants and then do a simple replacement for ozone pollutants. However during the QA phase of the work, MACTEC discovered that there were categories that had ozone precursor or CO emissions in the submittal that weren't in the original 2002 VISTAS base year inventory that should have PM or SO_2 emissions. For those records, MACTEC used an emissions ratio to build records for emissions of these pollutants. Data for Virginia PM and SO_2 emissions were generated by developing SCC level ratios to NO_x from the VISTAS 2002 base year inventory (version 3.1) or from emission factors and then calculating the emissions based on that ratio.

1.2.3 Ammonia and paved road emissions

The final component of inventory development was estimation of NH_3 emission estimates for livestock and fertilizers and paved road PM emissions. For the NH_3 emission estimates for livestock and fertilizers we used version 3.6 of the Carnegie Mellon University (CMU) NH_3 model (http://www.cmu.edu/ammonia/). Results from this model were used for all VISTAS States. The CMU model version 3.6 was used in large part because it had been just recently been updated to include the latest (2002) Census of Agriculture animal population statistics. Prior to inclusion of the CMU model estimates, MACTEC removed any ammonia records for agricultural livestock or fertilizer emissions from the VISTAS 2002 initial base year inventory. MACTEC also generated emissions from human perspiration and from wildlife using the CMU model and added those emissions for each State.

For the paved road PM emissions, we used the most recent estimates developed by EPA as part of the NEI development effort (Roy Huntley, U.S. EPA, email communication, 8/30/2004). EPA had developed an improved methodology for estimating paved road emissions for 2002 and had used that method to calculate emissions for that source category. MACTEC obtained those emissions from EPA and those values were substituted directly into the inventory after receiving consensus from all of the VISTAS States to perform the replacement. These files were obtained in March of 2004 in NIF format from the EPA FTP site.

1.2.4 Quality Assurance steps

Throughout the inventory development process, quality assurance steps were performed to ensure that no double counting of emissions occurred, and to ensure that a full and complete inventory was developed for VISTAS. Quality assurance was an important component to the inventory development process and MACTEC performed the following QA steps on the area source component of the 2002 base year revised:

1. All CERR and NIF format State supplied data submittals were run through EPA's Format and Content checking software.
2. SCC level emission summaries were prepared and evaluated to ensure that emissions were consistent and that there were no missing sources.
3. Tier comparisons (by pollutant) were developed between the revised 2002 base year inventory and the previous (version 3.1) base year inventory.
4. Fields were either added or used within each NIF data table to track the sources of data for each emission record.
5. Data product summaries were provided to both the VISTAS Emission Inventory Technical Advisor and to Area Source and Fires SIWG representatives for review and comment. Changes based on these comments were implemented in the files.
6. Version numbering was used for all inventory files developed. The version numbering process used a decimal system to track major and minor changes. For example, a major change would result in a version going from 1.0 to 2.0. A minor change would cause a version number to go from 1.0 to 1.1. Minor changes resulting from largely editorial changes would result in a change from 1.00 to 1.01.

In addition, for the fires inventory, data related to fuel loading and fuel consumption was reviewed and approved by the VISTAS Fire SIWG to ensure that values used for each type of fire and each individual fire were appropriate. Members of the VISTAS Fire SIWG included representatives from most State Divisions of Forestry (or equivalent) as well as U.S. Forest Service and National Park Service personnel.

1.3 Mobile Sources

This section describes the revisions made to the initial 2002 VISTAS Base Year emission inventory on-road mobile source input files. For this work actual emission estimates were not made, rather data files consistent with MOBILE6 were developed and provided to the VISTAS modeling contractor. These input data files were then run during the VISTAS modeling to generate on-road mobile source emissions using episodic and meteorological specific conditions configured in the SMOKE emissions processor.

During initial discussions with the VISTAS Mobile Source SIWG, some States indicated a desire to use CERR mobile source emissions data in place of the VISTAS 2002 inventories generated by E.H. Pechan and Associates, Inc. (the initial VISTAS 2002 Base Year inventory files).

However, the CERR emissions data by itself were not sufficient for an inventory process that includes both base and future year inventories. MACTEC needed to be able to replicate the CERR data rather than simply obtain CERR emissions estimates. The reason for this is that only input files were being prepared to provide revised 2002 estimates during the VISTAS modeling process, rather than the actual emission estimates and that the 2002 input data files would be used as a starting point for the projected emission estimates. This meant that the appropriate VMT, MOBILE6, and/or NONROAD model input data needed to be provided. If these data were provided with the CERR emissions estimates we used it as the starting point for revision of the 2002 Base Year inventory. However MACTEC did not have access to the on-road mobile CERR submissions from EPA, so resubmittal of these data directly to MACTEC was requested in order to begin compiling the appropriate input file data.

In those cases where States did not provide CERR on-road mobile source input data files, our default approach was to maintain the data input files and VMT estimates for the initial 2002 Base Year inventory prepared by Pechan.

1.3.1 Development of on-road mobile source input files and VMT estimates

Development of the 2002 on-road input files and VMT was a multi-step process depending upon what the State mobile source contacts instructed us to use as their data. In general the process involved one of three steps.

1. The first step was to evaluate the initial 2002 base year files and make any non-substantive changes (i.e., changes only to confirm that the files posted for 2002 by Pechan were executable and that all the necessary external files needed to run MOBILE6 were present). This approach was taken for AL, FL, GA, MS, SC, and WV. For these States the determination was made that the previous files would be okay to use as originally prepared. For SC, the VMT file was updated, but that did not affect the MOBILE6 input files.

2. For other States, modification to the input files was required. The information below indicates what changes were made for other States in the VISTAS region.

KY – For Kentucky, the I/M records in the input files for Jefferson County were updated in order to better reflect the actual I/M program in the Louisville metropolitan area.

NC - Substantial revisions were implemented to these input files based on input from the State. The modifications necessary to reflect the desires of the State led to complete replacement of the previous input files. Among the changes made were:

- The regrouping of counties (including the movement of some counties from one county group to another and the creation of new input files for previously grouped counties). There were originally 32 input files; after the changes there were 49. The pointer file was corrected to reflect these changes.
- Travel speeds were updated in over 3000 scenarios.
- All I/M records were updated.
- All registration distributions were updated.
- I/M VMT fractions were updated (which only affected the pointer file).
- VMT estimates were updated (which has no direct effect on the MOBILE6 input files but does ultimately effect emissions).

3. VA and TN – For these States, new input files were provided due to substantive changes that the State wanted to make relative to the 2002 initial base year input files. In addition, revised VMT data were developed for each State.

1.3.2 Development of non-road emission estimates

Emissions from non-road sources were estimated in two steps. First, emissions for non-road sources that are included in the NONROAD model were developed. Second, emissions from sources not included in the NONROAD model were estimated. The sections below detail the procedures used for each group of sources.

1.3.2.1 Emissions from NONROAD model sources

An initial 2002 base year emissions inventory for nonroad engines and equipment covered by the EPA NONROAD model was prepared for VISTAS in early 2004. The methods and assumptions used to develop the inventory are presented in a February 9, 2004 report "*Development of the VISTAS Draft 2002 Mobile Source Emission Inventory (February 2004 Version)*" as prepared by E.H. Pechan & Associates, Inc. Except as otherwise stated below, all aspects of the preparation methodology documented in that report continue to apply to the revised NONROAD modeling discussed in this section.

Revisions to the preliminary 2002 NONROAD emissions inventory were implemented to ensure that the latest State and local data were considered, as well as to more accurately reflect gasoline sulfur contents for 2002 and correct other State-specific discrepancies. This section details the specific revisions made to the NONROAD model input files for the revised 2002 VISTAS base year inventory, and provides insight into some key differences between the version of the NONROAD model employed for this inventory and the previous version employed for the initial 2002 base year inventory.

Three VISTAS States provided detailed data revisions for consideration in developing model inputs. These States were:

1. North Carolina
2. Tennessee (including a separate submission for Davidson County), and
3. Virginia.

The remaining seven VISTAS States indicated that the preliminary 2002 VISTAS input files continued to reflect the most recent data available. These States were:

1. Alabama,
2. Florida,
3. Georgia,
4. Kentucky,
5. Mississippi,
6. South Carolina, and
7. West Virginia.

However, it should be recognized that the NONROAD input files for *all* ten VISTAS States were updated to reflect gasoline sulfur content revisions for the revised 2002 base year inventory.

Before presenting the specific implemented revisions, it is important to note that the revised 2002 base year inventory utilizes a newer release of the NONROAD model than was used for the initial 2002 base year inventory. The revised 2002 base year inventory is based on the Draft NONROAD2004 model, which was released by the EPA in May of 2004. (The model can be downloaded from: http://www.epa.gov/otaq/nonrdmdl.htm#model.) The initial 2002 base year inventory was based on the Draft NONROAD2002a version of the model. Key differences between the models are as follows:

- Draft NONROAD2004 includes the effects of the Tier 4 nonroad engine and equipment standards (this did not impact 2002 inventory estimates, but does affect future year forecasts).
- Draft NONROAD2004 includes the *exhaust* emission impacts of the large spark-ignition engine standards; the evaporative impacts of these standards are *not* incorporated (this does not impact 2002 inventory estimates, but does affect future year forecasts).
- Draft NONROAD2004 includes revised equipment population estimates.
- The $PM_{2.5}$ fraction for *diesel* equipment in Draft NONROAD2004 has been updated from 0.92 to 0.97.
- Draft NONROAD2004 includes revisions to recreational marine activity, useful life, and emission rates.

To the extent that these revisions affect 2002 emissions estimates, they will be reflected as differentials between the initial and revised 2002 VISTAS base year inventories. It is perhaps important to identify that the EPA recognizes the Draft NONROAD2004 model as an appropriate mechanism for State Implementation Plan (SIP) development. Although the model continues to be designated as a draft update, it reflects the latest and most accurate NONROAD planning data, as evidenced by the EPA's use of the version for the Tier 4 Final Rulemaking.

For the initial 2002 base year inventory, all NONROAD modeling runs for VISTAS were performed utilizing a gasoline sulfur content of 339 parts per million by weight (ppmW) and a diesel sulfur content of 2,500 ppmW. Although the EPA-recommended nonroad diesel fuel sulfur content for 2002 is 2,283 ppmW, the 2,500 ppmW sulfur content used for the initial 2002 base year VISTAS inventory was designed to remove the effect of lower nonroad diesel fuel sulfur limits applicable only in California. (The EPA recommended inputs can be found in "*Diesel Fuel Sulfur Inputs for the Draft NONROAD2004 Model used in the 2004 Nonroad Diesel Engine Final Rule*," EPA, April 27, 2004.) This correction is appropriate and has been retained for the final 2002 inventory. Thus, the final inventory continues to assume diesel fuel sulfur content of 2,500 ppmW across the VISTAS region.

However, 339 ppmW is not the EPA recommended 2002 gasoline sulfur content for either eastern conventional gasoline areas or Federal Reformulated Gasoline (RFG) areas. The recommended sulfur content for eastern conventional gasoline is 279 ppmW year-round, while the recommended sulfur content for RFG areas is 129 ppmW during the summer season and 279 ppmW during the winter season. (Conventional gasoline and RFG sulfur contents for 2002 can be found in "*User's Guide to MOBILE6.1 and MOBILE6.2, Mobile Source Emission Factor Model*," EPA420-R-03-010, U.S. EPA, August 2003 [pages 149-155] and in the source code for

MOBILE6.2 at Block Data BD05.) Given the differences in the EPA-recommended values and the value used to generate the initial 2002 base year inventory, the input files for *all* VISTAS areas were updated to reflect revised gasoline sulfur content assumptions.

Since the VISTAS NONROAD modeling is performed on a seasonal basis, and since gasoline sulfur content in RFG areas varies with the RFG season, seasonal-specific gasoline sulfur content values were estimated for use in RFG area modeling. In addition, 25 counties in Georgia are subject to a summertime gasoline sulfur limit of 150 ppmW, so that seasonal sulfur content estimates were also estimated for these counties. The initial 2002 base year NONROAD inventory for these Georgia counties was based on a year-round 339 ppmW gasoline sulfur content, but that oversight was corrected in the revised 2002 base year inventory. Based on the seasonal definitions employed in the NONROAD model, monthly sulfur contents were averaged to estimate seasonal gasoline sulfur contents as follows:

Month/Season	RFG Areas	Conventional Gasoline Areas	Georgia Gasoline Control Areas
March	279 ppmW	279 ppmW	279 ppmW
April	279 ppmW	279 ppmW	279 ppmW
May	129 ppmW	279 ppmW	150 ppmW
Spring	229 ppmW	279 ppmW	236 ppmW
June	129 ppmW	279 ppmW	150 ppmW
July	129 ppmW	279 ppmW	150 ppmW
August	129 ppmW	279 ppmW	150 ppmW
Summer	129 ppmW	279 ppmW	150 ppmW
September	129 ppmW	279 ppmW	150 ppmW
October	279 ppmW	279 ppmW	279 ppmW
November	279 ppmW	279 ppmW	279 ppmW
Fall	229 ppmW	279 ppmW	236 ppmW
December	279 ppmW	279 ppmW	279 ppmW
January	279 ppmW	279 ppmW	279 ppmW
February	279 ppmW	279 ppmW	279 ppmW
Winter	279 ppmW	279 ppmW	279 ppmW

Note that the seasonal data are based on simple arithmetic averages and do not consider any monthly variation in activity (and fuel sales), and that the transition between summer and winter seasons is also not considered. Additionally, the summer fuel control season is treated as though it applies from May through September, while the summer RFG season actually ends on September 15 and the Georgia fuel control season does not officially begin until June 1. This treatment is consistent with the treatment of both fuel control programs in the VISTAS onroad vehicle modeling. Each of these influences will result in some error in the estimated sulfur content estimates, but it is expected that this error is small relative to the overall correction from a year-round sulfur content estimate of 339 ppmW.

The specific NONROAD modeling revisions implemented for each VISTAS area are presented in Table 1.3-2. Due to the more involved updates in several areas, the number of NONROAD input files as well as sequence numbers used to represent these files was also updated in a few instances. These structural revisions are presented in Table 1.3-3, and are provided solely for the benefit of NONROAD modelers as the indicated revisions have no impact on generated emission estimates.

Table 1.3-2. Summary of NONROAD Modeling Revisions

State	Revisions Implemented
AL	(1) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in all counties and all seasons (all are conventional gasoline areas).
FL	(1) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in all counties and all seasons (all are conventional gasoline areas).
GA	(1) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in all seasons for conventional gasoline counties. (2) Gasoline sulfur content changed from 339 ppmW to 150 ppmW in the summer for all gasoline control counties. (3) Gasoline sulfur content changed from 339 ppmW to 236 ppmW in the spring and fall for all gasoline control counties. (4) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in the winter for all gasoline control counties. *Gasoline control counties: Barrow, Bartow, Butts, Carroll, Cherokee (a), Clayton (a), Cobb (a), Coweta (a), Dawson, De Kalb (a), Douglas (a), Fayette (a), Forsyth (a), Fulton (a), Gwinnett (a), Hall, Haralson, Henry (a), Jackson, Newton, Paulding (a), Pickens, Rockdale (a), Spalding, and Walton*
KY	(1) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in all seasons for conventional gasoline counties. (2) Gasoline sulfur content changed from 339 ppmW to 129 ppmW in the summer for all gasoline control counties. (3) Gasoline sulfur content changed from 339 ppmW to 229 ppmW in the spring and fall for all gasoline control counties. (4) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in the winter for all gasoline control counties. *Gasoline control counties: Boone, Bullitt (b), Campbell, Jefferson, Kenton, and Oldham (b)*
MS	(1) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in all counties and all seasons (all are conventional gasoline areas).
NC	(1) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in all counties and all seasons (all are conventional gasoline areas). (2) Utilize revised (i.e., local) allocation files for three equipment categories. (3) Utilize revised (i.e., local) seasonal activity data.
SC	(1) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in all counties and all seasons (all are conventional gasoline areas).
TN	(1) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in all counties and all seasons (all are conventional gasoline areas). (2) Gasoline RVP values changed in accordance with local recommendations. (3) Temperature data changed in accordance with local recommendations. (4) Counties regrouped in accordance with local recommendations.

- continued -

Table 1.3-2. Summary of NONROAD Modeling Revisions (continued)

State	Revisions Implemented
VA	(1) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in all seasons for conventional gasoline counties. (2) Gasoline sulfur content changed from 339 ppmW to 129 ppmW in the summer for all gasoline control counties. (3) Gasoline sulfur content changed from 339 ppmW to 229 ppmW in the spring and fall for all gasoline control counties. (4) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in the winter for all gasoline control counties. (5) Gasoline RVP values changed in accordance with local recommendations. (6) Counties regrouped in accordance with local recommendations. (7) The control effectiveness for counties subject to Stage II controls revised to 77 percent in accordance with local recommendations. *Gasoline control counties: Arlington Co., Fairfax Co., Loudoun Co., Prince William Co., Stafford Co., Alexandria City, Fairfax City, Falls Church City, Manassas City, Manassas Park City, Chesterfield Co., Hanover Co., Henrico Co., Colonial Heights City, Hopewell City, Richmond City, James City, York Co., Chesapeake City, Hampton City, Newport News City, Norfolk City, Poquoson City, Portsmouth City, Suffolk City, Virginia Beach City, and Williamsburg City (c)*
WV	(1) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in all counties and all seasons (all are conventional gasoline areas). (2) Continue to utilize local allocation files for nine equipment categories.

Note:

(a) County is subject to local control currently, but is scheduled to join the RFG program in January 2005.

(b) Control area is a portion of the county, but modeling id performed as though the control applies countywide.
(c) The EPA also lists Charles City County as an RFG area, but local planners indicate that Charles City County is a conventional gasoline area and it is modeled as such.

:

Table 1.3-3. NONROAD Modeling Sequencing and Structural Input File Revisions

State	Initial 2002 Base Year Inventory Input File Sequence Numbers	Revised 2002 Inventory Input File Sequence Numbers	Reason(s) for Change	Number of Final 2002 Inventory NONROAD Input Files
AL	01-08	01-08	No Structural Changes	32 (at 8 per season)
FL	09-10	09-10	No Structural Changes	8 (at 2 per season)
GA	11-13	11-13	No Structural Changes	12 (at 3 per season)
KY	14-22	14-22	No Structural Changes	36 (at 9 per season)
MS	48	48	No Structural Changes	4 (at 1 per season)
NC	23-25	23-25	No Structural Changes	12 (at 3 per season)
SC	26-32	26-32	No Structural Changes	28 (at 7 per season)
TN	33-34	33-34, 49-52	Counties Regrouped	24 (at 6 per season)
VA	35-43	35-38, 40-43	Counties Regrouped	32 (at 8 per season)
WV	44-47	44-47	No Structural Changes	16 (at 4 per season)
All	**01-48**	**01-38, 40-52**		**204 (at 51 per season)**

Note: (1) All files include internal revisions to reflect the data changes summarized in Table 1.3-2 above. This table is intended to present structural revisions that are of interest in assembling the NONROAD model input files into a complete VISTAS region inventory. The indicated revisions do not (in and of themselves) result in emission estimate changes.

(2) The NONROAD model imposes an eight digit input file name limit, so all input files for the revised 2002 base year inventory follow a modified naming convention to allow each to be distinguished from the input files for the initial 2002 base year inventory. For the initial 2002 base year inventory, the naming convention was:

ss02aaqq, where: ss = the two character State abbreviation,

aa = a two character season indicator as follows: AU = autumn, WI = winter, SP = spring, and SU = summer, and

qq = the two digit sequence number indicated above.

For the revised 2002 inventory, the naming convention was modified to:

ss02aFqq, where: ss = the two character State abbreviation,

a = a one character season indicator as follows: A = autumn, W = winter, S = spring, and X = summer, and

1.3.2.2 Emissions from Commercial Marine Vessels, Locomotives, and Airplanes

An initial 2002 base year emissions inventory for aircraft, locomotives, and commercial marine vessels (CMV) was prepared for VISTAS in early 2004. The methods used to develop the inventory are presented in a February 9, 2004 report "*Development of the VISTAS Draft 2002 Mobile Source Emission Inventory (February 2004 Version)*" as prepared by E.H. Pechan & Associates, Inc. A summary of the initial 2002 base year emissions inventory is presented in Table 1.3-4. Except as otherwise stated below, all aspects of the preparation methodology continue to apply to the revised emissions inventory.

Revisions to the initial 2002 base year emissions inventory were implemented to ensure that the latest State and local data were incorporated as well as to correct an overestimation of particulate matter (PM) emissions from aircraft. Seven of the ten VISTAS States provided revised inventory data in the form of emissions reported to the EPA under the CERR. States providing CERR data were Alabama, Georgia, Mississippi, North Carolina, Tennessee (excluding Davidson, Hamilton, Knox, and Shelby Counties), Virginia, and West Virginia.

In many cases, the CERR data were only marginally different than the initial 2002 base year inventory data, but there were several instances where significant updates were evident. The remaining three VISTAS States (Florida, Kentucky, and South Carolina), plus Davidson, Hamilton, Knox, and Shelby counties in Tennessee, indicated that the preliminary 2002 VISTAS inventory continued to reflect the most recent data available. Florida did provide updated aircraft emissions data for one county (Miami-Dade) and these data were incorporated into the revised 2002 inventory as described below.

Since several States recommended retaining the initial 2002 base year inventory data, the initial step toward revising the 2002 inventory consisted of modifying the estimated aircraft PM emissions of the preliminary inventory. The overestimation of aircraft PM became evident shortly after the release of the initial 2002 base year inventory, when it was determined that VISTAS region airports would constitute the top seven, and 11 of the top 15, PM sources in the nation. Moreover, PM emissions for one airport (Miami International) were a full order of magnitude larger than *all* other modeled elemental carbon PM emission sources. In addition, unexpected relationships across airports were also observed, with emissions for Atlanta's Hartsfield International being substantially less than those of Miami International, even though Atlanta handles over twice as many aircraft operations annually. Given the pervasiveness of this problem, and since the CERR data submitted by States was based on the preliminary 2002 VISTAS inventory data, aircraft PM emissions for the entire VISTAS region were recalculated.

Table 1.3-4. Initial 2002 Base Year Aircraft, Locomotive, and Non-Recreational Marine Emissions as Reported in February 2004 (annual tons)

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	3,787	175	688	475	17	196
	FL	28,518	11,955	46,352	31,983	1,050	3,703
	GA	3,175	992	3,919	2,704	94	353
	KY	2,666	657	2,597	1,792	63	263
	MS	1,593	140	553	381	13	96
	NC	6,088	1,548	6,115	4,219	148	613
	SC	6,505	515	452	312	88	863
	TN	6,854	2,665	7,986	5,510	225	920
	VA	17,676	5,607	14,476	9,988	234	3,229
	WV	1,178	78	310	214	8	66
	Total	78,040	24,332	83,448	57,578	1,940	10,302
Commercial Marine (2280)	AL	1,195	9,217	917	843	3,337	736
	FL	5,888	44,817	1,936	1,781	6,683	1,409
	GA	1,038	7,874	334	307	1,173	246
	KY	6,607	50,267	2,246	2,066	9,608	1,569
	MS	5,687	43,233	1,903	1,750	7,719	1,351
	NC	599	4,547	193	178	690	142
	SC	1,067	8,100	343	316	1,205	253
	TN	4,129	31,397	1,390	1,278	5,753	980
	VA	1,198	3,426	929	855	3,258	596
	WV	2,094	15,882	668	614	720	497
	Total	29,503	218,760	10,858	9,989	40,146	7,779
Military Marine (2283)	VA	136	387	28	26	30	59
	Total	136	387	28	26	30	59
Locomotives (2285)	AL	3,490	26,339	592	533	1,446	1,354
	FL	1,006	9,969	247	222	605	404
	GA	2,654	26,733	664	598	1,622	1,059
	KY	2,166	21,811	542	488	1,321	867
	MS	2,302	23,267	578	520	1,429	899
	NC	1,638	16,502	410	369	1,001	654
	SC	1,160	11,690	291	261	710	462
	TN	4,530	44,793	1,110	999	2,689	1,805
	VA	1,928	19,334	1,407	1,266	3,443	798
	WV	1,105	11,150	277	249	681	436
	Total	21,980	211,588	6,118	5,505	14,947	8,738
Grand Total		129,659	455,067	100,452	73,099	57,062	26,877

Aircraft do emit PM while operating. However, official EPA inventory procedures for aircraft generally do not include PM emission factors and, therefore, aircraft PM is generally erroneously reported as zero. In an effort to overcome this deficiency, the developers of the initial VISTAS 2002 base year aircraft inventory estimated PM emission rates for aircraft using estimated NO_x emissions and an unreported PM-to-NO_x ratio (i.e., PM = NO_x times a PM-to-NO_x ratio). According to the initial 2002 base year inventory documentation, this approach was applied only to commercial aircraft NO_x, but a review of that inventory indicates that the technique was also applied to military, general aviation, and air taxi aircraft in many, but not all, instances. Although there is nothing inherently incorrect with this approach, the accuracy and inconsistent application of the assumed PM-to-NO_x ratio results in grossly overestimated aircraft PM.

Through examination of the initial 2002 base year aircraft inventory, it is apparent that the commercial aircraft PM-to-NO_x ratio used to generate PM emission estimates was approximately equal to 3.95 (i.e., PM = NO_x times 3.95). While the majority of observed commercial aircraft PM-to-NO_x ratios in that inventory are equal to 3.95, a few range as low as 3.00. If all aircraft estimates are included (i.e., commercial plus military, general aviation, and air taxi), observed PM-to-NO_x ratios range from 0 to 123.0, and average 3.43 as illustrated in Table 1.3-5.

Table 1.3-5 PM-to-NO_x ratios by aircraft type.

Aircraft Type	Average PM-to-NO_x	Range of PM-to-NO_x	Average $PM_{2.5}$ / PM_{10}	Range of $PM_{2.5}$ / PM_{10}
Undefined [(1)]	0.046	0-0.062	0.690	0.690-0.690
Military	0.073	0-92.3	0.688	0.333-1.000
Commercial	3.953	3.00-3.953	0.690	0.667-0.696
General Aviation	2.059	0-9.00	0.689	0.500-1.000
Air Taxi	2.734	0-123.0	0.690	0.500-1.000
Aggregate	3.427	0-123.0	0.690	0.333-1.000

Note: (1) Two counties report aircraft emissions as SCC 2275000000 “all aircraft.”

As indicated, the aggregate PM-to-NO_x ratio is similar in magnitude to the ratio for commercial aircraft. This results from the dominant nature of commercial aircraft NO_x emissions relative to NO_x from other aircraft types. It is surmised that ratios that deviate from 3.95 are based on PM emission estimates generated by local planners, which were retained without change in the PM estimation process (although a considerable number of unexplained "zero PM" records also exist in the initial 2002 base year inventory dataset). Regardless, based on previous statistical analyses performed in support of aircraft emissions inventory development outside the VISTAS region, a PM-to-NO_x ratio of 3.95 is too large by over an order of magnitude.

In analyses performed for the Tucson, Arizona planning area, PM-to-NO_x ratios for aircraft over a standard aircraft landing and takeoff (LTO) cycle are estimated to be as follows: ("Emissions Inventories for the Tucson Air Planning Area, Volume I., Study Description and Results," prepared for the Pima Association of Governments, Tucson, AZ, November 2001.)

Table 1.3-6 Tucson, AZ PM-to-NO_x ratios by aircraft type.

Aircraft Type	PM-to-NO_x
Commercial Aircraft	0.26
Military Aircraft	0.88
Air Taxi Aircraft	0.50
General Aviation Aircraft	1.90

Note:

The PM and NO_x emission estimates presented in the Tucson study are for local aircraft operating mode times. For this work, emission estimates for Tucson were recalculated for a standard LTO cycle, so that the ratios presented are applicable to the standard LTO cycle and not a Tucson-specific cycle. Thus, the ratios presented herein vary somewhat from those associated with the emission estimates presented in the Tucson study report.

In reviewing these data, it should be considered that they apply to a standard (i.e., EPA-defined) LTO cycle. Aircraft PM-to-NO_x ratios vary with operating mode, so that aircraft at airports with mode times that differ from the standard cycle will exhibit varying ratios. However, conducting an airport-specific analysis for all airports in the VISTAS region was beyond the scope of this work. While local PM-to-NO_x ratios could vary somewhat from the indicated standard cycle ratios, any error due to this variation will be significantly less than the order of magnitude error associated with the 3.95 commercial aircraft ratio used for the initial 2002 base year inventory.

It should be recognized that while the Tucson area is far removed from the VISTAS region, the data analyzed to generate the PM-to-NO_x ratios is standard aircraft emission factor data routinely employed for inventory purposes throughout the United States. With the exception of aircraft operating conditions, there are no inherent geographic implications associated with the use of data from the Tucson study. As indicated above, issues associated with local operating conditions have been eliminated by recalculating the Tucson study ratios for a standard LTO cycle.

To implement the revised PM-to-NO_x ratios, *all* aircraft PM records were removed from the initial 2002 base year inventory. This includes records for which local planners may have estimated PM emissions. This approach was taken for two reasons. First, there is no way to distinguish which records may have been generated by local planners. Second, the data available to local planners may be no better than that used to generate the presented PM-to-NO_x ratio data, so the consistent application of these data to the entire VISTAS region was determined to be the most appropriate approach to generating consistent inventories throughout the region. In undertaking this removal, it became apparent that there was an imbalance in the aircraft NO_x and PM records in the initial 2002 base year inventory. Whereas there were 1,531 NO_x records in the NIF emission data sets for this source category, there were only 1,212 PM records. The imbalance was distributed between three States, South Carolina, Tennessee, and Virginia as follows:

Table 1.3-7 Aircraft records with no corresponding pollutant records.

Aircraft NO_x records with no corresponding PM record:

Aircraft Type	South Carolina	Virginia	Total
Military Aircraft	8	100	108
General Aviation Aircraft	14	94	108
Air Taxi Aircraft	5	99	104
Aggregate	27	293	320

Aircraft PM records with no corresponding NO_x record:

Aircraft Type	Tennessee		Total
Air Taxi Aircraft	1		1
Aggregate	1		1

The unmatched PM record was for Hamilton County (Chattanooga), Tennessee and when removed, was not replaced since there was no corresponding NO_x record with which to estimate revised PM emissions. It is unclear how this orphaned record originated, but clearly there can be no air taxi PM emissions without other combustion-related emissions. Thus, the removal of the PM_{10} and $PM_{2.5}$ records for Hamilton County permanently reduced the overall size of the 2002 initial base year inventory database by two records.

Of the 320 unmatched NO_x records, 269 were records for which the reported emission rate was zero. Therefore, even though associated PM records were missing, the overall inventory was not affected. However, the 51 missing records for which NO_x emissions were non-zero, did impact PM estimates for the overall inventory.

Replacement PM_{10} records were calculated for all aircraft NO_x records using the PM-to-NO_x ratios presented above. Aircraft type-specific ratios were utilized in all cases, except for two counties where aircraft emissions were reported under the generic aircraft SCC 2275000000. For these counties (Palm Beach County, Florida and Davidson County, Tennessee), the commercial aircraft PM-to-NO_x ratio was applied since both contain commercial airports (Palm Beach International and Nashville International).

Replacement aircraft $PM_{2.5}$ records were also developed. The initial 2002 base year inventory assumed that aircraft $PM_{2.5}$ was 69 percent of aircraft PM_{10}. The origin of this fraction is not clear, but it is very low for combustion related particulate matter. The majority of internal combustion engine related particulate matter is typically 1 micron or smaller (PM-1.0), so that typical internal combustion engine $PM_{2.5}$ fractions approach 100 percent. For example, the EPA NONROAD model assumes 92 percent for gasoline engine particulate and 97 percent for diesel engine particulate. Based on recent correspondence from the EPA, it appears that the agency is preparing to recommend a $PM_{2.5}$ fraction of 98 percent for aircraft. (August 12, 2004 e-mail correspondence from U.S. EPA to Gregory Stella of Alpine Geophysics.) This is substantially more consistent with expectations based on emissions test data for other internal combustion engine sources and was used as the basis for the recalculated aircraft $PM_{2.5}$ emission estimates in the revised 2002 base year inventory.

Although a substantial portion of the initial 2002 base year inventory was ultimately replaced with data prepared by State and local planners under CERR requirements, it was necessary to first revise the initial 2002 base year aircraft inventory as described so that that records extracted from the inventory for areas not relying on CERR data would be accurate. Therefore, in *no case* is the aggregated State data reported for the revised 2002 base year inventory identical to that of the initial 2002 base year inventory. Even areas relying on the initial 2002 base year inventory will reflect updates due to changes in emissions of PM_{10} and $PM_{2.5}$ from aircraft.

Table 1.3-8 presents the revised 2002 base year inventory estimates. These estimates do not reflect any changes related to updated CERR data, but instead indicate the impacts associated with the recalculation of aircraft PM emissions alone. Table 1.3-9 presents a summary of the net impacts of these changes, where an over 90 percent reduction in aircraft PM is observed for all VISTAS areas except South Carolina and Virginia. The reasons for the lesser changes in these two States is that the overall aircraft NO_x inventories for both include a large share of military aircraft NO_x to which no (or very low) particulate estimates were assigned in the initial 2002 base year inventory. Since these operations are assigned non-zero PM emissions under the revised approach, the increase in military aircraft PM offsets a portion of the reduction in commercial aircraft PM. In Virginia, zero (or near zero) PM military operations were responsible for about 35 percent of total aircraft NO_x, while the corresponding fraction in South Carolina was almost 70 percent. As indicated, aggregate aircraft, locomotive, and commercial marine vessel PM is 70-75 percent lower in the revised 2002 base year inventory.

Table 1.3-8. Initial 2002 Base Year Aircraft, Locomotive, and Non-Recreational Marine Emissions with Modified Aircraft PM Emission Rates (annual tons)

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	3,787	175	64	62	17	196
	FL	28,518	11,955	3,193	3,129	1,050	3,703
	GA	3,175	992	269	264	94	353
	KY	2,666	657	179	175	63	263
	MS	1,593	140	44	43	13	96
	NC	6,088	1,548	419	411	148	613
	SC	6,505	515	409	401	88	863
	TN	6,854	2,665	707	692	225	920
	VA	17,676	5,607	2,722	2,667	234	3,229
	WV	1,178	78	25	24	8	66
	Total	78,040	24,332	8,030	7,870	1,940	10,302
Commercial Marine (2280)	AL	1,195	9,217	917	843	3,337	736
	FL	5,888	44,817	1,936	1,781	6,683	1,409
	GA	1,038	7,874	334	307	1,173	246
	KY	6,607	50,267	2,246	2,066	9,608	1,569
	MS	5,687	43,233	1,903	1,750	7,719	1,351
	NC	599	4,547	193	178	690	142
	SC	1,067	8,100	343	316	1,205	253
	TN	4,129	31,397	1,390	1,278	5,753	980
	VA	1,198	3,426	929	855	3,258	596
	WV	2,094	15,882	668	614	720	497
	Total	29,503	218,760	10,858	9,989	40,146	7,779
Military Marine (2283)	VA	136	387	28	26	30	59
	Total	136	387	28	26	30	59
Locomotives (2285)	AL	3,490	26,339	592	533	1,446	1,354
	FL	1,006	9,969	247	222	605	404
	GA	2,654	26,733	664	598	1,622	1,059
	KY	2,166	21,811	542	488	1,321	867
	MS	2,302	23,267	578	520	1,429	899
	NC	1,638	16,502	410	369	1,001	654
	SC	1,160	11,690	291	261	710	462
	TN	4,530	44,793	1,110	999	2,689	1,805
	VA	1,928	19,334	1,407	1,266	3,443	798
	WV	1,105	11,150	277	249	681	436
	Total	21,980	211,588	6,118	5,505	14,947	8,738
Grand Total		129,659	455,067	25,034	23,390	57,062	26,877

Table 1.3-9. Change in Initial 2002 Base Year Emissions due to Aircraft PM Emission Rate Modifications.

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	0%	0%	-91%	-87%	0%	0%
	FL	0%	0%	-93%	-90%	0%	0%
	GA	0%	0%	-93%	-90%	0%	0%
	KY	0%	0%	-93%	-90%	0%	0%
	MS	0%	0%	-92%	-89%	0%	0%
	NC	0%	0%	-93%	-90%	0%	0%
	SC	0%	0%	-9%	+29%	0%	0%
	TN	0%	0%	-91%	-87%	0%	0%
	VA	0%	0%	-81%	-73%	0%	0%
	WV	0%	0%	-92%	-89%	0%	0%
	Total	0%	0%	-90%	-86%	0%	0%
Commercial Marine (2280)	AL	0%	0%	0%	0%	0%	0%
	FL	0%	0%	0%	0%	0%	0%
	GA	0%	0%	0%	0%	0%	0%
	KY	0%	0%	0%	0%	0%	0%
	MS	0%	0%	0%	0%	0%	0%
	NC	0%	0%	0%	0%	0%	0%
	SC	0%	0%	0%	0%	0%	0%
	TN	0%	0%	0%	0%	0%	0%
	VA	0%	0%	0%	0%	0%	0%
	WV	0%	0%	0%	0%	0%	0%
	Total	0%	0%	0%	0%	0%	0%
Military Marine (2283)	VA	0%	0%	0%	0%	0%	0%
	Total	0%	0%	0%	0%	0%	0%
Locomotives (2285)	AL	0%	0%	0%	0%	0%	0%
	FL	0%	0%	0%	0%	0%	0%
	GA	0%	0%	0%	0%	0%	0%
	KY	0%	0%	0%	0%	0%	0%
	MS	0%	0%	0%	0%	0%	0%
	NC	0%	0%	0%	0%	0%	0%
	SC	0%	0%	0%	0%	0%	0%
	TN	0%	0%	0%	0%	0%	0%
	VA	0%	0%	0%	0%	0%	0%
	WV	0%	0%	0%	0%	0%	0%
	Total	0%	0%	0%	0%	0%	0%
Grand Total		0%	0%	-75%	-68%	0%	0%

As indicated above, for the revised 2002 base year inventory, data for all or portions of seven VISTAS States were replaced with corresponding data from recent CERR submissions for 2002. Before replacing these data, however, an analysis of the CERR data was performed to ensure consistency with VISTAS inventory methods. It should perhaps also be noted that three of the CERR datasets provided for the revised 2002 base year inventory (specifically those for Tennessee, Virginia, and West Virginia) included both annual and daily emissions data. Only the annual data were used.

Several important observations resulted from this analysis. First, it was clear that all of the CERR data continued to rely on the inaccurate aircraft PM estimation approach employed for the initial 2002 base year inventory. Therefore, an identical aircraft PM replacement procedure as described above for the revised 2002 base year inventory was undertaken. As a result, the CERR data for *all* VISTAS States has been modified for inclusion in the revised 2002 VISTAS base year inventory.

As was the case with the initial VISTAS 2002 base year inventory, there were a substantial number of aircraft NO_x records without corresponding PM records, so that the number of recalculated PM records added to the CERR dataset is greater than the number of PM records removed. The aggregated CERR inventory data, reflecting data for all or parts of seven States, consisted of 13,656 records, of which 1,211 were aircraft NO_x records. However, the number of corresponding aircraft PM records was 662 (662 PM_{10} records and 662 $PM_{2.5}$ records). This imbalance was distributed as follows:

Table 1.3-10 CERR Aircraft NOx records with no corresponding PM record.

Aircraft Type	Georgia	Tennessee	Virginia	Total
Military Aircraft			136	136
Commercial Aircraft		4	136	140
General Aviation Aircraft	1		136	137
Air Taxi Aircraft			136	136
Aggregate	1	4	544	549

From this tabulation, it is clear that virtually the entire imbalance is associated with the Virginia CERR submission, with minor imbalances in Georgia and Tennessee. Of the 549 unmatched NO_x records, 461 were records for which the reported emission rate was zero. Therefore, even though the associated PM records were missing, the overall inventory was not affected. However, the 88 missing records for which NO_x emissions were non-zero do impact PM emission estimates for the overall inventory.

Replacement aircraft PM records (both PM_{10} and $PM_{2.5}$) were generated for the CERR dataset using procedures identical to those described above for the initial 2002 base year inventory.

Further analysis revealed that the CERR data for Virginia included only VOC, CO, and NO_x emissions for all aircraft, locomotives, and non-recreational marine vessels. Since SO_2, PM_{10}, and $PM_{2.5}$ records are included in the 2002 VISTAS inventory, an estimation method was developed for these emission species and applied to the Virginia CERR data. For PM, the developed methodology was only employed for locomotive and marine vessel data since aircraft PM was estimated using the PM-to-NO_x ratio methodology described above.

Consideration was given to simply adding the Virginia SO_2 and non-aircraft PM records from the revised 2002 VISTAS dataset, but it is very unlikely that either the source distribution or associated emission rates are identical across the CERR and preliminary VISTAS inventories. This was confirmed through a comparative analysis of dataset CO records. Therefore, an estimation methodology was developed using Virginia source-specific SO_2/CO, PM_{10}/CO, and $PM_{2.5}$/ PM_{10} ratios from the initial 2002 base year VISTAS inventory. The calculated ratios were then applied to the source-specific CERR CO emission estimates to derive associated source-specific SO_2, PM_{10}, and $PM_{2.5}$ emissions.

Initially, the development of the emissions ratios from the initial 2002 base year inventory was performed at the State (i.e., Virginia), county, and SCC level of detail. However, it readily became clear that there were substantial inconsistencies in ratios for identical SCCs across counties. For example, in one county, the SO_2/CO ratio might be 0.2, while in the next county it would be 2.0. Since the sources in question are virtually identical (e.g., diesel locomotives) and since the fueling infrastructure for these large nonroad equipment sources is regional as opposed to local in nature, such variations in emission rates are not realistic. Therefore, a more aggregated approach was employed in which SCC-specific emission ratios were developed for the State as a whole. Through this approach county-to-county variation is eliminated, but the underlying variation does continue to influence the resulting aggregate emission estimates (but across all counties equally). The calculated emission ratios are as follows:

Table 1.3-11 Calculated emission rates for VA.

Source	SCC	SO_2/CO	PM_{10}/CO	$PM_{2.5}$/CO	$PM_{2.5}$/PM_{10}
Military Aircraft	2275001000	0.0215	*Emissions estimated using PM-to-NO_x ratios as described previously.*		
Commercial Aircraft	2275020000	0.3292			
General Aviation Aircraft	2275050000	0.0002			
Air Taxi Aircraft	2275060000	0.0015			
Aircraft Refueling	2275900000	0.0000	0.0000	0.0000	
Diesel Commercial Marine	2280002000	0.3697	0.3434	0.3157	0.92
Residual Commercial Marine	2280003000	0.3697	0.3434	0.3157	0.92
Diesel Military Marine	2283002000	0.2422	0.2248	0.2068	0.92
Line Haul Locomotives	2285002005	3.2757	1.2999	1.1696	0.90
Yard Locomotives	2285002010	2.2908	1.2461	1.1205	0.90

It is important to recognize that the inconsistency of emissions ratios across Virginia counties for sources of virtually identical design, which utilize a regional rather than local fueling infrastructure, has potential implications for other VISTAS States. There is no immediately obvious reason to believe that such inconsistencies would be isolated to Virginia.

One final revision to the CERR dataset was undertaken, and that was the removal of two records for unpaved airstrip particulate (SCC 2275085000) in Alabama. Otherwise identical records for these emissions were reported both in terms of filterable and primary particulate. The filterable particulate records were removed as all other particulate emissions in the VISTAS inventories are in terms of primary particulate. It is also perhaps worth noting that a series of aircraft refueling records (SCC 2275900000) for Virginia were left in place, even through typically such emissions would be reported under SCC 2501080XXX in the area source inventory. If additional VISTAS aircraft refueling emissions are reported under SCC 2501080XXX, then it may be desirable to recode these records.

Finally, data for areas of the VISTAS region not represented in the CERR dataset were added to the CERR data by extracting the appropriate records from the initial 2002 base year inventory (with revisions for PM). Specifically, records applicable to the States of Florida, Kentucky, South Carolina, and the Tennessee counties of Davidson, Hamilton, Knox, and Shelby were extracted from the initial 2002 inventory and added to the CERR dataset.

Following this aggregation, one last dataset revision was implemented. As indicated in the introduction of this section, the initial 2002 base year emission estimates for Miami International Airport were determined to be excessive. Although the reason for this inaccuracy was not apparent, revised estimates for aircraft emissions in Miami-Dade County were obtained from Florida planners and used to overwrite the erroneous estimates. (Aircraft emission estimates were provided in an August 10, 2004 e-mail transmittal from Bruce Coward of Miami-Dade County to Martin Costello of the Florida Department of Environmental Protection.)

Table 1.3-12 presents a summary of the resulting revised VISTAS 2002 base year inventory estimates for aircraft, locomotives, and non-recreational marine vessels. Table 1.3-13 provides a comparison of the revised 2002 base year inventory estimates to those of the initial 2002 base year inventory. As indicated, total emissions for VOC, CO, NO_x, and SO_2 are generally within 10 percent, but final PM emissions are reduced by 70-80 percent due to the approximate 90 percent reductions in aircraft PM estimates. In addition, the significant changes in Georgia aircraft emissions are due to the CERR correction of Atlanta Hartsfield International Airport emissions, which were significantly underestimated in the initial 2002 base year inventory. The reduction in Florida aircraft emissions due to the correction of Miami International estimates is also apparent.

Lastly, Table 1.3-14 provides a direct comparison of emission estimates from the initial and revised 2002 base year inventories for all 16 VISTAS region airports with estimated annual NO_x emissions of 200 tons or greater. The table entries are sorted in order of decreasing NO_x and once again, the dramatic reduction in PM emissions is evident. However, in addition, the appropriate reversal of the relationship between Atlanta's Hartsfield and Miami International Airport is also depicted. As a rough method of quality assurance, Table 1.3-14 also includes a *gross* estimate of expected airport NO_x emissions using detailed NO_x estimates developed for Tucson International Airport in conjunction with the ratio of local to Tucson LTOs. (The Tucson NO_x estimates are revised to reflect a standard LTO cycle rather than the Tucson-specific LTO cycle. This should provide for a more realistic comparison to VISTAS estimates.) This is not meant to serve as anything other than a crude indicator of the propriety of the developed VISTAS estimates, and it is clear that the range of estimated-to-expected NO_x emissions has been substantially narrowed in the revised 2002 base year inventory. Whereas estimated-to-expected ratios varied from about 0.2 to over 3.5 in the initial 2002 base year inventory, the range of variation is tightened on both ends, from about 0.5 to 1.75 for the revised 2002 base year inventory. In effect, all estimates are now within a factor of two of the expected estimates, which is quite reasonable given likely variation in local and standard LTO cycles and variations in aircraft fleet mix across airports.

It is perhaps important to note that some shifting in county emissions assignments is evident between the initial and revised 2002 base year aircraft inventories. For example, for the initial 2002 base year inventory, Atlanta Hartsfield estimates were assigned to Fulton County (FIP 13121), while they are assigned to Clayton County (FIP 13063) for the revised 2002 base year inventory. Similarly, Dulles International Airport emissions were assigned solely to Fairfax County, Virginia (FIP 51059) in the initial 2002 base year inventory, but are split between Fairfax and Loudoun County (FIP 51107) for the revised inventory. Such shifts reflect local planner decision-making and are not an artifact of the revisions described above.

Table 1.3-12. Revised 2002 Base Year Aircraft, Locomotive, and Non-Recreational Marine Emissions (tons/year)

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	3,787	175	226	87	17	196
	FL	25,431	8,891	2,424	2,375	800	3,658
	GA	6,622	5,372	1,475	1,446	451	443
	KY	2,666	657	179	175	63	263
	MS	1,593	140	44	43	13	96
	NC	6,088	1,548	419	411	148	613
	SC	6,505	515	409	401	88	863
	TN	7,251	2,766	734	719	235	943
	VA	9,763	2,756	1,137	1,115	786	2,529
	WV	1,178	78	25	24	8	66
	Total	70,884	22,899	7,072	6,797	2,607	9,670
Commercial Marine (2280)	AL	1,196	9,218	917	844	3,337	737
	FL	5,888	44,817	1,936	1,781	6,683	1,409
	GA	1,038	7,875	334	307	1,173	246
	KY	6,607	50,267	2,246	2,066	9,608	1,569
	MS	5,688	43,233	1,903	1,751	7,719	1,351
	NC	599	4,547	193	178	690	142
	SC	1,067	8,100	343	316	1,205	253
	TN	3,624	27,555	1,217	1,120	4,974	860
	VA	972	2,775	334	307	359	483
	WV	1,528	11,586	487	448	525	362
	Total	28,207	209,972	9,911	9,118	36,275	7,413
Military Marine (2283)	VA	110	313	25	23	27	48
	Total	110	313	25	23	27	48
Locomotives (2285)	AL	3,490	26,339	592	533	1,446	1,354
	FL	1,006	9,969	247	222	605	404
	GA	2,725	27,453	682	614	1,667	1,086
	KY	2,166	21,811	542	488	1,321	867
	MS	2,302	23,267	578	520	1,429	899
	NC	1,638	16,502	410	369	1,001	654
	SC	1,160	11,690	291	261	710	462
	TN	2,626	25,627	633	570	1,439	1,041
	VA	1,186	11,882	1,529	1,375	3,641	492
	WV	1,311	13,224	329	296	808	517
	Total	19,611	187,764	5,833	5,248	14,066	7,777
Grand Total		118,812	420,948	22,841	21,186	52,976	24,908

Table 1.3-13. Change in 2002 Emissions, Revised Inventory Relative to Initial Inventory

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	0%	0%	-67%	-82%	0%	0%
	FL	-11%	-26%	-95%	-93%	-24%	-1%
	GA	+109%	+442%	-62%	-47%	+379%	+26%
	KY	0%	0%	-93%	-90%	0%	0%
	MS	0%	0%	-92%	-89%	0%	0%
	NC	0%	0%	-93%	-90%	0%	0%
	SC	0%	0%	-9%	+29%	0%	0%
	TN	+6%	+4%	-91%	-87%	+4%	+2%
	VA	-45%	-51%	-92%	-89%	+236%	-22%
	WV	0%	0%	-92%	-89%	0%	0%
	Total	-9%	-6%	-92%	-88%	+34%	-6%
Commercial Marine (2280)	AL	+0%	+0%	+0%	+0%	+0%	+0%
	FL	0%	0%	0%	0%	0%	0%
	GA	+0%	+0%	+0%	+0%	+0%	+0%
	KY	0%	0%	0%	0%	0%	0%
	MS	+0%	+0%	+0%	+0%	+0%	+0%
	NC	+0%	+0%	+0%	+0%	+0%	+0%
	SC	0%	0%	0%	0%	0%	0%
	TN	-12%	-12%	-12%	-12%	-14%	-12%
	VA	-19%	-19%	-64%	-64%	-89%	-19%
	WV	-27%	-27%	-27%	-27%	-27%	-27%
	Total	-4%	-4%	-9%	-9%	-10%	-5%
Military Marine (2283)	VA	-19%	-19%	-12%	-12%	-12%	-19%
	Total	-19%	-19%	-12%	-12%	-12%	-19%
Locomotives (2285)	AL	0%	0%	0%	0%	0%	0%
	FL	0%	0%	0%	0%	0%	0%
	GA	+3%	+3%	+3%	+3%	+3%	+3%
	KY	0%	0%	0%	0%	0%	0%
	MS	0%	0%	0%	0%	0%	0%
	NC	0%	0%	0%	0%	0%	0%
	SC	0%	0%	0%	0%	0%	0%
	TN	-42%	-43%	-43%	-43%	-46%	-42%
	VA	-38%	-39%	+9%	+9%	+6%	-38%
	WV	+19%	+19%	+19%	+19%	+19%	+19%
	Total	-11%	-11%	-5%	-5%	-6%	-11%
Grand Total		-8%	-7%	-77%	-71%	-7%	-7%

Table 1.3-14. Comparison of Airport Emissions (Airports with NO_x > 200 tons per year)

Airport	FIP	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC	Approx. LTOs	Predicted NO_x	VISTAS to Predicted
Initial 2002 Base Year Inventory										
Miami	12086	9,757	5,997	23,706	16,357	525	1,641	150,000	1,680	3.57
Orlando	12095	3,456	2,170	8,578	5,919	204	642	150,000	1,680	1.29
Memphis	47157	3,462	1,934	7,645	5,275	185	603	125,000	1,400	1.38
Reagan	51013	3,892	1,806	7,138	4,925	164	302	100,000	1,120	1.61
Hampton	51650	2,690	1,705	0	0	0	611	Military		
Dulles	51059	2,032	1,330	5,246	3,620	0	272	75,000	840	1.58
Orlando-Sanford	12117	3,615	1,225	4,837	3,337	100	351			
Atlanta	13121	1,457	913	3,608	2,490	86	274	420,000	4,704	0.19
Fort Lauderdale	12011	1,930	809	3,196	2,206	75	257	75,000	840	0.96
Charlotte	37119	1,643	788	3,113	2,148	75	255	150,000	1,680	0.47
Tampa	12057	1,399	785	3,101	2,140	74	240	75,000	840	0.93
Nashville	47037	1,819	653	40	28	33	239	60,000	672	0.97
Raleigh	37183	1,584	592	2,338	1,613	56	204	75,000	840	0.70
Louisville	21111	1,073	468	1,851	1,277	45	155	60,000	672	0.70
Jacksonville	12031	871	325	1,284	886	31	112	30,000	336	0.97
Palm Beach	12099	1,156	226	0	0	1	132	30,000	336	0.67
Aggregate		41,836	21,724	75,682	52,220	1,655	6,290			0.19-3.57
Revised 2002 Base Year Inventory										
Atlanta	13063	4,121	5,288	1,435	1,406	443	337	420,000	4,704	1.12
Miami	12086	6,670	2,933	805	789	274	1,596	150,000	1,680	1.75
Orlando	12095	3,456	2,170	568	556	204	642	150,000	1,680	1.29
Memphis	47157	3,462	1,934	506	495	185	603	125,000	1,400	1.38
Orlando-Sanford	12117	3,615	1,225	338	332	100	351			
Fort Lauderdale	12011	1,930	809	217	212	75	257	75,000	840	0.96
Charlotte	37119	1,643	788	206	202	75	255	150,000	1,680	0.47
Tampa	12057	1,399	785	206	202	74	240	75,000	840	0.93
Nashville	47037	1,819	653	170	166	33	239	60,000	672	0.97
Reagan	51013	1,269	635	171	168	193	97	100,000	1,120	0.57
Dulles 1	51107	1,807	595	164	161	252	153	37,500	420	1.42
Raleigh	37183	1,584	592	156	153	56	204	75,000	840	0.70
Dulles 2	51059	1,095	591	156	153	252	115	37,500	420	1.41
Hampton	51650	858	535	471	461	18	305	Military		
Louisville	21111	1,073	468	123	121	45	155	60,000	672	0.70
Jacksonville	12031	871	325	87	85	31	112	30,000	336	0.97
Palm Beach	12099	1,156	226	59	58	1	132	30,000	336	0.67
Aggregate		37,829	20,550	5,838	5,721	2,312	5,793			0.47-1.75
Net Change		-10%	-5%	-92%	-89%	+40%	-8%			

Note: For the revised inventory, Dulles International Airport emissions are split between two Virginia counties.
Predicted NO_x is based on the ratio of airport LTOs to test airport (Tucson International Airport) LTOs and NO_x. This is not a rigorous comparison, but rather an approximate indicator of expected magnitude.

1.3.3 Quality Assurance steps

Throughout the inventory development process, quality assurance steps were performed to ensure that no double counting of emissions occurred, and to ensure that a full and complete inventory was developed for VISTAS. Quality assurance was an important component to the inventory development process and MACTEC performed the following QA steps on the area source component of the 2002 base year revised:

1. All CERR and NIF format State supplied data submittals were run through EPA's Format and Content checking software.
2. SCC level emission summaries were prepared and evaluated to ensure that emissions were consistent and that there were no missing sources.
3. Tier comparisons (by pollutant) were developed between the revised 2002 base year inventory and the initial base year inventory.
4. Data product summaries were provided to both the VISTAS Emission Inventory Technical Advisor and to Mobile Source SIWG representatives for review and comment. Changes based on these comments were implemented in the files.
5. Version numbering was used for all inventory files developed. The version numbering process used a decimal system to track major and minor changes. For example, a major change would result in a version going from 1.0 to 2.0. A minor change would cause a version number to go from 1.0 to 1.1. Minor changes resulting from largely editorial changes would result in a change from 1.00 to 1.01.

2.0 Projection Inventory Development

2.1 Point Sources

We used different approaches for different sectors of the point source inventory. For the electric generating units (EGUs), VISTAS used the Integrated Planning Model (IPM) to both project future activity as well as to calculate the impact of future control programs. For non-EGUs, we used recently updated growth and control data consistent with the data used in EPA's Clean Air Interstate Rule analyses, and supplemented these data with available stakeholder input. For both sectors, we generated 2009 and 2018 inventories for two control scenarios: on-the-books (OTB) controls (also referred to as Base 1 controls), and on-the-way (OTW) controls (also referred to as Base 2 controls). The OTB control scenario accounts for post-2002 emission reductions from promulgated federal, State, local, and site-specific control programs as of July 1, 2004. The OTW control scenario accounts for proposed (but not final) control programs that are reasonably anticipated to result in post-2002 emission reductions. Section 2.1.1 discusses the EGU projection inventory development, while Section 2.1.2 discusses the non-EGU projection inventory development.

2.1.1 EGU sources

Three options were considered for developing the final VISTAS 2009/2018 projection inventories for EGUs:

- Option 1 – Use the results of IPM modeling conducted in support of the proposed Clean Air Interstate Rule (CAIR) base and control case analyses as the starting point and refine the projections with readily available inputs from stakeholders; these IPM runs were conducted for 2010 and 2015, which VISTAS would use to represent projected emissions in 2009 and 2018 respectively.

- Option 2 – Use the VISTAS 2002 typical year as the starting point, apply growth factors from the Energy Information Administration, and refine future emission rates with stakeholder input regarding utilization rates, capacity, retirements, and new unit information.

- Option 3 – Use the results of a new round of IPM modeling sponsored by VISTAS and the Midwest Regional Planning Organization (MRPO). These runs incorporated VISTAS specific unit and regulation modified parameters, and generate results for 2009 and 2018 explicitly.

An additional consideration for each of the three options was the inclusion of emission projections developed by the Southern Company specifically for their units. Southern Company is a super-regional company which owns EGUs in Alabama, Florida, Georgia, and Mississippi and participates in VISTAS as an industry stakeholder. Southern Company used their energy budget forecast to project net generation and heat input for every existing and future Southern Company EGU for the years 2009 and 2018. Further documentation of how Southern Company created the 2009/2018 inventory for their units can be found in *Developing Southern Company Emissions and Flue Gas Characteristics for VISTAS Regional Haze Modeling (April 2005, presented at 14th International Emission Inventory Conference).*

Each of these three options was discussed in a series of conference calls with the VISTAS EGU Special Interest Work Group (SIWG) during the fall of 2004. During a conference call on December 6, 2004, the VISTAS EGU SIWG approved the use of the latest VISTAS/MRPO sponsored IPM runs (Option 3) to represent the 2009 and 2018 EGU forecasts of emissions for the OTB and OTW cases. During the call, Alabama and Georgia specified that they did not wish to use Southern Company provided emissions forecasts of 2009 and 2018 to represent the sources in their States. Mississippi decided to utilize the Southern Company projections to represent activity at Southern Company facilities in Mississippi. After the call, Florida decided against using Southern Company provided emissions forecasts of 2009 and 2018 to represent the sources in their State.

The Option 3 IPM modeling resulted from a joint agreement by VISTAS and MRPO to work together to develop future year utility emissions based on IPM modeling. The decision to use IPM modeling was based in part on a study of utility forecast methods by E.H. Pechan and Associates, Inc. (Pechan) for MRPO, which recommended IPM as a viable methodology (see *Electricity Generating Unit {EGU} Growth Modeling Method Task 2 Evaluation*, February 11, 2004). Although EPA used IPM recently to support their rulemaking for the Clean Air Interstate Rule (CAIR), VISTAS stakeholders felt that certain model inputs needed to be improved. Thus, VISTAS and MRPO decided to hire contractors to conduct new IPM modeling and to post-process the IPM results. Southern Company projections in 2009 were roughly comparable with IPM. For 2018, Southern Company projections were generally less than IPM because of assumptions made by Southern Company on which units would be economical to control and incorrect data in the NEEDS database which feeds IPM.

In August, VISTAS contracted with ICF to run IPM to provide utility forecasts for 2009 and 2018 for two scenarios: a base, referred to as "on the books" controls, and EPA's proposed CAIR rule, referred to as "on the way" controls. Also in August, MRPO contracted with E.H. Pechan to do the post-processing of these new IPM outputs to provide model-ready emission files. The IPM output files were delivered by ICF in November, and the post-processed data files were delivered by Pechan in December. A brief summary of the VISTAS/MRPO IPM modeling and post-processing of the IPM output is presented in the following subsections.

2.1.1.1 VISTAS/MRPO IPM runs for EGU sources

The following summary of the VISTAS/MRPO IPM modeling is based on ICF's documentation *Future Year Electricity Generating Sector Emission Inventory Development Using the Integrated Planning Model (IPM®) in Support of Fine Particulate Mass and Visibility Modeling in the VISTAS and Midwest RPO Regions*, April 2005. The ICF documentation is to be used as an extension to EPA's proposed CAIR modeling runs documented in *Documentation Supplement for EPA Modeling Applications (V.2.1.6) Using the Integrated Planning Model*, EPA 430/R-03-007, July 2003.

According to the IPM documentation, the model provides "forecasts of least-cost capacity expansion, electricity dispatch, and emission control strategies for meeting energy demand and environmental, transmission, dispatch, and reliability constraints." The underlying database in this modeling is U.S. EPA's National Electric Energy Data System (NEEDS) released with the CAIR Notice of Data Availability (NODA). The NEEDS database contains the existing and planned/committed unit data in EPA modeling applications of IPM. NEEDS includes basic geographic, operating, air emissions, and other data on these generating units. VISTAS States and stakeholders provided changes for:

- NO_x post-combustion control on existing units
- SO_2 scrubbers on existing units
- SO_2 emission limitations
- PM controls on existing units
- Summer net dependable capacity
- Heat rate for existing units
- Unit ID
- SO_2 and NO_x control plans for North Carolina Clean Smokestacks Rule

The analysis covers the period between 2007 and 2030. To make the model size and run time tractable, IPM is run for a number of selected years within the study horizon known as run years. Each run year represents several calendar years in the study horizon, and all calendar years within the study horizon are mapped to their representative run years. The years 2009 and 2018 were explicitly modeled in this set of runs.

The Duke Power and Progress Energy SO_2 and NO_x control technology investment strategies for complying with North Carolina's Clean Smokestacks Rule were explicitly hardwired in the analysis.

The CAIR rule implemented as part of this analysis is broadly consistent with the *Supplemental Proposal for the Rule to Reduce Interstate Transport of Fine Particulate Matter and Ozone (Clean Air Interstate Rule)*, proposed on June 10, 2004. The CAIR plants affected by the annual NO_x policy are capped at 1.6 million tons starting 2010 and 1.33 million tons starting 2015. The power plants affected by the CAIR SO_2 policy have to surrender 2 Title IV SO_2 allowances for every ton of SO_2 emitted starting 2010 and 3 Title IV SO_2 allowances for every ton of SO_2 emitted starting 2015. It is important to remember that all EGU emission projections presented below are based on requirements of CAIR ***as proposed*** on June 10, 2004. The final CAIR (which was promulgated after our analyses) moved the NO_x compliance date from 2010 to 2009. Future versions of the VISTAS projection emission inventory will likely reflect the Final CAIR requirements.

ICF ran IPM under two future scenarios – Base Case and CAIR Case. The Base Case represents the current operation of the power system under currently known laws and regulations, including those that come into force in the study horizon. The CAIR Case is the Base Case with the proposed CAIR rule superimposed. The run results were parsed at the unit level for the 2009 and 2018 run years.

2.1.1.2 Post-Processing of IPM Parsed Files

The following summary of the VISTAS/MRPO IPM modeling is based on Pechan's documentation *LADCO IPM Model Parsed File Post-Processing Methodology and File Preparation*, February 8, 2005.

The essence of the IPM model post-processing methodology is to take an initial IPM model output file and transform it into air quality model input files. ICF via VISTAS/MRPO provides an initial spreadsheet file containing unit-level records of both

(1) "existing" units and

(2) committed or new generic aggregates.

All records have unit and fuel type data; existing, retrofit (for SO_2 and NOx), and separate NO_x control information; annual SO_2 and NO_x emissions and heat input; summer season (May-September) NO_x and heat input; July day NO_x and heat input; coal heat input by coal type; nameplate capacity (MW), and State FIPS code. Existing units also have county FIPS code, a unique plant identifier (ORISPL) and unit ID (also called boiler ID) (BLRID); generic units do not have these data. The processing includes estimating various types of emissions and adding in control efficiencies, stack parameters, latitude-longitude coordinates, and State identifiers (plant ID, point ID, stack ID, process ID). Additionally, the generic units are sited in a county and given appropriate IDs. This processing is described in more detail below.

The data are prepared by transforming the generic aggregates into units similar to the existing units in terms of the available data. The generic aggregates are split into smaller generic units based on their unit types and capacity, are provided a dummy ORIS unique plant and boiler ID, and are given a county FIPS code based on an algorithm that sites each generic by assigning a sister plant that is in a county based on its attainment/nonattainment status. Within a State, plants (in county then ORIS plant code order) in attainment counties are used first as sister sites to generic units, followed by plants in PM nonattainment counties, followed by plants in 8-hour ozone nonattainment counties. Note that no LADCO or VISTAS States provided us with blackout counties that would not be considered when siting generics, so this process is identical to the one used for EPA IPM post-processing.

SCCs were assigned for all units; unit/fuel/firing/bottom type data were used for existing units' assignments, while only unit and fuel type were used for generic units' assignments. Latitude-longitude coordinates were assigned, first using the EPA-provided data files, secondly using the September 17, 2004 Pechan in-house latitude-longitude file, and lastly using county centroids. These data were only used when the data were not provided in the 2002 NIF files. Stack parameters were attached, first using the EPA-provided data files, secondly using a March 9, 2004 Pechan in-house stack parameter file based on previous EIA-767 data, and lastly using an EPA June 2003 SCC-based default stack parameter file. These data were only used when the data were not provided in the 2002 NIF files.

Additional data were required for estimating VOC, CO, filterable primary PM10 and PM2.5, PM condensable, and NH_3emissions for all units. Thus, ash and sulfur contents were assigned by first using 2002 EIA-767 values for existing units or SCC-based defaults; filterable PM10 and PM2.5 efficiencies were obtained from the 2002 EGU NEI that were based on 2002 EIA-767 control data and the PM Calculator program (a default of 99.2% is used for coal units if necessary); fuel use was back calculated from the given heat input and a default SCC-based heat content; and emission factors were obtained from an EPA-approved October 7, 2004 Pechan emission factor file based on AP-42 emission factors. Note that this updated file is not the one used for estimating emissions for previous EPA post-processed IPM files. Emissions for 28 temporal-pollutant combinations were estimated since there are seven pollutants (VOC, CO, primary PM10 and PM2.5, NH_3, SO_2 and NO_x) and four temporal periods (annual, summer season, winter season, July day).

The next step was to match the IPM unit IDs with the identifiers in VISTAS 2002 inventory. A crosswalk file was used to obtain FIPS State and county, plant ID (within State and county), and point ID. If the FIPS State and county, plant ID and point ID are in the 2002 VISTAS NIF tables, then the process ID and stack ID are obtained from the NIF; otherwise, defaults, described above, were used.

Pechan provided the post-processed files in NIF 3.0 format. Two two sets of tables were developed : "NIF files" for IPM units that have a crosswalk match and are in the 2002 VISTAS inventory, and "NoNIF files" for IPM units that are not in the 2002 VISTAS inventory (which includes existing units with or without a crosswalk match as well as generic units).

2.1.1.3 Eliminating Double Counting of EGU Units

To avoid double counting of EGU emissions in the 2009/2018 point source inventory, all IPM matched units were removed from the 2009/2018 point source inventory. The initial set of 2009/2018 point source inventories included both EGUs and non-EGUs, which were created by applying growth and control factors to the 2002 base year inventory. These initial inventories were modified to remove any EGU that was included in the IPM modeling. This was done on a site-by-site basis. If a site was contained in the NIF files created by Pechan from the IPM output, then that site was removed from the initial 2009/2018 point source inventory. Thus, for 2009/2018, separate sets of NIF files were created for EGUs and non-EGUs.

2.1.1.4 Quality Assurance steps

Quality assurance was an important component to the inventory development process and MACTEC performed the following QA steps on the EGU component of the VISTAS revised 2009/2018 EGU inventory:

1. Provided parsed files (i.e., Excel spreadsheets that provide unit-level results derived from the model plant projections obtained by the IPM) to the VISTAS EGU SIWG for review and comment.

2. Provided facility level emission summaries for 2009/2018 for both the base case and CAIR case to the VISTAS EGU SIWG to ensure that emissions were consistent and that there were no missing sources.

3. Compared, at the State-level, emissions from the IPM parsed files and the post-processed NIF files to verify that the post-processed NIF files were consistent with the IPM parsed file results.

2.1.1.5 Summary of Revised 2009/2018 EGU Point Source Inventories

Tables 2.1-1 through 2.1-7 compare the revised 2002 base year inventory to the 2009/2018 projection inventories. Note that there is a discrepancy between the base year 2002 and 2009/2018 emissions for PM10-PRI, PM25-PRI, and NH_3. The 2002 emissions were provided directly by the S/L agencies and were estimated using a variety of techniques (i.e., EPA emission factors, S/L emission factors, site-specific emission factors, and source test data). The 2009/2018 emissions, on the other hand, were estimated by Pechan using an emission factor file based solely on AP-42 emission factors.

Table 2.1-2 EGU Point Source SO_2 Emission Comparison for 2002/2009/2018.

	2002	2009		2018	
State	2002 VISTAS	IPM Base 1 OTB Control (without CAIR)	IPM Base 2 OTW Control (with CAIR)	IPM Base 1 OTB Control (without CAIR)	IPM Base 2 OTW Control (with CAIR)
AL	447,862	465,576	314,841	375,305	226,506
FL	448,046	219,073	199,834	215,178	126,280
GA	513,266	582,078	394,426	554,013	221,615
KY	484,059	483,235	342,670	429,418	225,772
MS	67,339	76,855	76,855	74,505	23,769
NC	471,030	182,356	132,053	133,691	78,205
SC	203,587	163,560	143,492	178,939	152,457
TN	333,934	436,453	279,931	323,654	103,602
VA	232,747	220,685	140,665	181,337	115,988
WV	516,109	598,555	246,850	482,959	111,937
Total	**3,717,979**	**3,428,426**	**2,271,617**	**2,948,999**	**1,386,131**

Table 2.1-3 EGU Point Source NO_x Emission Comparison for 2002/2009/2018.

	2002	2009		2018	
State	2002 VISTAS	IPM Base 1 OTB Control (without CAIR)	IPM Base 2 OTW Control (with CAIR)	IPM Base 1 OTB Control (without CAIR)	IPM Base 2 OTW Control (with CAIR)
AL	160,480	131,988	132,323	135,009	39,942
FL	244,541	148,522	147,800	159,003	59,446
GA	146,143	131,900	119,425	128,938	65,560
KY	198,726	178,930	177,272	182,192	64,673
MS	29,976	38,910	38,978	38,355	11,206
NC	146,465	66,598	67,051	64,537	59,917
SC	86,264	50,433	50,128	55,103	36,264
TN	155,762	106,979	104,528	112,411	32,411
VA	82,435	64,949	62,810	56,715	40,045
WV	230,950	173,977	174,572	170,522	42,227
Total	**1,481,742**	**1,093,186**	**1,074,887**	**1,102,785**	**451,691**

It is important to remember that all EGU emission projections presented are based on requirements of CAIR ***as proposed*** on June 10, 2004. The final CAIR (which was promulgated after our analyses) moved the NO_x compliance date from 2010 to 2009. Future versions of the VISTAS projection emission inventory will likely reflect the Final CAIR requirements.

Table 2.1-3 EGU Point Source VOC Emission Comparison for 2002/2009/2018.

	2002	2009		2018	
State	2002 VISTAS	IPM Base 1 OTB Control (without CAIR)	IPM Base 2 OTW Control (with CAIR)	IPM Base 1 OTB Control (without CAIR)	IPM Base 2 OTW Control (with CAIR)
AL	1,438	1,261	1,312	1,574	1,612
FL	2,295	1,562	1,559	2,052	1,988
GA	1,178	1,497	1,499	1,794	1,790
KY	1,464	1,595	1,580	1,635	1,616
MS	473	585	590	766	827
NC	1,042	1,100	1,093	1,183	1,171
SC	434	601	625	745	754
TN	833	866	854	899	826
VA	679	547	502	694	674
WV	1,176	1,442	1,397	1,471	1,456
Total	**11,012**	**11,056**	**11,011**	**12,813**	**12,714**

Table 2.1-3 EGU Point Source CO Emission Comparison for 2002/2009/2018.

	2002	2009		2018	
State	2002 VISTAS	IPM Base 1 OTB Control (without CAIR)	IPM Base 2 OTW Control (with CAIR)	IPM Base 1 OTB Control (without CAIR)	IPM Base 2 OTW Control (with CAIR)
AL	11,243	16,494	19,205	26,601	29,893
FL	51,278	40,643	40,641	59,794	57,758
GA	9,248	19,169	20,023	27,152	28,894
KY	12,374	15,273	15,120	16,974	14,954
MS	2,714	6,713	6,954	10,552	12,927
NC	11,922	11,090	11,169	13,482	13,777
SC	3,699	6,316	6,526	10,175	10,670
TN	6,414	6,750	6,651	7,074	6,509
VA	6,294	9,811	10,245	14,788	14,839
WV	10,303	12,622	12,328	13,065	12,993
Total	**125,489**	**144,881**	**148,862**	**199,657**	**203,214**

It is important to remember that all EGU emission projections presented are based on requirements of CAIR ***as proposed*** on June 10, 2004. The final CAIR (which was promulgated after our analyses) moved the NO_x compliance date from 2010 to 2009. Future versions of the VISTAS projection emission inventory will likely reflect the Final CAIR requirements.

Table 2.1-3 EGU Point Source PM10-PRI Emission Comparison for 2002/2009/2018.

	2002	2009		2018	
State	2002 VISTAS	IPM Base 1 OTB Control (without CAIR)	IPM Base 2 OTW Control (with CAIR)	IPM Base 1 OTB Control (without CAIR)	IPM Base 2 OTW Control (with CAIR)
AL	7,834	29,053	23,250	31,815	20,450
FL	26,912	25,778	24,494	27,321	22,204
GA	11,148	39,579	28,118	41,221	26,905
KY	5,711	32,406	29,606	33,784	25,733
MS	1,467	5,864	5,883	6,268	6,459
NC	22,480	23,028	21,459	21,417	20,259
SC	23,423	18,023	17,492	19,290	19,182
TN	14,954	17,735	17,159	19,103	12,432
VA	3,824	15,343	12,805	14,389	12,652
WV	7,188	36,442	31,780	37,424	24,253
Total	**124,941**	**243,251**	**212,046**	**252,032**	**190,529**

Table 2.1-3 EGU Point Source PM25-PRI Emission Comparison for 2002/2009/2018.

	2002	2009		2018	
State	2002 VISTAS	IPM Base 1 OTB Control (without CAIR)	IPM Base 2 OTW Control (with CAIR)	IPM Base 1 OTB Control (without CAIR)	IPM Base 2 OTW Control (with CAIR)
AL	4,274	24,876	19,190	27,280	16,279
FL	20,305	19,306	18,186	20,847	16,278
GA	4,888	33,111	22,164	34,361	20,549
KY	3,443	26,640	23,915	27,857	19,915
MS	912	5,510	5,530	5,919	6,111
NC	16,305	17,449	16,034	15,636	14,701
SC	19,162	14,471	14,079	15,601	15,510
TN	12,311	15,770	15,228	17,103	10,514
VA	2,560	13,452	11,238	12,365	10,755
WV	3,369	29,772	25,251	30,628	17,548
Total	**87,529**	**200,357**	**170,815**	**207,597**	**148,160**

It is important to remember that all EGU emission projections presented are based on requirements of CAIR ***as proposed*** on June 10, 2004. The final CAIR (which was promulgated after our analyses) moved the NO_x compliance date from 2010 to 2009. Future versions of the VISTAS projection emission inventory will likely reflect the Final CAIR requirements.

Table 2.1-3 EGU Point Source NH_3 Emission Comparison for 2002/2009/2018.

	2002	2009		2018	
State	2002 VISTAS	IPM Base 1 OTB Control (without CAIR)	IPM Base 2 OTW Control (with CAIR)	IPM Base 1 OTB Control (without CAIR)	IPM Base 2 OTW Control (with CAIR)
AL	90	1,129	1,344	1,909	2,172
FL	58	2,524	2,524	4,022	3,865
GA	5	1,305	1,376	1,912	2,057
KY	0	717	711	763	772
MS	64	388	407	686	872
NC	36	577	574	740	781
SC	0	409	422	702	742
TN	0	406	400	427	394
VA	127	396	440	759	784
WV	13	691	673	722	719
Total	**393**	**8,542**	**8,871**	**12,642**	**13,158**

2.1.2 Non-EGU Sources

The general approach for assembling future year data was to use recently updated growth and control data consistent with the data used in EPA's Clean Air Interstate Rule analyses, supplement these data with available stakeholder input, and provide the results for stakeholder review to ensure credibility. To assemble growth/control data needed for the final 2009 and 2018 inventories, MACTEC performed the following activities:

- Used the revised 2002 VISTAS base year inventory, based on the 2002 CERR submittals as the starting point for the non-EGU projection inventories;
- Obtained, reviewed, and applied the most current growth factors developed by EPA, based on forecasts from an updated Regional Economic Models, Inc. (REMI) model (version 5.5) and the latest *Annual Energy Outlook* published by the Department of Energy (DOE);
- Obtained, reviewed, and applied any State-specific or sector-specific growth factors submitted by stakeholders;
- Obtained and incorporated information regarding sources that have shut down after 2002 and set the emissions to zero in the projection inventories;
- Obtain, review, and apply control assumptions for programs "on-the-books" and "on-the-way"; and
- Provided data files in NIF3.0 format and emission summaries in EXCEL format for review and comment.

The following sections discuss each of these steps.

2.1.2.1 Growth assumptions for non-EGU sources

In developing the preliminary 2018 inventory for VISTAS, we used the EPA's Economic Growth Analysis System (Version 4.0) (EGAS) projection factors by 2-digit SIC code. These growth factors used historical data no more recent than 1996. Although a project was underway to create an updated EGAS (version 5.0) that would ultimately supply more up-to-date factors, this software was not available in time for use in developing the 2009/2018 VISTAS inventories. However, EPA had completed an effort to provide growth factors that can be used in the interim period before EGAS 5.0 is available.

The development of the new growth factor data was used in developing the CAIR analyses and is fully documented in the reports entitled *Development of Growth Factors for Future Year Modeling Inventories* (dated April 30, 2004) and *CAIR Emission Inventory Overview* (dated July 23, 2004). Three sources of data were used in developing the growth factors:

- State-specific growth rates from the Regional Economic Model, Inc. (REMI) Policy Insight® model, version 5.5 (being used in the development of the EGAS Version 5.0).

The REMI socioeconomic data (output by industry sector, population, farm sector value added, and gasoline and oil expenditures) are available by 4-digit SIC code at the State level.

- Energy consumption data from the DOE's Energy Information Administration's (EIA) *Annual Energy Outlook 2004, with Projections through 2025* for use in generating growth factors for non-EGU fuel combustion sources. These data include regional or national fuel-use forecast data that were mapped to specific SCCs for the non-EGU fuel use sectors (e.g., commercial coal, industrial natural gas). Growth factors for the residential natural gas combustion category, for example, are based on residential natural gas consumption forecasts that are reported at the Census division level. These Census divisions represent a group of States (e.g., the South Atlantic division includes eight southeastern States and the District of Columbia). Although one would expect different growth rates in each of these States due to unique demographic and socioeconomic trends, all States within each division received the same growth rate.
- Specific changes for sectors (e.g., plastics, synthetic rubber, carbon black, cement manufacturing, primary metals, fabricated metals, motor vehicles and equipment) where the REMI-based rates were unrealistic or highly uncertain. Growth projections for these sectors were based on industry group forecasts, Bureau of Labor Statistics (BLS) projections and Bureau of Economic Analysis (BEA) historical growth from 1987-2002.

Note that in developing the preliminary 2018 inventory, we adjusted the projected emissions for combustion sources in the industrial/commercial/institutional sector by assuming increases in fuel efficiencies for future years. These adjustments were no longer necessary because the EIA data already considers these changes.

In addition to the growth data described above, we received two sets of growth projections from VISTAS stakeholders. The NCDENR supplied recent projections for three key sectors in North Carolina where declining production was anticipated – SIC 22xx Textile Mill Products, 23xx Apparel and Other Fabrics, and 25xx Furniture and Fixtures. The NCDENR supplied the following specific growth factors for these industrial sectors:

SIC Code	Sector	NC Growth Factor	
		2002 to 2009	2002 to 2018
22xx	Textile Mill Products	0.6239	0.2792
23xx	Apparel and Other Fabrics	0.5867	0.2247
25xx	Furniture and Fixtures	0.8970	0.7647

The American Forest and Paper Association (AF&PA) supplied growth projections for the pulp and paper sector, which were applied to SIC 26xx Paper and Allied Products. The AF&PA projection factors are for the U.S. industry and apply to all States equally. The numbers come from the 15-year forecast for world pulp and recovered paper prepared by Resource Information Systems Inc. (RISI).

SIC Code	Sector	AF&PA Growth Factor	
		2002 to 2009	2002 to 2018
2611	Pulp Mills	1.067	1.169
2621	Paper Mills	1.067	1.169
2631	Paperboard Mills	1.067	1.169

For the above SIC Codes, we used the NCDENR and AF&PA growth factors instead of the factors obtained from EPA. No documentation was provided with these growth factors. Readers should contact NCDENR or AF&PA for more information on their development.

2.1.2.2 Source Shutdowns

Davidson County (Nashville) indicated that significant source shutdowns have occurred since data were submitted for the 2002 CERR. Source number 47-037-00002 (Dupont) shut down a portion of their facility, which was permanently taken out of service. Source 47-037-00050 (Nashville Thermal Transfer Corp.) shut down their municipal waste combustors and replaced them with natural gas fired boilers with propane stand by.

Georgia indicated that the former Blue Circle (now LaFarge) facility in downtown Atlanta will likely shut down before 2009. The facility has two cement kilns, one of which is already shut down. The second kiln will continue to operate until the new facility in Alabama has enough milling capacity, after which the entire Atlanta facility will be completely closed down.

South Carolina provided a list of facilities that were identified as closing down on or after Jan. 1, 2003. The emissions for these facilities were set to zero in the 2009 and 2018 projection inventories.

2.1.2.3 Control Programs applied to non-EGU sources

We used the same control programs for both the 2009 and 2018 non-EGU point inventory. Two control scenarios were developed: on-the-books (OTB) controls (also referred to as Base 1 controls), and on-the-way (OTW) controls (also referred to as Base 2 controls). The OTB control scenario accounts for post-2002 emission reductions from recently promulgated federal, State, local, and site-specific control programs. The OTW control scenario accounts for proposed (but not final) control programs that are reasonably anticipated to result in post-2002 emission reductions.

Table 2.1-8. Non-EGU Point Source Control Programs Included in 2009/2018 Projection Inventories.

Base 1 – On-the-Books (Cut-off of July 1, 2004 for Base 1 adoption)

- Atlanta / Northern Kentucky / Birmingham 1-hr SIPs
- Industrial Boiler/Process Heater/RICE MACT
- NOx RACT in 1-hr NAA SIPs
- NOx SIP Call (Phase I- except where States have adopted II already e.g. NC)
- Petroleum Refinery Initiative (October 1, 2003 notice; MS & WV)
- RFP 3% Plans where in place for one hour plans
- VOC 2-, 4-, 7-, and 10-year MACT Standards
- Combustion Turbine MACT

Base 2a – On-the-Way

- NOx SIP Call (Phase II – remaining States & IC engines)

2.1.2.3.1 OTB - NO_x SIP Call (Phase I)

Phase I of the NO_x SIP call applies to certain large non-EGUs, including large industrial boilers and turbines, and cement kilns. States in the VISTAS region affected by the NO_x SIP call have developed rules for the control of NO_x emissions that have been approved by EPA. We reviewed the available State rules and guidance documents to determine the affected sources and ozone season allowances. We also obtained and reviewed information in the EPA's CAMD NO_x

Allowance Tracking System – Allowances Held Report. Since these controls are to be in effect by the year 2007, we capped the emissions for NO_x SIP call affected sources at 2007 levels and carried forward the capped levels for the 2009/2018 future year inventories. Since the NO_x SIP call allowances are given in terms of tons per ozone season (5 months May to September), we calculated annual emissions by multiplying the 5-month allowances by a factor of 12 divided by 5.

2.1.2.3.2 OTB - Industrial Boiler/Process Heater MACT

EPA anticipates reductions in PM and SO_2 as a result of the Industrial Boiler/Process Heater MACT standard. The methods used to account for these reductions are the same as those used for the CAIR analysis. Reductions were included for existing units firing solid fuel (coal, wood, waste, biomass) which had a design capacity greater than 10 mmBtu/hr. EPA prepared a list of SCCs for solid fuel industrial and commercial/ institutional boilers and process heaters. We identified boilers greater than 10 mmBtu/hr using either the boiler capacity from the VISTAS 2002 inventory, or if the boiler capacity was missing, a default capacity based on a methodology developed by EPA for assigning default capacities based on SCC code. The applied MACT control efficiencies were 4 percent for SO_2 and 40 for percent for PM10 and PM2.5.

2.1.2.3.3 OTB - 2, 4, 7, and 10-year MACT Standards

Maximum achievable control technology (MACT) requirements were also applied, as documented in the report entitled *Control Packet Development and Data Sources,* dated July 14, 2004. The point source MACTs and associated emission reductions were designed from Federal Register (FR) notices and discussions with EPA's Emission Standards Division (ESD) staff. We did not apply reductions for MACT standards with an initial compliance date of 2001 or earlier, assuming that the effects of these controls are already accounted for in the 2002 inventories supplied by the States. Emission reductions were applied only for MACT standards with an initial compliance date of 2002 or greater.

2.1.2.3.4 OTB Combustion Turbine MACT

The projection inventories do not include the NO_x co-benefit effects of the MACT regulations for Gas Turbines or stationary Reciprocating Internal Combustion Engines, which EPA estimates to be small compared to the overall inventory.

2.1.2.3.5 OTB - Petroleum Refinery Initiative (MS and WV)

Three refineries in the VISTAS region are affected by two October 2003 Clean Air Act settlements under the EPA Petroleum Refinery Initiative. The refineries are: (1) the Chevron refinery in Pascagoula, MS; (2) the Ergon refinery in Vicksburg, MS; and (3) the Ergon refinery in Newell, WV.

The first consent decree pertained to Chevron refineries in Richmond and El Segundo, CA; Pascagoula, MS; Salt Lake City, UT; and Kapolei, HI. Actions required under the Consent Decree will reduce annual emissions of NO_x by 3,300 tons and SO_2 by 6,300 tons. The consent decree requires a program to reduce NO_x emissions from refinery heaters and boilers through the installation of NO_x controls that meet at least an SNCR level of control. The refineries are to eliminate fuel oil burning in any combustion unit. The consent decree also requires reductions of NO_x and SO_2 from the fluid catalytic cracking unit and control of acid gas flaring incidents. The consent decree does not provide sufficient information to calculate emission reductions for the FCCU or flaring at the Pascagoula refinery. Therefore, we calculated a general percent reduction for NO_x and SO_2 by dividing the expected emission reductions at the five Chevron refineries by the total emissions from these five refineries (as reported in the 1999 NEI). This resulted in applying percent reductions of 45% for SO_2 and 28% for NO_x to FCCU and flaring emissions at the Chevron Pascagoula refinery.

The second consent decree pertained to the Ergon-West Virginia refinery in Newell, WV; and the Ergon Refining facility in Vicksburg, MS. The consent decree requires the two facilities to implement a 6-year program to reduce NO_x emission from all heaters and boilers greater than 40 mmBtu/hr, and to eliminate fuel oil burning in any combustion unit (except during periods of natural gas curtailment). Specifically, ultra low NO_x burners are required on Boilers A and B at Newell, a low NOx-equivalent level of control for heater H-101 at Newell and heaters H-1 and H-3 at Vicksburg, and an ultra low NO_x burner level of control for heater H-451 at Vicksburg.

2.1.2.3.6 OTW - NO_x SIP Call (Phase II)

The final Phase II NO_x SIP call rule was finalized on April 21, 2004. States have until April 21, 2005, to submit SIPs meeting the Phase II NO_x budget requirements. The Phase II rule applies to large IC engines, which are primarily used in pipeline transmission service at compressor stations.

The NCDENR has already established emissions caps for three facilities affected by the Phase II NO_x SIP call rule, as follows:

- SiteID 3705700300 – permit limits for engines 1, 2, 3, 4, 5, and 6 cap emissions at 1.941 tons/day during the ozone season.
- SiteID 3709700225 – permit limits for engines 12, 13, 14, and 15 cap emissions at 0.497 tons/day during the ozone season.
- SiteID 3715700131 – permit limits for engines 11, 12, 13, 14, and 15 limit emission to a total of 0.974 tons/day during the ozone season.

The other States have not yet prepared their Phase II SIPs, so we have identified affected units using the same methodology as was used by EPA in the proposed Phase II rule (i.e., a large IC engine is one that emitted, on average, more than 1 ton per day during 2002). The final rule reflects a control level of 82 percent for natural gas-fired IC engines and 90 percent for diesel or dual fuel categories.

2.1.2.3.7 Clean Air Interstate Rule

CAIR does not require or assume additional emission reductions from non-EGU boilers and turbines.

2.1.2.4 Quality Assurance steps

Final QA checks were run on the revised projection inventory data set to ensure that all corrections provided by the S/L agencies and stakeholders were correctly incorporated into the S/L inventories and that there were no remaining QA issues that could be addressed during the duration of the project. After exporting the inventory to ASCII text files in NIF 3.0, the EPA QA program was run on the ASCII files and the QA output was reviewed to verify that all QA issues that could be addressed were resolved

Throughout the inventory development process, quality assurance steps were performed to ensure that no double counting of emissions occurred, and to ensure that a full and complete inventory was developed for VISTAS. Quality assurance was an important component to the inventory development process and MACTEC performed the following QA steps on the point source component of the VISTAS revised 2002 base year inventory:

1. Facility level emission summaries were prepared and evaluated to ensure that emissions were consistent and reasonable. The summaries included base year 2002 emissions, 2009/2018 projected emissions accounting only for growth, 2009/2018 projected emissions accounting for both growth and emission reductions from OTB and OTW controls.

2. State-level non-EGU comparisons (by pollutant) were developed for the base year 2002 emissions, 2009/2018 projected emissions accounting only for growth, 2009/2018 projected emissions accounting for both growth and emission reductions from OTB and OTW controls..

3. Data product summaries and raw NIF 3.0 data files were provided to the VISTAS Emission Inventory Technical Advisor and to the Point Source, EGU, and non-EGU Special Interest Work Group representatives for review and comment. Changes based on these comments were reviewed and approved by the S/L point source contact prior to implementing the changes in the files.

4. Version numbering was used for all inventory files developed. The version numbering process used a decimal system to track major and minor changes. For

example, a major change would result in a version going from 1.0 to 2.0 for example. A minor change would cause a version number to go from 1.0 to 1.1. Minor changes resulting from largely editorial changes would result in a change from 1.00 to 1.01 for example.

2.1.2.5 Summary of Revised 2009/2018 non-EGU Point Source Inventories

Tables 2.1-9 through 2.1-15 summarize the revised 2009/2018 non-EGU point source inventories. The "growth only" column does not include the shutdowns (section 2.1.2.2) or control factors (section 2.1.2.3), only the growth factors described in section 2.1.2.1.

Table 2.1-9 Non-EGU Point Source SO_2 Emission Comparison for 2002/2009/2018.

	2002	2009			2018		
State	2002 CERR	Growth Only	Growth plus Base 1 OTB Control	Growth plus Base 1 plus Base 2 OTW Control	Growth Only	Growth plus Base 1 OTB Control	Growth plus Base 1 plus Base 2 OTW Control
AL	96,447	101,684	100,845	100,845	113,671	112,771	112,771
FL	70,675	77,234	76,851	76,851	87,480	87,065	87,065
GA	62,044	66,359	63,348	63,348	73,900	70,386	70,386
KY	34,027	35,725	35,479	35,479	39,069	38,816	38,816
MS	36,049	38,031	35,028	35,028	43,519	40,318	40,318
NC	51,082	56,187	52,693	52,693	62,464	58,671	58,671
SC	56,329	60,351	53,746	53,746	67,053	60,300	60,300
TN	90,375	87,795	85,275	85,275	95,024	92,396	92,396
VA	72,360	77,085	76,081	76,081	86,401	85,351	85,351
WV	54,044	55,658	54,701	54,701	61,109	60,141	60,141
Total	**623,432**	**656,109**	**634,047**	**634,047**	**729,690**	**706,215**	**706,215**

Table 2.1-10 Non-EGU Point Source NO_x Emission Comparison for 2002/2009/2018.

	2002	2009			2018		
State	2002 CERR	Growth Only	Growth plus Base 1 OTB Control	Growth plus Base 1 plus Base 2 OTW Control	Growth Only	Growth plus Base 1 OTB Control	Growth plus Base 1 plus Base 2 OTW Control
AL	83,868	90,783	80,738	70,644	102,632	91,052	80,031
FL	62,138	68,364	67,533	67,533	78,479	77,551	77,551
GA	52,388	56,465	53,008	53,008	62,916	59,005	59,005
KY	38,483	41,045	37,960	37,201	45,235	41,776	40,948
MS	74,685	80,238	70,463	70,463	87,134	76,738	76,738
NC	50,317	53,546	46,242	46,242	58,424	50,044	50,044
SC	44,129	47,164	43,799	43,799	52,580	48,314	47,403
TN	73,431	74,543	62,435	61,176	83,260	69,374	67,999
VA	64,865	68,536	64,298	60,027	76,554	71,480	66,931
WV	46,710	49,924	42,140	40,469	55,206	46,846	44,944
Total	**591,014**	**630,608**	**568,616**	**549,707**	**702,420**	**632,180**	**611,595**

Table 2.1-11 Non-EGU Point Source VOC Emission Comparison for 2002/2009/2018.

	2002	2009			2018		
State	2002 CERR	Growth Only	Growth plus Base 1 OTB Control	Growth plus Base 1 plus Base 2 OTW Control	Growth Only	Growth plus Base 1 OTB Control	Growth plus Base 1 plus Base 2 OTW Control
AL	47,893	52,500	47,600	47,600	61,204	55,373	55,373
FL	38,700	41,550	39,255	39,255	48,794	46,049	46,049
GA	33,736	37,566	34,153	34,153	44,458	40,354	40,354
KY	44,856	49,649	47,733	47,733	57,996	55,729	55,729
MS	43,379	49,173	38,119	38,119	58,467	45,966	45,966
NC	72,945	75,644	70,146	70,146	82,135	75,985	75,985
SC	38,493	43,924	36,410	36,410	53,546	44,586	44,586
TN	88,059	100,946	89,129	89,129	126,207	111,373	111,373
VA	43,227	47,706	44,359	44,359	57,959	53,968	53,968
WV	14,599	15,705	14,015	14,015	18,601	16,636	16,636
Total	**465,887**	**514,363**	**460,919**	**460,919**	**609,367**	**546,018**	**546,018**

Table 2.1-12 Non-EGU Point Source CO Emission Comparison for 2002/2009/2018.

	2002	2009			2018		
State	2002 CERR	Growth Only	Growth plus Base 1 OTB Control	Growth plus Base 1 plus Base 2 OTW Control	Growth Only	Growth plus Base 1 OTB Control	Growth plus Base 1 plus Base 2 OTW Control
AL	174,306	177,145	177,145	177,145	194,801	194,801	194,801
FL	89,970	98,325	98,325	98,325	113,924	113,923	113,923
GA	131,413	147,876	147,835	147,835	169,206	169,156	169,156
KY	110,181	121,981	121,981	121,981	139,395	139,395	139,395
MS	57,158	61,783	60,709	60,709	71,630	70,454	70,454
NC	52,539	56,019	54,791	54,791	65,044	63,699	63,699
SC	59,605	65,720	65,612	65,612	75,323	75,209	75,209
TN	119,453	126,260	121,420	121,420	150,098	143,845	143,845
VA	64,395	69,823	69,822	69,822	77,590	77,590	77,590
WV	89,917	100,292	100,292	100,292	119,367	119,367	119,367
Total	**948,937**	**1,025,224**	**1,017,931**	**1,017,931**	**1,176,378**	**1,167,440**	**1,167,440**

Table 2.1-13 Non-EGU Point Source PM10-PRI Emission Comparison for 2002/2009/2018.

	2002	2009			2018		
State	2002 CERR	Growth Only	Growth plus Base 1 OTB Control	Growth plus Base 1 plus Base 2 OTW Control	Growth Only	Growth plus Base 1 OTB Control	Growth plus Base 1 plus Base 2 OTW Control
AL	24,957	26,780	25,161	25,161	31,195	29,278	29,278
FL	30,331	33,403	27,531	27,531	38,805	31,890	31,890
GA	22,055	24,906	23,861	23,861	29,351	28,177	28,177
KY	15,615	16,938	15,858	15,858	19,937	18,587	18,587
MS	19,622	22,073	19,439	19,439	26,160	23,145	23,145
NC	14,511	15,560	14,301	14,301	17,415	16,002	16,002
SC	18,149	19,777	17,368	17,368	22,949	20,272	20,272
TN	35,983	37,661	33,838	33,838	46,166	41,466	41,466
VA	13,242	14,335	13,470	13,470	16,646	15,661	15,661
WV	14,865	15,465	14,926	14,926	19,096	18,433	18,433
Total	**209,330**	**226,898**	**205,753**	**205,753**	**267,720**	**242,911**	**242,911**

Table 2.1-14 Non-EGU Point Source PM25-PRI Emission Comparison for 2002/2009/2018.

	2002	2009			2018		
State	2002 CERR	Growth Only	Growth plus Base 1 OTB Control	Growth plus Base 1 plus Base 2 OTW Control	Growth Only	Growth plus Base 1 OTB Control	Growth plus Base 1 plus Base 2 OTW Control
AL	19,016	20,360	19,184	19,184	23,673	22,268	22,268
FL	25,842	28,415	23,063	23,063	32,939	26,622	26,622
GA	17,890	20,347	19,562	19,562	23,997	23,110	23,110
KY	10,730	11,690	10,837	10,837	13.816	12,738	12,738
MS	10,132	11,283	9,459	9,459	13,141	11,068	11,068
NC	11,207	11,985	10,888	10,888	13,364	12,136	12,136
SC	13,565	14,759	12,977	12,977	17,081	15,136	15,136
TN	29,131	30,600	27,313	27,313	37,542	33,502	33,502
VA	10,211	11,037	10,368	10,368	12,827	12,062	12,062
WV	12,154	12,608	12,138	12,138	15,636	15,045	15,045
Total	**159,878**	**173,084**	**155,789**	**155,789**	**190,213**	**183,687**	**183,687**

Table 2.1-15 Non-EGU Point Source NH_3 Emission Comparison for 2002/2009/2018.

	2002	2009			2018		
State	2002 CERR	Growth Only	Growth plus Base 1 OTB Control	Growth plus Base 1 plus Base 2 OTW Control	Growth Only	Growth plus Base 1 OTB Control	Growth plus Base 1 plus Base 2 OTW Control
AL	1,883	2,112	2,112	2,112	2,457	2,456	2,456
FL	1,432	1,605	1,605	1,605	1,905	1,905	1,905
GA	3,613	3,965	3,963	3,963	4,801	4,799	4,799
KY	674	733	733	733	839	839	839
MS	1,169	1,267	667	667	1,419	761	761
NC	1,171	1,255	1,255	1,255	1,413	1,412	1,412
SC	1,411	1,578	1,578	1,578	1,779	1,779	1,779
TN	1,628	1,861	1,861	1,861	2,240	2,240	2,240
VA	3,104	3,057	3,057	3,057	3,620	3,620	3,620
WV	331	342	342	342	416	416	416
Total	**16,416**	**17,775**	**17,173**	**17,173**	**20,889**	**20,227**	**20,227**

2.2 Area Sources

This section describes the methodology used to develop the 2009 and revised 2018 projection inventories. This section describes two approaches to these projections. Separate methods for projecting emissions were used for non-agricultural (stationary area) and agricultural area sources (predominantly NH_3 emissions). The two methods used for these sectors are described in the sections that follow.

2.2.1 Stationary area sources

The general approach used to calculate projected emissions for stationary area sources was as follows:

1. Use the VISTAS revised 2002 base year inventory as the starting point for projections.
2. MACTEC then worked with the VISTAS States (via the Stationary Area Source SIWG) to obtain any State specific growth factors and/or future controls from the States to use in developing the projections.
3. MACTEC then back calculated uncontrolled emissions from the revised 2002 base year inventory based on existing controls reported in the 2002 revised base year inventory.
4. Controls (including control efficiency, rule effectiveness and rule penetration) provided by the States or originally developed for use in estimating projected emissions for U.S. EPA's Heavy Duty Diesel (HDD) rulemaking emission projections and used in the Clean Air Interstate Rule (CAIR) projections were then used to calculate controlled emissions. State submitted controls had precedence over the U.S. EPA developed controls.
5. Growth factors supplied from the States or the U.S. EPA's CAIR emission projections were then applied to project the controlled emissions to the appropriate year.
6. MACTEC then provided the final draft inventory for review and comment by the VISTAS States.

For stationary area sources, no State-supplied growth or control factors were provided. Thus for all of the sources in this sector of the inventory, growth and controls were applied based on controls initially identified for the CAIR and growth factors identified for the CAIR projections.

2.2.1.1 Stationary area source controls

The controls obtained by MACTEC for the HDD rulemaking were controls for the years 2007, 2020, and 2030. Since MACTEC was preparing 2009 and 2018 projections, control values for intermediate years were prepared using a straight line interpolation of control level between 2007 and 2020. The equation used to calculate the control level was as follows:

CE = (((2020 CE – 2007 CE)/13)*YRS) + 2007 CE

Where:

CE	= Control Efficiency for either 2009 or 2018
2020 CE	= HDD Control Efficiency value for 2020
2007 CE	= HDD Control Efficiency value for 2007
13	= Number of years between 2020 and 2007
YRS	= Number of years beyond 2007 to VISTAS Projection year

For 2009 the value of YRS would be two (2) and for 2018 the value would be eleven (11). Control efficiency values were determined for VOC, CO and PM. Rule penetration values for each year in the HDD controls tables obtained by MACTEC were always 100 percent so those values were maintained for the VISTAS projections.

Prior to performing the linear interpolation of the controls, MACTEC evaluated controls from the IAQTR projections. Those controls appeared to be identical to those used for the HDD rulemaking. In addition, MACTEC received some additional information on some controls for area source solvents (email from Jim Wilson, E.H. Pechan and Associates, Inc. to Gregory Stella, VISTAS Emission Inventory Technical Advisor, 3/5/04) that were used to check against the controls in the HDD rulemaking files. Where those controls proved to be more stringent than the HDD values, MACTEC updated the control file with those values (which were then used in the interpolation to develop 2009 and 2018 values). Finally, for VOC the HDD controls were initially provided at the State-county-SCC level. However, upon direction from the VISTAS Emission Inventory Technical advisor, the VOC controls were consolidated at the SCC level and applied across all counties within the VISTAS region (email from Gregory Stella, Alpine Geophysics, 3/3/2004) to ensure that no controls were missed due to changes in county FIPS codes and/or SCC designations between the time the HDD controls were developed and 2002.

The equation below indicates how VOC emissions were projected for stationary area sources.

$$VOC_{2018} = VOC_{2002}\ x \left(1 - \left(\frac{VOC\_CE_{2018}}{100}\right)\left(\frac{VOC\_RE_{2018}}{100}\right)\left(\frac{VOC\_RP_{2018}}{100}\right)\right)$$

where:

VOC_{2018}	= VOC emissions for 2018
VOC_{2002}	= Uncontrolled VOC emissions for 2002

VOC_CE_{2018} = Control Efficiency for VOC (in this example for 2018)

VOC_RE_{2018} = Rule Effectiveness for VOC (in this example for 2018)

VOC_RP_{2018} = Rule Penetration for VOC (in this example for 2018)

A similar equation could be constructed for either PM or CO. It should be noted that the control efficiencies calculated based on the HDD rulemaking were only applied if they were greater than any existing 2002 base year controls. No controls were found for SO_2 or NO_x.

In the preliminary 2018 emission estimates, an energy efficiency factor was applied to energy related stationary area sources. That factor was not applied to the revised projections since information supplied by U.S. EPA related to the CAIR growth factors indicated that growth values for those categories were derived from U.S. Department of Energy (DOE) and were felt to account for changes in projected energy efficiency.

2.2.1.2 Stationary area source growth

As indicated above, growth factors for 2009 and the revised 2018 inventories were obtained from the U.S. EPA and are linear interpolations of the growth factors used for the Clean Air Interstate Rule (CAIR) projections. The growth factors for the CAIR obtained by MACTEC were developed using a base year of 2001 and provided growth factors for 2010 and 2015. MACTEC used the TREND function in Microsoft Excel™ to calculate 2002, 2009 and 2018 values from the 2001, 2010 and 2015 values. The TREND function provides a linear interpolation of intermediate values from a known series of data points (in this case the 2001, 2010 and 2015 values) based on the equation for a straight line. These values were calculated at the State and SCC level with the exception of paved road emissions (SCC = 2294000000). The growth factors for paved roads were available in the CAIR data set at the State, county and SCC level so they were applied at that level.

Prior to utilizing the growth factors from the CAIR projections, MACTEC confirmed that all SCCs found in the VISTAS 2002 revised base year inventory were in the CAIR file. Some SCCs were not found in the CAIR file. For those SCCs, the growth factors used were derived in one of five ways. First where possible, they were taken from a beta version of EGAS 5.0. In other cases, the growth factor was set to one (i.e., no growth). In other cases, a similar SCC that had a CAIR growth factor was used. In a few cases a growth factor based on an average CAIR growth at the 6 digit SCC level was calculated. Finally a number of records used population as the growth surrogate. A comment field in the growth factor file was used to mark those records that were not taken directly from the CAIR projection growth factors.

2.2.1.3 Stage II refueling

In the revised 2002 VISTAS base year inventory, Stage II refueling emissions were included in the area source files. This was done because the units generated from MOBILE and NONROAD are not compatible when combined. In addition, the on-road mobile emissions were to be projected within the model and only input files were being prepared. As a consequence, Stage II refueling emissions were projected to 2009 and 2018 using growth factors and controls, similarly to stationary area sources. As with stationary area sources the growth factors were derived from the CAIR values. Controls for Stage II were developed using linear interpolations of values developed for the HDD rulemaking effort. Counties with confirmed Stage II programs had the controls applied to them for both 2009 and 2018 based on a database of counties having Stage II programs developed by MACTEC for EPA. Refueling emissions were taken out of all emission estimates developed for NONROAD to ensure no double counting.

2.2.1.3.1 Differences between 2009/2018

Methodologically, there was no difference in the way that 2009 and 2018 emissions were calculated for stationary area sources (or Stage II refueling). The individual control and growth factors were different (due to the linear interpolation used to calculate the values) but the calculation methods were identical.

2.2.2 Agricultural area sources

The general approach used to calculate projected emissions for agricultural area sources (predominantly NH_3 emission sources) was as follows:

1. MACTEC used the revised 2002 base year inventory data (which was based on the CMU ammonia model version 3.6).
2. MACTEC worked with the VISTAS States (via the Agricultural Sources SIWG) to obtain any State specific growth and/or future controls from the States for agricultural sources.
3. Since the base year emissions were uncontrolled, and no future controls for these sources were identified, MACTEC projected the agricultural emissions using State-specific growth if available, otherwise the U.S. EPA's IAQTR/Ammonia inventory was used to develop the growth factors used to project the revised 2002 base year inventory to 2009 or 2018.
4. MACTEC then provided the final draft inventory for review and comment by the VISTAS States.

2.2.2.1 Control assumptions for agricultural area sources

No controls were identified either by the individual VISTAS States or in the information provided in the EPA's IAQTR Ammonia inventory document. Thus all projected emissions for agricultural area sources represent simple growth with no controls.

2.2.2.2 Growth assumptions for non-agricultural area sources

Growth for several agricultural area source livestock categories was developed using the actual emission estimates developed by the EPA as part of the NEI. That work included projections for the years 2002, 2010, 2015, 2020, and 2030. The actual emissions themselves were not used other than to develop growth factors since the 2002 NEI upon which the growth projections were based was prepared prior to the release of the 2002 Census of Agriculture which was included in the CMU model (version 3.6) which was used to develop the revised 2002 VISTAS base year inventory. Thus VISTAS Agricultural Sources SIWG decided to use the NEI ammonia inventory projected emissions to develop the 2009 and revised 2018 growth factors used to project emission for VISTAS. Details on the NEI inventory and projections can be found at:

http://www.epa.gov/ttn/chief/ap42/ch09/related/nh3inventorydraft_jan2004.pdf. The actual data files for the projected emissions can be found at:

http://www.epa.gov/ttn/chief/ap42/ch09/related/nh3output01_23_04.zip.

In order to use the NEI projected emissions as growth factors, several steps were required. These steps were as follows:

1. NEI projected emissions were only available for the years 2002, 2010, 2015, 2020, and 2030, thus the first task was to calculate intermediate year emissions for 2009 and 2018. These values were calculated based on linear interpolation of the existing data.

2. Once the intermediate emissions were calculated, MACTEC developed emission ratios to provide growth factors for 2009 and 2018. Ratios of emissions were established relative to the 2002 NEI emissions.

3. Once the growth factors were established, MACTEC then evaluated whether or not all agricultural SCCs within the revised 2002 base year inventory had corresponding growth factors. MACTEC established that not all SCCs within the base year inventory had growth factors. These SCCs fell into one of two categories:

    a. SCCs that had multiple entries in the NEI but only a single SCC in the 2002 VISTAS base year inventory. The NEI was established using a process model and for some categories of animals, emissions were calculated for several aspects of the process. The CMU model version 3.6 which was the basis for the VISTAS 2002 revised base year inventory did not use a process model. As a consequence a mapping of SCCs in the NEI projections and corresponding SCCs in the CMU inventory was made and for those SCCs an average growth factor was calculated from the NEI projections for use with the corresponding SCC in the CMU based 2002 base year inventory.

b. There were also State, county, SCC trios in the 2002 VISTAS revised base year inventory which had no corresponding emissions in the NEI files. For these instances, MACTEC first developed State level average growth factors from the NEI projections for use in growing these records. Even after developing State level average growth factors there were still some State/SCC pairs that did not have matching growth. For these records, MACTEC developed VISTAS regional average growth factors at the SCC level from the NEI data.

4. Once all of the growth factors were developed, they were used to project the emissions to 2009 and 2018. Growth factors were first applied at the State, county and SCC level. Then remaining records were grown with the State/SCC specific growth factors. Finally, any remaining ungrown records were projected at the SCC level using the VISTAS regional growth factor.

For the livestock categories, the NEI emission projections only had data for beef and dairy cattle, poultry and swine. Thus for other livestock categories and for fertilizers alternative growth factors were required.

The growth factors for other livestock categories and fertilizers were obtained from growth factors used for the IAQTR projections made by the U.S. EPA. The methodology for these categories was identical to that used for dairy, beef, poultry and swine with the exception that State/SCC and VISTAS/SCC growth factors were not required for these categories since the IAQTR data contained State, county and SCC level growth factors. The IAQTR data provided growth factors for 1996, 2007, 2010, 2015 and 2020. Linear interpolation was used to develop the growth factors for the intermediate years 2009 and 2018 required for the VISTAS projections.

There were a few exceptions to the methods used for projecting agricultural sources for the VISTAS projections. These exceptions were:

1. All swine emissions for North Carolina were maintained at 2002 levels for each projection year to capture a moratorium on swine production in that State.

2. Ammonia growth factors for a few categories (mainly feedlots) were assigned to be the same as growth factors for PM emissions from the NEI projections. This assignment was made because the CMU model showed emissions from these categories but the NEI projections did not show ammonia emissions but did show PM emissions.

3. No growth factors were found for horse and pony emissions. These emissions were held constant at 2002 levels.

2.2.2.2.1 Differences between 2009/2018

Methodologically, there was no difference in the way that 2009 and 2018 emissions were calculated for agricultural area sources. The growth factors were different (due to the linear interpolation used to calculate the values) but the calculation methods were identical.

2.2.3 Quality Assurance steps

Throughout the inventory development process, quality assurance steps were performed to ensure that no double counting of emissions occurred, to ensure that a full and complete inventory was developed for VISTAS, and to make sure that projection calculations were working correctly. Quality assurance was an important component to the inventory development process and MACTEC performed the following QA steps on the stationary and agricultural area source components of the 2009 and revised 2018 projection inventories:

1. All final files were run through EPA’s Format and Content checking software.

2. SCC level emission summaries were prepared and evaluated to ensure that emissions were consistent and that there were no missing sources.

3. Tier comparisons (by pollutant) were developed between the revised 2002 base year inventory and the 2009 and 2018 projection inventories.

4. Data product summaries were provided to both the VISTAS Emission Inventory Technical Advisor and to the SIWG representatives for review and comment. Changes based on these comments were implemented in the files.

5. Version numbering was used for all inventory files developed. The version numbering process used a decimal system to track major and minor changes. For example, a major change would result in a version going from 1.0 to 2.0. A minor change would cause a version number to go from 1.0 to 1.1. Minor changes resulting from largely editorial changes would result in a change from 1.00 to 1.01.

2.3 Mobile Sources

Our general approach for assembling data was to use as much existing data from the preliminary projections as possible for these inventories, supplement these data with easily available stakeholder input, and provide the results for stakeholder review to ensure credibility. To develop the "base case" projections, MACTEC originally assembled data to develop two 2009 and 2018 base case inventories: 1) an inventory that included all "on-the-books" control programs and 2) an "on-the-way" inventory that included controls that were likely to be "on-the-way". For the revised emission forecasts to the mobile source sector, "on-the-books" and "on-the-way" are defined with the same strategies and therefore only a single projection scenario was developed for each forecast year.

To ensure consistency across evaluation years, the 2009 and 2018 base case inventories were developed, to the maximum extent practical, using methodologies identical to those employed in developing the 2002 on-road portion of the revised 2002 VISTAS base year inventory. All modifications to the 2002 inventory methods were developed in consultation with the Mobile Source Special Interest Workgroup (MSSIWG). Generally, modifications were only made to properly account for actual changes expected in the intervening period (i.e., between 2002 and 2009 and between 2002 and 2018), but the underlying inventory development methodology was identical, except to the extent requested by VISTAS or the MSSIWG.

MACTEC developed a preliminary 2018 inventory in early 2004. That inventory was designed to 1) be used for modeling sensitivity evaluations and 2) help establish the methods that would be used for the final 2018 inventory and the initial 2009 inventory. Since that work took place prior to the revision of the 2002 base year inventory data files, MACTEC provided a review of the data and methods used to develop on-road mobile source input files for the initial 2002 base year inventory prior to developing the preliminary 2018 inventory. Through this review, MACTEC determined the following:

- Onroad VMT. Most States provided local data for 2002 (or a neighboring year that was converted to 2002 using appropriate VMT growth surrogates). Since these data were not applicable to 2018 due to intervening growth, input for 2018 was solicited from the MSSIWG. At the same time we researched county-specific growth rate data utilized for recent national rulemakings as a backstop approach to State supplied VMT projections.

- Modeling Temperatures. Actual 2002 temperatures were used for the initial 2002 base year inventory.

- Vehicle Registration Mix (age fractions by type of vehicle). A mix of State, local, and MOBILE6 default data were used for the 2002 initial base year inventory.

Forecast data were solicited from the States, with a fallback position that we hold the fractions constant at their 2002 values.

- Vehicle Speed by Roadway Type. For the 2002 initial base year inventory, speeds varying by vehicle and road type were used.
- VMT Mixes (fraction of VMT by vehicle type). A mix of State, local, and quasi MOBILE6 default (i.e., MOBILE6 defaults normalized to better reflect local conditions) data were used for the 2002 initial base year inventory. Forecast data were solicited from the States.
- Diesel Sales Fractions. As with the VMT mix data, the diesel sales fraction data employed for the 2002 initial base year inventory represents a mix of State, local, and quasi MOBILE6 default data. The issues related to updating these data to 2018 are also similar, but are complicated by the fact that MOBILE6 treats diesel sales fraction on a model year, rather than age specific basis. Therefore, diesel sales fractions generally cannot be held constant across time. Once again, we solicited any local projections, with a fallback position that we would keep the data for 2002 and earlier model years constant for the forecast inventory, supplemented with MOBILE6 default data for 2003 and newer model years.
- State/Local Fuel Standards. For the 2002 initial base year inventory, these data were based on appropriate local requirements and updated data for 2018 was only required if changes were expected between 2002 and 2018. There are some national changes in required fuel quality for both onroad and nonroad fuels that are expected to occur between 2002 and 2018 and these would be reflected in the 2018 inventory in the absence of more stringent local fuel controls. Expected changes in local fuel control programs were solicited.
- Vehicle Standards. The 2002 initial base year inventory assumed NLEV applicability. This was altered to reflect Tier 2 for 2018, unless a State indicated a specific plan to adopt the California LEV II program. If so, we made the required changes to implement those plans for the preliminary 2018 inventory.
- Other Local Controls. This includes vehicle emissions inspection (i.e., I/M) programs, Stage II vapor recovery programs, anti tampering programs, etc. By nature, the assumptions used for the 2002 initial base year inventory vary across the VISTAS region, but our presumption is that these data accurately reflected each State's situation as it existed in 2002. If a State had no plans to change program requirements between 2002 and 2018, we proposed to maintain the 2002 program descriptions without change. However, if a State planned changes, we requested

information on those plans. In the final implementation of the inventory, Stage II controls were exercised in the area source component of the inventory, since the units used to develop Stage II refueling estimates are different between MOBILE6 and the NONROAD models.

Once the preliminary 2018 base case projection inventory data were compiled, MACTEC applied the data and methods selected and proceeded to develop the preliminary base case 2018 projection inventories. The resulting inventories were provided to the MSSIWG in a user-friendly format for review. After stakeholder review and comment, the final preliminary 2018 base case inventories and input files were provided to VISTAS in formats identified by the VISTAS Technical Advisor (in this case, MOBILE input files and VMT, NONROAD input files and annual inventory files for NONROAD in NIF 3.0 format). Annual inventory files for MOBILE were not developed as part of this work, only input files and VMT forecasts. MOBILE emissions were calculated by VISTAS air quality modeling contractor using the provided files.

2.3.1 Development of on-road mobile source input files

As indicated above, MACTEC prepared a preliminary version of the 2018 base case mobile inventory input data files. These files were then updated to provide a final set of 2018 base case inventory input data files as well as a set of input files for 2009. The information below describes the updates performed on the preliminary 2018 files and the development of the 2009 input data files.

Our default approach to preparing the revised 2018 and initial 2009 projection inventories for on-road mobile sources was to estimate the emissions by using either:

1. the revised 2002 data provided by each State coupled with the projection methods employed for the preliminary 2018 inventory, or
2. the same data and methods used to generate the preliminary 2018 inventory.

We also investigated whether or not there was more recent VMT forecasting data available (e.g., from the CAIR and if appropriate revised the default VMT growth rates accordingly. This did not affect any State that provided local VMT forecasting data, but would alter the VMT estimates used for other areas.

Since no preliminary 2009 inventory was developed there did not exist an option (2) above for 2009. As a consequence, MACTEC crafted the 2009 initial inventory for on-road mobile sources using methods identical to those employed for the 2018 preliminary inventories coupled with any changes/revisions provided by the States during the review of the revised 2002 base year and the 2018 preliminary inventories. Therefore, as was the case for 2018, we obtained from the States any input data revisions, methodological revisions, and local control program specifications (to the extent that they differed from 2002/2018).

2.3.1.1 Preparation of revised 2018 input data files

Preparation of the revised 2018 inventories required the following updates:

1. The evaluation year was updated to 2018 in all files.
2. The diesel fuel sulfur content was revised from 500 ppm to 11 ppm, consistent with EPA data for 2018 in all files.
3. Since the input data is model year, rather than age, specific for diesel sales fractions (with data for the newest 25 model years required), we updated all files that included diesel sales fractions. In the revised 2002 base year files, the data included applied to model years 1978-2002. For 2018, the data included would reflect model years 1994-2018. To forecast the 2002 data, MACTEC took the data for 1994-2002 from the 2002 files and added data for 2003-2018. To estimate the data for these years, we employed the assumption employed by "default" in MOBILE6 -- namely that diesel sales fractions for 1996 and later are constant. Therefore, we set the diesel sales fractions for 2003-2018 at the same value as 2002.
4. VMT mix fractions must be updated to reflect expected changes in sales patterns between 2002 and 2018. If explicit VMT mix fractions are not provided, these changes are handled internally by MOBILE6 or externally through absolute VMT distributions. However, files that include explicit VMT mix fractions override the default MOBILE6 update and may or may not be consistent with external VMT distributions. MACTEC updated the VMT mix in such files as follows:

   First, we calculated the VMT fractions for LDV, LDT1, LDT2, HDV, and MC from the external VMT files for 2018. This calculation was performed in accordance with section 5.3.2 of the MOBILE6 Users Guide which indicates:

   LDV = LDGV + LDDV

   LDT1 = LDGT1 + LDDT

   LDT2 = LDGT2

   HDV = HDGV + HDDV

   MC = MC

The resulting five VMT fractions were then split into the 16 fractions required by MOBILE6 using the distributions for 2018 provided in Appendix D of the MOBILE6 Users Guide. This approach ensures that explicit input file VMT fractions are consistent with the absolute VMT distributions prepared by MACTEC. These changes were made to all files that included VMT mixes.

5. All other input data were retained at 2002 values, except as otherwise instructed by the States. This includes all control program descriptions (I/M, ATP, Stage II, etc.), all other fuel qualities (RVP, oxy content, etc.), all other vehicle descriptive data (registrations age distributions, etc.), and all scenario descriptive data.

In addition to the updates described above that were applied to all VISTAS-region inputs, the following additional State-specific updates were performed:

Kentucky:

MACTEC revised the 2018 input files for the Louisville, Kentucky area (Louisville APCD) based on comments received relative to several components of MOBILE input data. Based on these comments, the input files for Jefferson County, Kentucky were updated accordingly as follows:

a) I/M and tampering program definitions were removed since the program was discontinued at the end of 2003.

b) The "Speed VMT", "Facility VMT" and "Registration Age Distribution" file pointers were updated to reflect revised 2002 files provided by the Louisville APCD.

c) The "VMT Mix" data, which was previously based on the default approach of "growing" 2002 data, was replaced by 2018-specific data provided by the Louisville APCD.

North Carolina:

North Carolina provided a wide range of revised input data, including complete MOBILE6 input files for July modeling. MACTEC did not use the provided input files directly as they did not match the 2002 NC input files for critical elements such as temperature distributions and gasoline RVP (while they were close, they were slightly different). To maintain continuity between 2002 and 2018 modeling, MACTEC instead elected to revise the 2002 input files to reflect all control program and vehicle-related changes implied by the new 2018 files, while retaining the basic temperature and gasoline RVP assumptions at their 2002 values. Under this approach, the following changes were made:

a) NC provided a county cross reference file specific to 2018 that differed from that used for 2002. We removed files that were referenced in the 2002 input data and replaced those files with those referenced in the 2018 data. In addition, since NC only provided 2018 input files for July, we estimated the basic data for these new files for the other months by cross referencing the target files for 2002 by county against the target files for 2018 by county.

b) We then revised the 2002 version of each input file to reflect the 2018 "header" data included in the NC-provided 2018 files. These data are exclusively limited to I/M and ATP program descriptions, so that the 2002 I/M and ATP data were replaced with 2018 I/M and ATP data.

c) We retained the registration age fractions at their 2002 "values" (external file pointers) as per NC instructions.

d) We retained all scenario-specific data (i.e., temperatures, RVP, etc.) at 2002 values, which (as indicated above), were slightly different in most cases from data included in the 2018 files provided by NC. We believe these differences were due to small deviations between the data assembled to support VISTAS 2002 and the process used to generate the 2018 files provided by NC, and that revising the VISTAS 2002 data to reflect these variations was not appropriate given the resulting inconsistencies that would be reflected between VISTAS 2002 and VISTAS 2018.

e) NC also provided non-I/M versions of the 2018 input files that would generally be used to model the non-I/M portion of VMT. While these files were retained they were not used for the 2018 input data preparation.

Finally, NC also provided a speed profile file and a speed profile cross reference file for 2018. We did not use these in our updates as they have no bearing on the MOBILE6 input files, but they were maintained in case they needed to be included in SMOKE control files for a future year control strategy scenario.

Virginia:

In accordance with instructions from VA, the input files that referenced an external I/M descriptive program file (VAIM02.IM) were revised to reference an alternative external file (VAIM05.IM). This change was to make the I/M program more relevant to the year 2018.

One additional important difference was made with respect to the revised 2018 and initial 2009 on-road mobile source input data files. MACTEC developed updated SMOKE ready input files rather than MOBILE6 files so that the input data could be used directly by the VISTAS modeling contractor to estimate on-road mobile source emissions during modeling runs.

2.3.1.2 Preparation of initial 2009 input data files

The methodology used to develop the 2009 on-road input files was based on forecasting the previously developed revised 2002 base year input files and is identical to that previously described for the revised 2018 methodology except as follows:

1. The evaluation year was updated to 2009.
2. Diesel fuel sulfur content was revised from 500 ppm to 29 ppm. The 29 ppm value was derived from an EPA report entitled "Summary and Analysis of the Highway Diesel Fuel 2003 Pre-compliance Reports" (EPA420-R-03-013, October 2003), which includes the Agency's estimates for the year-to-year fuel volumes associated with the transition from 500 ppm to 15 ppm diesel fuel. According to Table 2 of the report, there will be 2,922,284 barrels per day of 15 ppm diesel distributed in 2009 along with 110,488 barrels per day of 500 ppm diesel. Treating the 15 ppm diesel as 11 ppm on average (consistent with EPA assumptions and assumptions employed for the 2018 input files) and sales weighting the two sulfur content fuels results in an average 2009 diesel fuel sulfur content estimate of 29 ppm.
3. Diesel sales fractions were updated identically to 2018 except that the diesel sales fractions for 2003-2009 were set at the same value as those for 2002 (rather than 2003-2018).
4. VMT mix fractions were updated to 2009 using an identical method to that described for 2018.
5. All other input data were retained at 2002 values, except as otherwise instructed by individual States (see below). This includes all control program descriptions (I/M, ATP, Stage II, etc.), all other fuel qualities (RVP, oxy content, etc.), all other vehicle descriptive data (registration age distributions, etc.), and all scenario descriptive data.

In addition to the updates described above that were applied to all VISTAS-region inputs, the following additional State-specific updates were performed:

KY – Identical changes to those made for 2018 (but specific to 2009) were made for the 2009 input files.

NC – Identical changes to those made for 2018 (but specific to 2009) were made for the 2009 input files.

VA – Identical changes to those made for 2018 were made for 2009.

2.3.2 VMT Data

The basic methodology used to generate the 2009 and 2018 VMT for use in estimating on-road mobile source emissions was as follows:

1. All estimates start from the final VMT estimates used for the 2002 revised base year inventory.
2. Initial 2009 and 2018 VMT estimates were based on linear growth rates for each State, county, and vehicle type as derived from the VMT data assembled by the U.S. EPA for their most recent HDD (heavy duty diesel) rulemaking. The methodology used to derive the growth factors is identical to that employed for the preliminary 2018 VMT estimates (which is described in the next section).
3. For States that provided no independent forecast data, the estimates derived in step 2 are also the final estimates. These States are: Alabama, Florida, Georgia, Kentucky, Mississippi, and West Virginia. For States that provided forecast data, the provided data were used to either replace or augment the forecast data based on the HDD rule. These States, and the specific approaches employed, are detailed following the growth method description.

The steps involved in performing the growth estimates for VMT were as follows:

1. Linear growth estimates were used (although MACTEC investigated the potential use of nonlinear factors and presented that information to the MSSIWG, the decision was made to use linear growth factors instead of nonlinear).
2. Estimates were developed at the vehicle class (i.e., LDGV, LDGT1, LDGT2, etc.) level of detail since the base year 2002 estimates were presented at that level of resolution. In effect, the county and vehicle class specific growth factors were applied to the 2002 VMT estimates for each vehicle and road class.
3. Overall county-specific VMT estimates for each year (developed by summing the vehicle and road class specific forecasts) were then compared to overall county-specific growth. Since overall county growth is a more appropriate controlling factor as it includes the combined impacts of all vehicle classes, the initial year-specific vehicle and road class VMT forecasts were normalized so that they matched the overall county VMT growth. Mathematically, this process is as follows:

   (Est_rv_f) = (Est_rv_i) * (C_20XX / Sum(Est_rv_i))

   where:

   Est_rv_f = the final road/vehicle class-specific estimates,

Est_rv_i = the initial road/vehicle class-specific estimates, and

C_20XX = the county-specific growth target for year 20XX.

Table 2.3-1 presents a basic summary of the forecasts for the preliminary 2018 inventory for illustrative purposes:

Table 2.3-1 2002 vs 2018 VMT (million miles per year)

State	2002	2018	Growth Factor
Alabama	55,723	72,966	1.309
Florida	178,681	258,191	1.445
Georgia	106,785	148,269	1.388
Kentucky	51,020	66,300	1.299
Mississippi	36,278	46,996	1.295
North Carolina	80,166	110,365	1.377
South Carolina	47,074	63,880	1.357
Tennessee	68,316	91,647	1.342
Virginia	76,566	102,971	1.345
West Virginia	19,544	24,891	1.274

The following States provided some types of forecast data for VMT. The information presented below indicates how those data were processed by MACTEC for use in the VISTAS projection inventories.

Kentucky:

Revised 2009 and 2018 VMT mix data were provided by the Louisville APCD. Therefore, the distribution of Jefferson County VMT by vehicle type within the KY VMT file was revised to reflect the provided mix. This did not affect the total forecasted VMT for either Jefferson County or the State, but does alter the fraction of that VMT accumulated by each of the eight vehicle types reflected in the VMT file. The following procedure was employed to make the VMT estimates consistent with the provided 2009/2018 VMT mix:

a) The 16 MOBILE6 VMT mix fractions were aggregated into the following five vehicle types: LDV, LDT1, LDT2, HDV, and MC.

b) The 8 VMT mileage classes were aggregated into the same five vehicle types (across all roadway types) and converted to fractions by normalizing against the total Jefferson County VMT.

c) The ratio of the "desired" VMT fraction (i.e., that provided in the Louisville APCD VMT mix) to the "forecasted" VMT fraction (i.e., that calculated on the basis of the forecasted VMT data) was calculated for each of the five vehicle classes.

d) All forecasted VMT data for Jefferson County were multiplied by the applicable ratio from step c as follows:

new LDGV = old LDGV * LDV ratio
new LDGT1 = old LDGT1 * LDT1 ratio
new LDGT2 = old LDGT2 * LDT2 ratio
new HDGV = old HDGV * HDV ratio
new LDDV = old LDDV * LDV ratio
new LDDT = old LDDT * LDT1 ratio
new HDDV = old HDDV * HDV ratio
new MC = old MC * MC ratio

The total forecasted VMT for Jefferson County was then checked to ensure that it was unchanged.

North Carolina:

North Carolina provided both VMT and VMT mix data by county and roadway type for 2018. Therefore, these data replaced the data developed for North Carolina using HDD rule growth rates in their entirety. Similar data were submitted for 2009. Table 2.3-2 presents the resulting VMT estimates which differ from the "default" HDD rule estimates as follows:

Table 2.3-2 VMT and HDD Rule Estimates for North Carolina (million miles per year)

North Carolina		
2002	106,795	
	State Data	**HDD Data**
2009	123,396	124,626
2018	129,552	146,989

As indicated, there are substantial reductions in the State-provided forecast data relative to that derived from the HDD rule. The growth rates for both 2009 and 2018 are only about half that implied by the HDD data (1.15 versus 1.17 for 2009 and 1.21 versus 1.38 for 2018). The resulting growth rates are the lowest in the VISTAS region.

NC did not provide VMT mix data for 2009. Therefore, the VMT mix fractions estimated using the "default" HDD rule growth rates were applied to the State-provided VMT estimates to generate vehicle-specific VMT. Essentially, the default HDD methodology produces VMT estimates at the county-road type-vehicle type level of detail, and these data can be converted into VMT fractions at that same level of detail. Note that these are not HDD VMT fractions, but VMT fractions developed from 2002 NC data using HDD vehicle-specific growth rates. In effect, they are 2002 NC VMT fractions "grown" to 2009.

The default VMT mix fraction was applied to the State-provided VMT data at the county and road type level of detail to generate VMT data at the county-road type-vehicle type level of detail. The one exception was for county 063, road 110, for which no VMT data were included in the HDD rule. For this single county/road combination, State-aggregate VMT mix fractions (using the HDD growth methodology) were applied to the county/road VMT data. The difference between road 110 VMT fractions across all NC counties is minimal, so there is no effective difference in utilizing this more aggregate approach vis-a-vis the more resolved county/road approach.

South Carolina:

South Carolina provided county and roadway type-specific VMT data for several future years. Data for 2018 was included and was used directly. Data for 2009 was not included, but was linearly interpolated from data provided for 2007 and 2010. The data were disaggregated into vehicle type-specific VMT using the VMT mixes developed for South Carolina using the HDD rule VMT growth rates. Table 2.3-3 presents the resulting VMT estimates which differ from the "default" HDD rule estimates as follows:

Table 2.3-3 VMT and HDD Rule Estimates for North Carolina (million miles per year)

South Carolina		
2002	**47,074**	
	State Data	**HDD Data**
2009	55,147	54,543
2018	65,133	63,880

Tennessee:

In general, Tennessee estimates are based on the HDD rule growth rate as described in step two. However, Knox County provided independent VMT estimates for 2018 and these were used in place of the HDD rule-derived estimates. The Knox County estimates were total county VMT data only, so these were disaggregated into roadway and vehicle-type VMT using the distributions developed for Knox County in step two using the HDD rule VMT growth rates. No data for Knox County were provided for 2009, so the estimates derived using the HDD rule growth factors were adjusted by the ratio of "Knox County provided 2018 VMT" to "Knox

County HDD Rule-derived 2018 VMT." Table 2.3-4 presents the resulting VMT estimates which differ from the "default" HDD rule estimates as follows:

Table 2.3-4 VMT and HDD Rule Estimates for Tennessee (million miles per year)

Tennessee		
2002	68,316	
	State Data	**HDD Data**
2009	78,615	78,813
2018	91,417	91,647

Virginia:

Virginia provided county and roadway type-specific annual VMT growth rates and these data were applied to Virginia -provided VMT data for 2002 to estimate VMT in both 2009 and 2018. Virginia provided VMT mix data for 2002, but not 2009 or 2018. Therefore, the estimated VMT data for both 2009 and 2018 were disaggregated into vehicle type-specific VMT using the VMT mixes developed for VA using the HDD rule VMT growth rates. Table 2.3-5 presents the resulting VMT estimates which differ from the "default" HDD rule estimates as follows:

Table 2.3-5 VMT and HDD Rule Estimates for Virginia (million miles per year)

Virginia		
2002	77,472	
	State Data	**HDD Data**
2009	88,419	89,196
2018	104,944	104,164

2.3.3 Development of non-road emission estimates

The sections that follow describe the projection process used to develop 2009 and revised 2018 nonroad projection estimates for sources found in the NONROAD model and those sources estimated outside of the model (locomotives, airplanes and commercial marine vessels).

2.3.3.1 NONROAD model sources

NONROAD model input files were prepared based on those prepared for the 2002 revised base year inventory with appropriate updates for the projection years. In large part the updates for the projection years for NONROAD model sources were to:

1. Revise the emission inventory year in the model to be reflective of the projection year.
2. Revise the fuel sulfur content for diesel powered vehicles.

Item 2 is discussed briefly below.

To correctly account for diesel fuel sulfur content differences, we prepared two sets of input and output files for each year, one set for land-based equipment and one set for marine equipment. The specific diesel fuel sulfur contents modeled are as follows:

Diesel S (ppm)	2002	2009	2018
Land-Based	2500	348	11
Marine-Based	2500	408	56

The NONROAD model was run with both sets of input files and the output file results were then combined to produce a single NONROAD output set.

2.3.3.1.1 Differences between 2009/2018

Other than diesel fuel sulfur content and the year of the projections, there are no differences in the methodology used to estimate emissions from NONROAD model sources.

2.3.3.2 Non-NONROAD model sources

Using the revised 2002 base year emissions inventory for aircraft, locomotives, and commercial marine vessels (CMV) prepared as described earlier in this document, corresponding emission projections for 2009 and 2018 were developed. This section describes the procedures employed in developing those inventories. The information presented is intended to build off of that presented in the section describing the 2002 revised base year inventory.

Table 2.3-6 shows the final 2002 emissions for each State in the VISTAS region for aircraft, locomotives and CMV.

Table 2.3-6. Final 2002 Aircraft, Locomotive, and Non-Recreational Marine Emissions (annual tons)

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	3,787	175	226	87	17	196
	FL	25,431	8,891	2,424	2,375	800	3,658
	GA	6,620	5,372	1,475	1,446	451	443
	KY	2,666	657	179	175	63	263
	MS	1,593	140	44	43	13	96
	NC	6,088	1,548	419	411	148	613
	SC	6,505	515	409	401	88	863
	TN	7,251	2,766	734	719	235	943
	VA	9,763	2,756	1,137	1,115	786	2,529
	WV	1,178	78	25	24	8	66
	Total	70,882	22,899	7,072	6,797	2,607	9,670
Commercial Marine (2280)	AL	1,196	9,218	917	844	3,337	737
	FL	5,888	44,817	1,936	1,781	6,683	1,409
	GA	1,038	7,875	334	307	1,173	246
	KY	6,607	50,267	2,246	2,066	9,608	1,569
	MS	5,688	43,233	1,903	1,751	7,719	1,351
	NC	599	4,547	193	178	690	142
	SC	1,067	8,100	343	316	1,205	253
	TN	3,624	27,555	1,217	1,120	4,974	860
	VA	972	2,775	334	307	359	483
	WV	1,528	11,586	487	448	525	362
	Total	28,207	209,972	9,911	9,118	36,275	7,413
Military Marine (2283)	VA	110	313	25	23	27	48
	Total	110	313	25	23	27	48
Locomotives (2285)	AL	3,490	26,339	592	533	1,446	1,354
	FL	1,006	9,969	247	222	605	404
	GA	2,654	26,733	664	598	1,622	1,059
	KY	2,166	21,811	542	488	1,321	867
	MS	2,302	23,267	578	520	1,429	899
	NC	1,638	16,502	410	369	1,001	654
	SC	1,160	11,690	291	261	710	462
	TN	2,626	25,627	633	570	1,439	1,041
	VA	1,186	11,882	1,529	1,375	3,641	492
	WV	1,311	13,224	329	296	808	517
	Total	19,540	187,044	5,815	5,232	14,022	7,750
Grand Total		118,739	420,228	22,823	21,170	52,931	24,881

Although some of the data utilized was updated, the methodology used to develop the 2009 and 2018 emissions forecasts for aircraft, locomotives, and CMV is identical to that used in the spring of 2004 to develop the preliminary 2018 Base 1 ("On the Books") and 2018 Base 2 ("On the Way") inventories. Briefly, the methodology relies on growth and control factors developed from inventories used in support of recent EPA rulemakings, and consists of the following steps:

(a) Begin with the 2002 revised base year emission estimates for aircraft, locomotive, and CMV as described above (at the State-county-SCC-pollutant level of detail).

(b) Detailed inventory data (both before and after controls) for these same emission sources for 1996, 2010, 2015, and 2020 were obtained from the EPA's Clean Air Interstate Rule (CAIR) Technical Support Document. Using these data, combined growth and control factors for the period 2002-2009 and 2002-2018 were estimated using straight line interpolation between 1996 and 2010 (for 2009) and 2105 and 2020 (for 2018). This is done at the State-county-SCC-pollutant level of detail.

(c) The EPA growth and control data are matched against the 2002 VISTAS revised base year data using State-county-SCC-pollutant as the match key. Ideally, there would be a one-to-one match and the process would end at this point. Unfortunately, actual match results were not always ideal, so additional matching criteria were required. For subsequent reference, this initial (highest resolution) matching criterion is denoted as the "CAIR-Primary" criterion.

(d) A second matching criterion is applied that utilizes a similar, but higher-level SCC (lower resolution) matching approach. For example, SCC 2275020000 (commercial aircraft) in the 2002 revised base year inventory data would be matched with SCC 2275000000 (all aircraft) in the CAIR data. This criterion is applied to records in the 2002 revised base year emissions file that are not matched using the "CAIR-Primary" criterion, and is also performed at the State-county-SCC-pollutant level of detail. For subsequent reference, this is denoted as the "CAIR-Secondary" criterion. At the end of this process, a number of unmatched records continued to remain, so a third level matching criterion was required.

(e) In the third matching step, the most frequently used SCC in the EPA CAIR files for each of the aircraft, locomotive, and commercial marine sectors is averaged at the State level to produce a "default" State and pollutant-specific growth and control factor for the sector. The resulting factor is used as a "default" growth factor for all unmatched county-SCC-pollutant level data in each State. In effect, State-specific growth data are applied to county level data for which an explicit match between the VISTAS 2002 revised base year data and EPA CAIR data could not be developed. The default growth and control SCCs are 2275020000 (commercial aircraft) for the aircraft sector, 2280002000 (commercial marine diesel total) for the CMV sector, and 2285002000 (railroad equipment diesel total) for the locomotive sector. Matches made using this criterion are denoted as “CAIR-Tertiary” matches.

(f) According to EPA documentation, the CAIR baseline emissions include the impacts of the (then proposed) Tier 4 (T4) nonroad diesel rulemaking, which implements a low sulfur fuel requirement that affects both future CMV and locomotive emissions. However, the impacts of this rule were originally intended to be excluded from the initial VISTAS 2018 forecast, which was to include only “on-the-books” controls. (The T4 rule was finalized subsequent to the development of the preliminary 2018 inventory in March of 2004.) Given its final status, T4 impacts have now been moved into the “on the books” inventory for nonroad equipment. In addition, since there are no other proposed rules affecting the nonroad sector between 2002 and 2018, there is no difference between the 2018 “on the books” and 2018 “on the way” inventories for the sector; so that only a single forecast inventory (for each evaluation year) was developed. Nevertheless, since the algorithms developed to produce the VISTAS forecasts were developed when there was a distinction between the “on the books” and “on the way” inventories, the distinct algorithms used to produce the two inventories have been maintained even though the conceptual distinctions have been lost. This approach was taken for two reasons. First, it allowed the previously developed algorithms to be utilized without change. Second, it allowed for separate treatment of the T4 emissions impact which was important as those impacts have changed between the proposed and final T4 rules. Thus, previous EPA inventories that include the proposed T4 impacts would not be accurate. Therefore, the procedural discussion continues to reflect the distinctions between non-T4 and T4 emissions, as these distinctions continue to be intrinsically important to the forecasting process. Therefore, a second set of EPA CAIR files that excluded the Tier 4 diesel impacts was obtained and the same matching exercise described above in steps (b) through (e) was performed using these “No T4” files. It is important to note that the matching exercise described in steps (b) through (e) cannot simply be replaced because the “No T4” files obtained from the EPA include only those SCCs specifically affected by the T4 rule (i.e., diesel CMV and locomotives). So in effect, the matching exercise was augmented (rather than replaced) with an additional three criteria analogous to those described in steps (c) through (e), and these are denoted as the “No T4-Primary,” “No T4-Secondary,” and “No T4-Tertiary” criteria. Because they exclude the impacts of the proposed T4 rule, matches using the “No T4” criteria supersede matches made using the basic CAIR criteria (as described in steps (c) through (e) above).

(g) The CAIR matching criteria were overridden for any record for which States provided local growth data. Only North Carolina provided these forecasts, as that State has provided specific growth factors for airport emissions in four counties. Because the provided data were based on forecasted changes in landings and takeoffs at major North Carolina airports, the factors were applied only to commercial (SCC 2275020000) and air taxi (SCC 2275060000) emissions. Emissions forecasts for military and general aviation aircraft operations, as well as all aircraft operations in counties other than the four identified in the North Carolina growth factor submission, continued to utilize the growth factors developed according to steps (b) through (f) above. Table 2.3-7 presents the locally generated growth factors applied in North Carolina are as follows:

Table 2.3-7 Locally Generated Growth Factors for North Carolina

FIP	2009 Factor	2018 Factor
37067	0.71	0.84
37081	0.97	0.89
37119	1.15	1.01
37183	0.88	0.81

Note:

Growth factor = Year Emissions/2002 Emissions.
Under CAIR approach, 2009 = 1.16 to 1.17 for all 4 counties.
Under CAIR approach, 2018 = 1.36 to 1.37 for all 4 counties.

(h) Using this approach, each State-county-SCC-pollutant was assigned a combined growth and control factor using the EPA CAIR forecast or locally provided data. The 22,838 data records for aircraft, locomotives, and CMV in the 2002 revised base year emissions file were assigned growth factors in accordance with the following breakdown:

48 records matched State-provided growth factors,

4,179 records matched using the CAIR-Primary criterion,

240 records matched using the CAIR-Secondary criterion,

7,463 records matched using the CAIR-Tertiary criterion,

720 records matched using the No T4-Primary criterion,

3,858 records matched using the No T4-Secondary criterion, and

6,330 records matched using the No T4-Tertiary criterion.

(i) Finally, the impacts of the T4 rule as adopted were applied to the grown "non T4" emission estimates. The actual T4 emission standards do not affect aircraft, locomotive, or CMV directly, but associated diesel fuel sulfur requirements do affect locomotives and CMV. Lower fuel sulfur content affects both SO_2 and PM emissions. Expected fuel sulfur contents were obtained for each evaluation year from the EPA technical support document for the final T4 rule (*Final Regulatory Analysis: Control of Emissions from Nonroad Diesel Engines*, EPA420-R-04-007, May 2004). According to that document, the average diesel fuel sulfur content for locomotives and CMV is expected to be 408 ppmW in 2009 and 56 ppmW in 2018. These compare to expected non-T4 fuel sulfur levels of 2599 ppmW in 2009 and 2336 ppmW in 2018. Table 2.3-8 uses calculated emissions estimates for base and T4 control scenarios to estimate emission reduction impacts.

Table 2.3-8 Estimated Emission Reduction Impacts based on T-4 Rule

				2009	2018
CMV SO_2	=	Non-T4 SO_2	×	0.1569	0.0241
Locomotive SO_2	=	Non-T4 SO_2	×	0.1569	0.0241
CMV PM	=	Non-T4 PM	×	0.8962	0.8762
Locomotive PM	=	Non-T4 PM	×	0.8117	0.7734

However, since the diesel fuel sulfur content assumed for the 2002 VISTAS revised base year inventory, upon which both the 2009 and 2018 inventories were based, is 2500 ppmW, a small adjustment to the emission reduction multipliers calculated from the T4 rule is appropriate since they are measured relative to modestly different sulfur contents (2599 ppmW for 2009 and 2336 ppmW for 2018). Correcting for these modest differences produces the emission reduction impact estimates relative to forecasts based on the VISTAS 2002 inventory shown in Table 2.3-9.

Table 2.3-9 Estimated Emission Reduction Impacts Relative to VISTAS 2002 Base Year Values

				2009	2018
CMV SO_2	=	Non-T4 SO_2	×	0.1632	0.0225
Locomotive SO_2	=	Non-T4 SO_2	×	0.1632	0.0225
CMV PM	=	Non-T4 PM	×	0.9004	0.8685
Locomotive PM	=	Non-T4 PM	×	0.8187	0.7610

These factors were applied directly to the non-T4 emission forecasts to produce the final VISTAS 2009 and 2018 emissions inventories for aircraft, locomotive, and CMV.

The only exception is for Palm Beach County, Florida, where CMV emissions are reported as "all fuels" rather than separately by residual and diesel fuel components. To estimate T4 impacts in Palm Beach County, the ratio of diesel CMV emissions to total CMV emissions in the remainder of Florida was calculated and the T4 impact estimates for Palm Beach County were adjusted to reflect that ratio. Table 2.3-10 shows the calculated diesel CMV ratios.

Table 2.3-10 Diesel CMV Adjustment Ratios for Palm Beach County, FL

GROWTH BASIS	SO_2	PM
2009 (1996, 2020 Growth Basis)	0.2410	0.7861
2009 (1996, 2010, 2015, and 2020 Growth Basis)	0.1279	0.7875
2018 (1996, 2020 Growth Basis)	0.2432	0.7925
2018 (1996, 2010, 2015, and 2020 Growth Basis)	0.2624	0.7918

The differences between the growth bases are discussed in detail below.

Combining these ratios with the T4 impact estimates for diesel engines, as presented above, yields the following impact adjustment factors for Palm Beach County:

Table 2.3-11 Overall Adjustment Factors for Palm Beach County, FL

GROWTH BASIS		
2009 SO_2 (19, 20 Growth Basis)	0.7894	[0.1632×0.2410+(1-0.2410)]
2009 SO_2 (96, 10, 15, and 20 Growth Basis)	0.8930	[0.1632×0.1279+(1-0.1279)]
2018 SO_2 (96, 20 Growth Basis)	0.7623	[0.0225×0.2432+(1-0.2432)]
2018 SO_2 (96, 10, 15, and 20 Growth Basis)	0.7436	[0.0225×0.2624+(1-0.2624)]
2009 PM (19, 20 Growth Basis)	0.9217	[0.9004×0.7861+(1-0.7861)]
2009 PM (96, 10, 15, and 20 Growth Basis)	0.9216	[0.9004×0.7875+(1-0.7875)]
2018 PM (96, 20 Growth Basis)	0.8958	[0.8685×0.7925+(1-0.7925)]
2018 PM (96, 10, 15, and 20 Growth Basis)	0.8959	[0.8685×0.7918+(1-0.7918)]

The differences between the growth bases are discussed in detail below.

Utilizing this approach, emission inventory forecasts for both 2009 and 2018 were developed. As indicated in step (b) above, basic growth factors were developed using EPA CAIR inventory data for 1996, 2010, 2015, and 2020. From these data, equivalent EPA CAIR inventories for 2002 and 2009 were developed through linear interpolation of the 1996 and 2010 inventories, while an equivalent CAIR inventory for 2018 was developed through linear interpolation of the 2015 and 2020 inventories. Growth factors for 2009 and 2018 were then estimated as the ratios of the CAIR 2009 and 2018 inventories to the CAIR 2002 inventory.

During the development of the preliminary 2018 VISTAS inventory in March 2004, this process yielded reasonable results and exhibited no particular systematic concerns. However, when the 2009 inventory was developed, significant concerns related to SO_2 and PM were encountered. Essentially, what was revealed by the 2009 forecast was a series of apparent inconsistencies in the CAIR 2010 and 2015 emission inventories (as compared to the 1996 and 2020 CAIR inventories) that were masked during the construction of the "longer-term" 2018 inventory.

The apparent inconsistencies are best illustrated by looking at the actual data extracted from the CAIR inventory files. Note that although a limited example is being presented, the same general issue applies throughout the CAIR files. For FIP 01001 (Autauga County, Alabama) and SCC 2285002000 (Diesel Rail), the CAIR inventories indicate SO_2 emission estimates a shown in Table 2.3-12.

Table 2.3-12 SO_2 Emissions for Diesel Rail in Autauga County, AL from the CAIR Projections

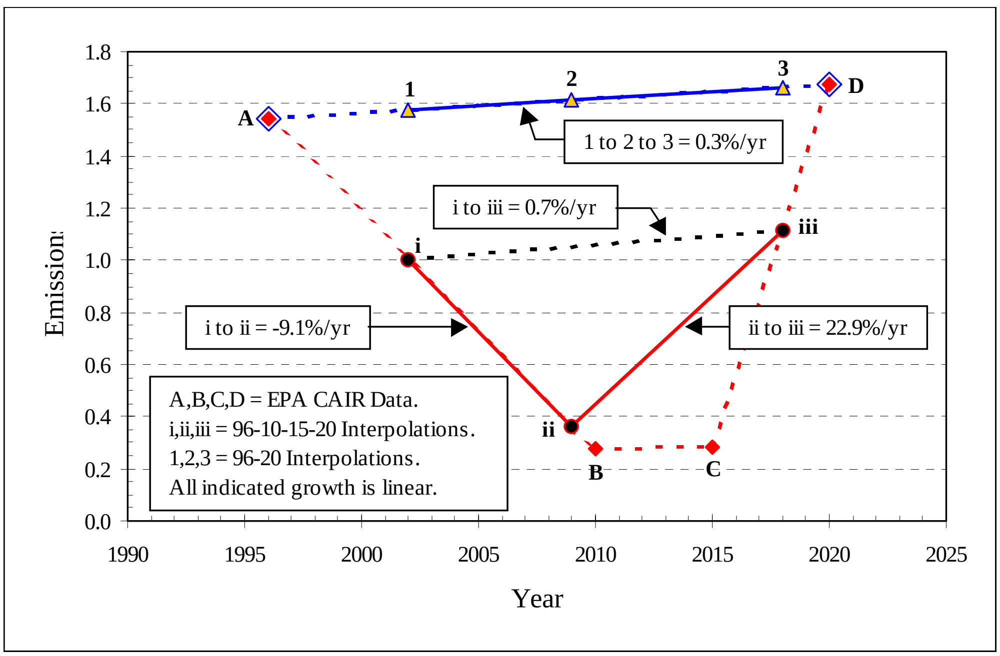
YEAR	TONS
1996:	15.3445
2010:	2.7271
2015:	2.8178
2020:	16.6232

Clearly, there is a major drop in emissions between 1996 and 2010, followed by a major increase in emissions between 2015 and 2020. Several observations regarding these changes are important. First, the CAIR data were reported to exclude the T4 rule, so that the drop in emissions should be related to something other than simply a change in diesel fuel sulfur content. Second, if the T4 rule impacts were "accidentally" included in the estimates, there should be a resultant 90 percent drop in diesel sulfur between 2010 and 2015; so such inclusion is unlikely. Third, the rate of growth between 2015 and 2020 (43 percent *per year* compound or 97 percent *per year* linear) is well beyond any reasonable expectations for rail service; and fuel sulfur content during this period is constant both with and without T4. In short, there appeared to be no rational explanation for the data, yet the same basic relations are observed for thousands of CAIR inventory records.

For the most part, the issue seems to be centered on SO_2 and PM records, which are those records primarily affected by the T4 rule. But, as noted above, there does not seem to be any pattern of consistency that would indicate that either inclusion or exclusion of T4 rule impacts is the underlying cause. Moreover, where they occur, the observed growth extremes generally affect both SO_2 and PM equally, while one would expect PM effects to be buffered if the T4 rule was the underlying cause, since changes in diesel fuel sulfur content will only affect a fraction of PM (i.e., sulfate), while directly reducing SO_2.

The data presented in Figure 2.3-1 illustrates what this meant to the VISTAS forecasting process. Figure 2.3-1 depicts the same data presented above for Autauga County, Alabama, but normalized so that the interpolated 2002 CAIR emissions estimate was equal to unity. The "raw" CAIR data is depicted by the markers labeled A, B, C, and D. Interpolated data for 2002 and 2009, based on 1996 and 2010 CAIR data, is depicted by the markers labeled i and ii. Interpolated data for 2018, based on 2015 and 2020 CAIR data is depicted by the marker labeled iii. The relationship between marker iii and marker i is exactly the relationship used to construct the preliminary 2018 VISTAS inventory (i.e., a linear growth rate equal to 0.7 percent per year). Thus, it is easy to see that although there is a major "dip and rise" between 2002 and 2018, it is essentially masked unless data for intervening years are examined. Since no intervening year was examined for the preliminary 2018 inventory, the "dip and rise" was not discovered. However, upon the development of the 2009 inventory forecast, the issue became obvious, as the marker labeled ii readily illustrates. In effect, the 2009 inventory reflected very low negative "growth rates" for some SCCs and pollutants relative to the 2002 inventory, while the 2018 inventory reflected very high and positive growth rates for those same SCCs and pollutants. In effect, the path between 2002 and 2018 that previously looked like the dotted line connecting markers i and iii, now looks like the solid line connecting markers i, ii, and iii. For reference purposes, this path is hereafter referred to as the 1996, 2010, 2015, and 2020 growth basis, since all interpolated data is based on CAIR data for those four years.

Figure 2.3-1. Impacts of the Apparent CAIR Inventory Discrepancy



In light of the apparent discrepancies inherent in the 1996, 2010, 2015, and 2020 growth basis data and the inconsistencies its use would impart into the 2009 and 2018 VISTAS inventories, a secondary forecasting method was developed. This second method relies on the apparent consistency between the 1996 and 2020 non-T4 CAIR inventories, interpolating equivalent 2002, 2009, and 2018 inventories solely from these two inventories. In effect, the CAIR inventories for 2010 and 2015 are ignored. In Figure 2.3-1, this secondary approach is depicted by the data points that lie along the lines connecting markers A and D. Markers A and D represent the 1996 and 2020 CAIR inventories, and the markers labeled 1, 2, and 3 represent the interpolated 2002, 2009, and 2018 CAIR equivalent inventories. The growth rate between 2009 and 2002 is then equal to the ratio of the 2009 and 2002 CAIR inventories, while that between 2018 and 2002 is equal to the ratio of the 2018 and 2002 CAIR inventories. For the example data, the resulting linear growth estimate is 0.3 percent per year. For reference purposes, this path is hereafter referred to as the 1996-2020 growth basis, since all interpolated data is based on CAIR data for only those two years.

It is perhaps worth noting that the only elements of Figure 2.3-1 that have any bearing on the VISTAS inventories are the growth rates. The absolute CAIR data are of importance only in determining those rates, as all VISTAS inventories were developed on the basis of the VISTAS 2002 revised base year inventory, not any of the CAIR inventories. So referring to Figure 2.3-1, the two growth options are summarized in Table 2.3-13.

Table 2.3-13 Growth Options based on CAIR Data

GROWTH BASIS	PERCENT PER YEAR
1996, 2010, 2015, 2020 Growth Basis:	-9.1% per year (linear) between 2002 and 2009
1996-2020 Growth Basis:	+0.3% per year (linear) between 2002 and 2009
1996, 2010, 2015, 2020 Growth Basis:	+22.9% per year (linear) between 2009 and 2018
1996-2020 Growth Basis:	+0.3% per year (linear) between 2009 and 2018
1996, 2010, 2015, 2020 Growth Basis:	+0.7% per year (linear) between 2002 and 2018
1996-2020 Growth Basis:	+0.3% per year (linear) between 2002 and 2018

Of course, these specific rates are applicable only to the example case (i.e., diesel rail SO_2 in Autauga County, Alabama), but there are thousands of additional CAIR records that are virtually identical from a growth viewpoint.

While MACTEC developed forecast inventories for aircraft, locomotives, and CMV for 2009 and 2018 using both growth methods in the end the decision was made to utilize the 1996-2020 growth basis since it seemed to provide more reasonable growth rates for 2009. Tables 2.3-2 and 2.3-3 present a summary of each inventory, while Tables 2.3-4 and 2.3-5 present the associated change in emissions for each forecast inventory relative to the final 2002 VISTAS inventory. The larger reduction in CMV SO_2 emissions in 2009 and 2018 (relative to 2002) for Virginia and West Virginia is notable relative to the other VISTAS States, but this has been checked and is attributable to a high diesel contribution to total CMV SO_2 in the 2002 inventories for these two States.

Figures 2.3-2 through 2.3-13 graphically depict the relationships between the various inventories. There are two figures for each pollutant, the first of which presents a comparison of total VISTAS regional emission estimates for aircraft, locomotives, and CMV, and the second of which presents total VISTAS region emission estimates for locomotives only. This two figure approach is intended to provide a more robust illustration of the differences between the various inventories, as some of the differences are less distinct when viewed through overall aggregate emissions totals. All of the figures include the following emissions estimates:

- The 2002 revised base year VISTAS emissions inventory (labeled as “2002”),
- The 2002 initial base year VISTAS emissions inventory (labeled as “2002 Prelim”),
- The final 2009 VISTAS emissions inventory as developed using growth rates derived from 1996 and 2020 EPA CAIR data (labeled as “2009”),
- The revised 2018 VISTAS emissions inventory as developed using growth rates derived from 1996 and 2020 EPA CAIR data (labeled as “2018”), and
- The preliminary 2018 VISTAS emissions inventory estimates as developed in the spring of 2004 using growth rates derived from 1996, 2010, 2015, and 2020 EPA CAIR data (labeled as “2018 Prelim”).

All 12 figures generally illustrate a reduction in emissions estimates between the 2002 emission estimates published in February 2004 and the revised 2002 base year emission estimates. This reduction generally results from emission updates reflected in State CERR submittals, although the major differences in aggregate PM emission estimates are driven to a greater extent by modifications in the methodology used to estimate aircraft PM in the revised 2002 base year inventory.

Table 2.3-2. 2009 Aircraft, Locomotive, and Non-Recreational Marine Emissions (annual tons) -- Based on Growth Using 1996 and 2020 EPA Inventories

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	4,178	202	278	102	19	217
	FL	29,258	10,316	2,812	2,756	928	4,235
	GA	7,635	6,233	1,712	1,678	523	512
	KY	3,075	762	207	203	73	304
	MS	1,765	162	51	50	16	108
	NC	6,551	1,601	436	427	153	644
	SC	7,372	559	446	437	98	975
	TN	8,020	3,096	824	807	268	1,050
	VA	10,994	3,094	1,239	1,214	907	2,892
	WV	1,312	91	28	28	9	74
	Total	**80,159**	**26,116**	**8,033**	**7,704**	**2,993**	**11,011**
Commercial Marine (2280)	AL	1,280	8,888	872	802	2,753	768
	FL	6,236	43,198	1,838	1,691	5,864	1,467
	GA	1,097	7,599	317	291	974	256
	KY	7,087	48,039	2,158	1,985	8,350	1,649
	MS	6,074	41,437	1,821	1,676	6,587	1,415
	NC	634	4,386	184	169	584	148
	SC	1,133	7,796	326	300	1,012	264
	TN	3,887	26,333	1,168	1,074	4,512	904
	VA	1,042	2,662	312	286	61	506
	WV	1,638	11,073	455	419	89	381
	Total	**30,109**	**201,412**	**9,450**	**8,693**	**30,786**	**7,759**
Military Marine (2283)	VA	118	299	23	21	5	50
	Total	**118**	**299**	**23**	**21**	**5**	**50**
Locomotives (2285)	AL	3,648	23,529	452	406	242	1,279
	FL	1,052	8,905	189	170	101	382
	GA	2,769	24,398	507	456	271	1,003
	KY	2,264	19,597	415	374	221	819
	MS	2,406	20,785	441	397	239	849
	NC	1,712	14,741	313	282	167	618
	SC	1,213	10,443	222	200	119	437
	TN	2,745	23,924	483	435	240	984
	VA	1,236	11,134	1,167	1,050	608	467
	WV	1,369	12,177	251	226	135	489
	Total	**20,412**	**169,635**	**4,440**	**3,995**	**2,343**	**7,328**
Grand Total		**130,798**	**397,462**	**21,946**	**20,413**	**36,126**	**26,148**

Table 2.3-3. 2018 Aircraft, Locomotive, and Non-Recreational Marine Emissions (annual tons) -- Based on Growth Using 1996 and 2020 EPA Inventories

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	4,681	236	345	122	23	245
	FL	34,178	12,147	3,312	3,246	1,093	4,976
	GA	8,939	7,340	2,016	1,976	616	601
	KY	3,602	898	244	239	86	357
	MS	1,986	190	60	58	18	122
	NC	6,728	1,454	400	392	139	615
	SC	8,487	616	493	484	112	1,119
	TN	9,009	3,519	939	921	309	1,187
	VA	12,578	3,528	1,370	1,342	1,063	3,358
	WV	1,484	106	33	33	10	85
	Total	**91,670**	**30,035**	**9,213**	**8,814**	**3,468**	**12,666**
Commercial Marine (2280)	AL	1,388	8,464	880	809	2,715	809
	FL	6,684	41,117	1,853	1,705	6,248	1,543
	GA	1,174	7,246	319	293	976	269
	KY	7,703	45,174	2,199	2,023	8,383	1,752
	MS	6,571	39,129	1,850	1,702	6,556	1,498
	NC	679	4,179	185	170	596	155
	SC	1,217	7,406	329	303	1,027	278
	TN	4,225	24,763	1,190	1,095	4,808	960
	VA	1,133	2,517	314	289	9	537
	WV	1,781	10,412	459	422	13	404
	Total	**32,554**	**190,407**	**9,578**	**8,811**	**31,330**	**8,205**
Military Marine (2283)	VA	128	282	23	21	1	53
	Total	**128**	**282**	**23**	**21**	**1**	**53**
Locomotives (2285)	AL	3,850	19,917	381	343	34	1,183
	FL	1,110	7,538	159	143	14	353
	GA	2,917	21,395	427	385	38	932
	KY	2,389	16,751	352	317	31	757
	MS	2,540	17,594	372	335	34	785
	NC	1,807	12,478	264	237	24	571
	SC	1,280	8,840	187	168	17	404
	TN	2,897	21,735	407	367	34	910
	VA	1,300	10,173	983	885	86	436
	WV	1,444	10,831	212	190	19	453
	Total	**21,534**	**147,252**	**3,744**	**3,368**	**333**	**6,785**
Grand Total		**145,885**	**367,975**	**22,557**	**21,015**	**35,132**	**27,709**

Table 2.3-4. Change in 2009 Emissions (Based on Growth Using 1996 and 2020 EPA Inventories) from Revised 2002 Base Year Emissions

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	+10%	+15%	+23%	+18%	+16%	+11%
	FL	+15%	+16%	+16%	+16%	+16%	+16%
	GA	+15%	+16%	+16%	+16%	+16%	+16%
	KY	+15%	+16%	+16%	+16%	+16%	+16%
	MS	+11%	+16%	+15%	+15%	+16%	+12%
	NC	+8%	+3%	+4%	+4%	+3%	+5%
	SC	+13%	+9%	+9%	+9%	+12%	+13%
	TN	+11%	+12%	+12%	+12%	+14%	+11%
	VA	+13%	+12%	+9%	+9%	+15%	+14%
	WV	+11%	+16%	+15%	+15%	+16%	+12%
	Total	**+13%**	**+14%**	**+14%**	**+13%**	**+15%**	**+14%**
Commercial Marine (2280)	AL	+7%	-4%	-5%	-5%	-18%	+4%
	FL	+6%	-4%	-5%	-5%	-12%	+4%
	GA	+6%	-3%	-5%	-5%	-17%	+4%
	KY	+7%	-4%	-4%	-4%	-13%	+5%
	MS	+7%	-4%	-4%	-4%	-15%	+5%
	NC	+6%	-4%	-5%	-5%	-15%	+4%
	SC	+6%	-4%	-5%	-5%	-16%	+4%
	TN	+7%	-4%	-4%	-4%	-9%	+5%
	VA	+7%	-4%	-7%	-7%	-83%	+5%
	WV	+7%	-4%	-7%	-7%	-83%	+5%
	Total	**+7%**	**-4%**	**-5%**	**-5%**	**-15%**	**+5%**
Military Marine (2283)	VA	+7%	-4%	-7%	-7%	-83%	+5%
	Total	**+7%**	**-4%**	**-7%**	**-7%**	**-83%**	**+5%**
Locomotives (2285)	AL	+5%	-11%	-24%	-24%	-83%	-6%
	FL	+5%	-11%	-24%	-24%	-83%	-6%
	GA	+4%	-9%	-24%	-24%	-83%	-5%
	KY	+5%	-10%	-23%	-23%	-83%	-6%
	MS	+5%	-11%	-24%	-24%	-83%	-6%
	NC	+5%	-11%	-24%	-24%	-83%	-6%
	SC	+5%	-11%	-24%	-24%	-83%	-6%
	TN	+5%	-7%	-24%	-24%	-83%	-6%
	VA	+4%	-6%	-24%	-24%	-83%	-5%
	WV	+4%	-8%	-24%	-24%	-83%	-5%
	Total	**+4%**	**-9%**	**-24%**	**-24%**	**-83%**	**-5%**
Grand Total		**+10%**	**-5%**	**-4%**	**-4%**	**-32%**	**+5%**

Table 2.3-5. Change in 2018 Emissions (Based on Growth Using 1996 and 2020 EPA Inventories) from Revised 2002 Base Year Emissions

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	+24%	+35%	+53%	+41%	+36%	+25%
	FL	+34%	+37%	+37%	+37%	+37%	+36%
	GA	+35%	+37%	+37%	+37%	+37%	+36%
	KY	+35%	+37%	+37%	+37%	+37%	+36%
	MS	+25%	+36%	+35%	+35%	+36%	+27%
	NC	+10%	-6%	-5%	-5%	-6%	0%
	SC	+30%	+20%	+21%	+21%	+27%	+30%
	TN	+24%	+27%	+28%	+28%	+31%	+26%
	VA	+29%	+28%	+20%	+20%	+35%	+33%
	WV	+26%	+36%	+35%	+35%	+36%	+28%
	Total	**+29%**	**+31%**	**+30%**	**+30%**	**+33%**	**+31%**
Commercial Marine (2280)	AL	+16%	-8%	-4%	-4%	-19%	+10%
	FL	+14%	-8%	-4%	-4%	-7%	+9%
	GA	+13%	-8%	-5%	-5%	-17%	+9%
	KY	+17%	-10%	-2%	-2%	-13%	+12%
	MS	+16%	-9%	-3%	-3%	-15%	+11%
	NC	+13%	-8%	-4%	-4%	-14%	+9%
	SC	+14%	-9%	-4%	-4%	-15%	+10%
	TN	+17%	-10%	-2%	-2%	-3%	+12%
	VA	+17%	-9%	-6%	-6%	-98%	+11%
	WV	+17%	-10%	-6%	-6%	-98%	+12%
	Total	**+15%**	**-9%**	**-3%**	**-3%**	**-14%**	**+11%**
Military Marine (2283)	VA	+17%	-10%	-6%	-6%	-98%	+12%
	Total	**+17%**	**-10%**	**-6%**	**-6%**	**-98%**	**+12%**
Locomotives (2285)	AL	+10%	-24%	-36%	-36%	-98%	-13%
	FL	+10%	-24%	-36%	-36%	-98%	-13%
	GA	+10%	-20%	-36%	-36%	-98%	-12%
	KY	+10%	-23%	-35%	-35%	-98%	-13%
	MS	+10%	-24%	-36%	-36%	-98%	-13%
	NC	+10%	-24%	-36%	-36%	-98%	-13%
	SC	+10%	-24%	-36%	-36%	-98%	-13%
	TN	+10%	-15%	-36%	-36%	-98%	-13%
	VA	+10%	-14%	-36%	-36%	-98%	-11%
	WV	+10%	-18%	-36%	-36%	-98%	-12%
	Total	**+10%**	**-21%**	**-36%**	**-36%**	**-98%**	**-12%**
Grand Total		**+23%**	**-12%**	**-1%**	**-1%**	**-34%**	**+11%**

Figure 2.3-2. Total Aircraft, Locomotive, and CMV CO Emissions

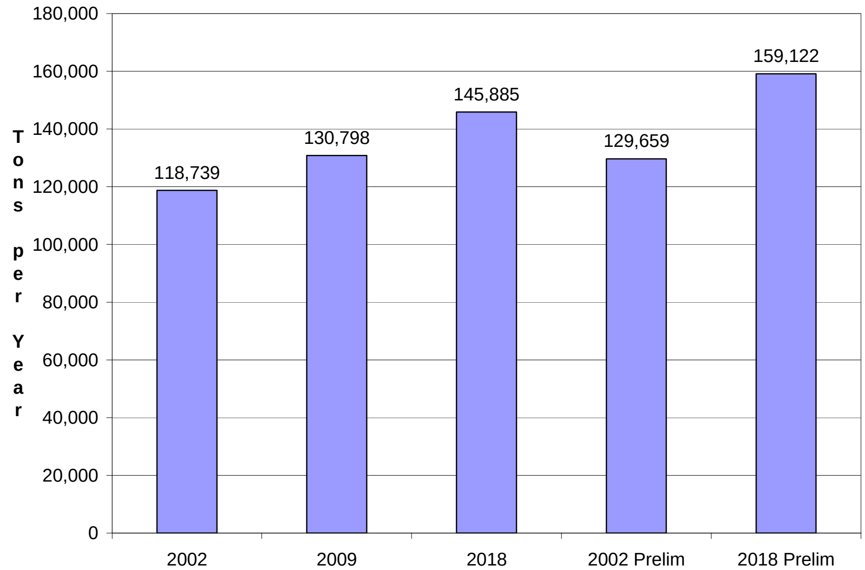


Figure 2.3-3. Locomotive CO Emissions

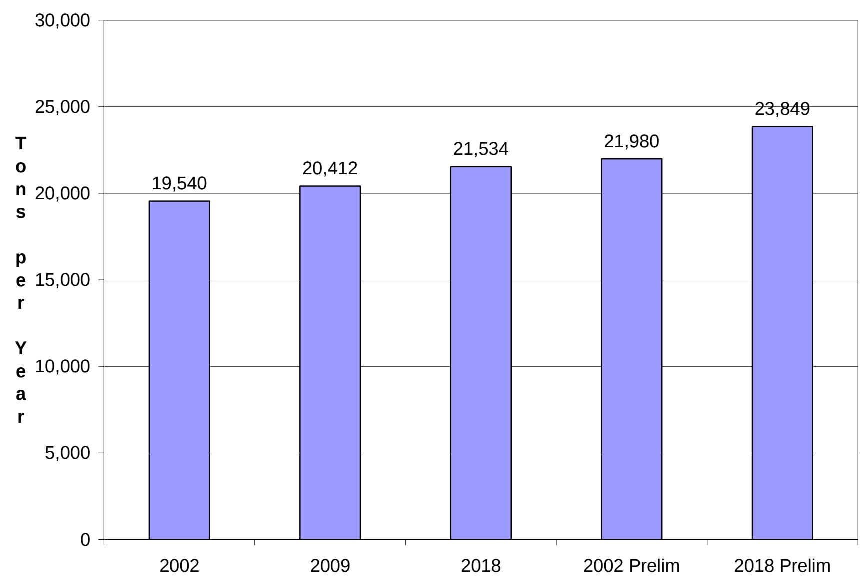


Figure 2.3-4. Total Aircraft, Locomotive, and CMV NO_x Emissions

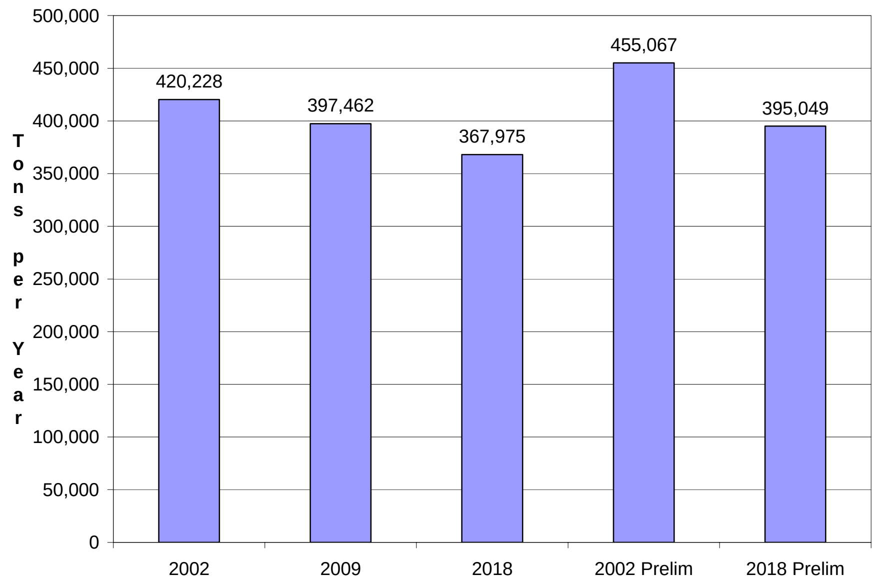


Figure 2.3-5. Locomotive NO_x Emissions

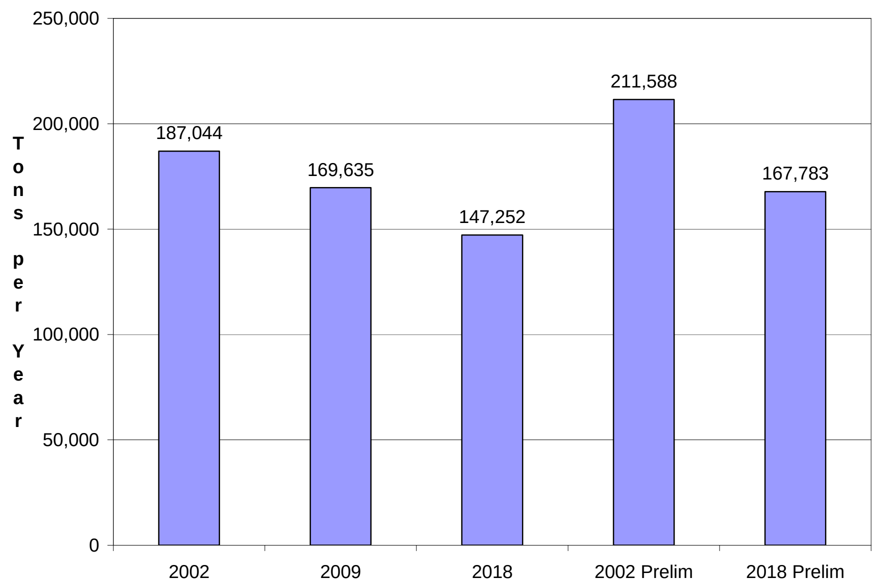


Figure 2.3-6. Total Aircraft, Locomotive, and CMV PM_{10} Emissions

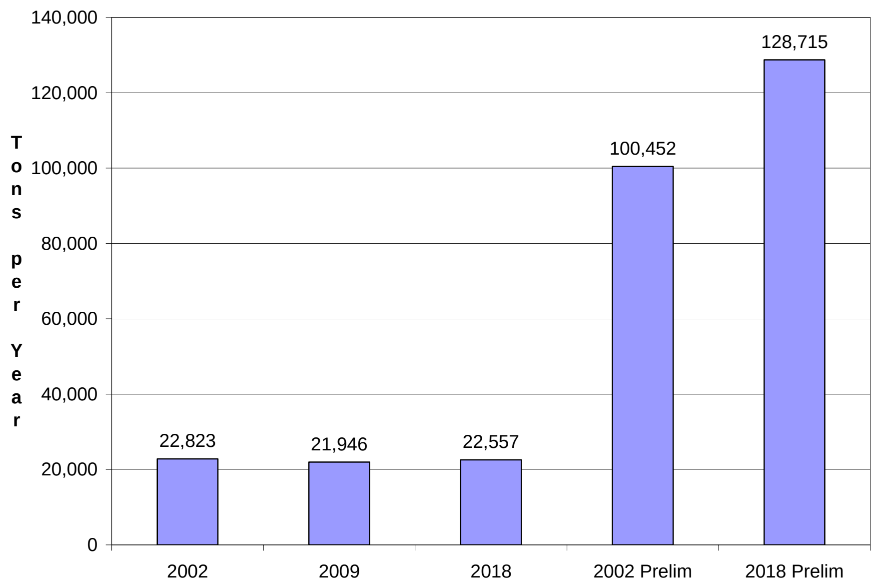


Figure 2.3-7. Locomotive PM_{10} Emissions

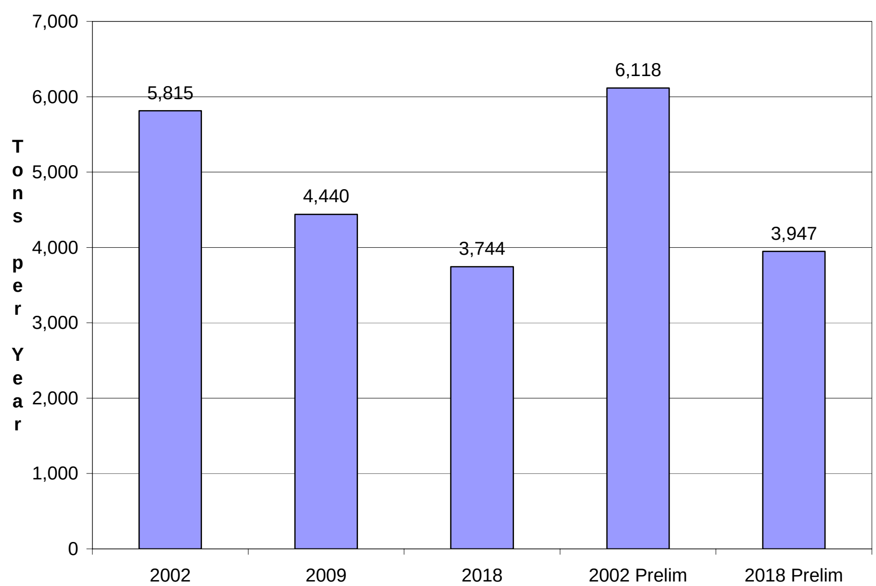


Figure 2.3-8. Total Aircraft, Locomotive, and CMV $PM_{2.5}$ Emissions

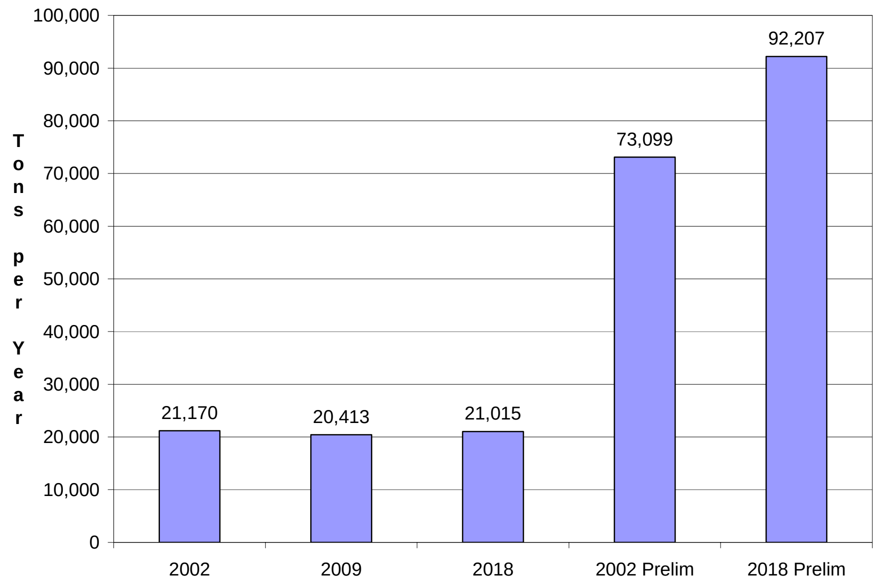


Figure 2.3-9. Locomotive $PM_{2.5}$ Emissions

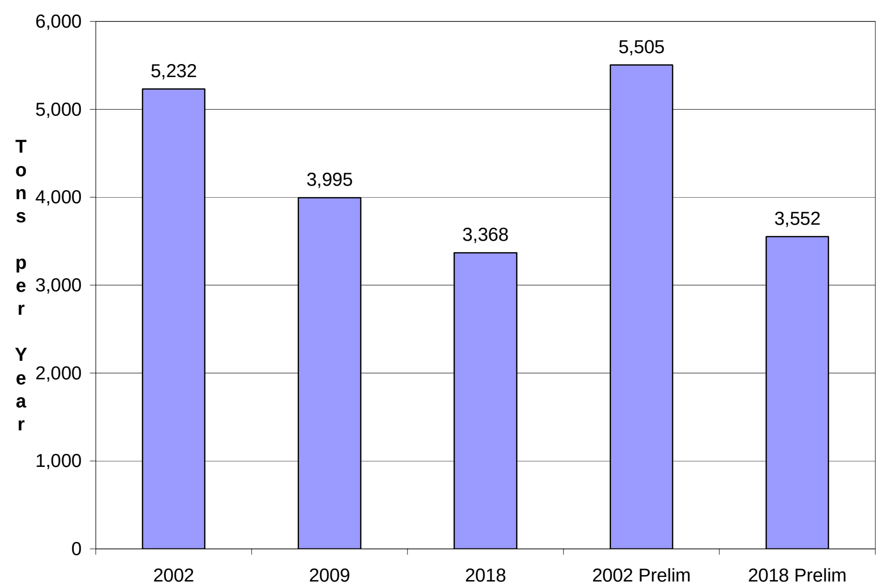


Figure 2.3-10. Total Aircraft, Locomotive, and CMV SO_2 Emissions

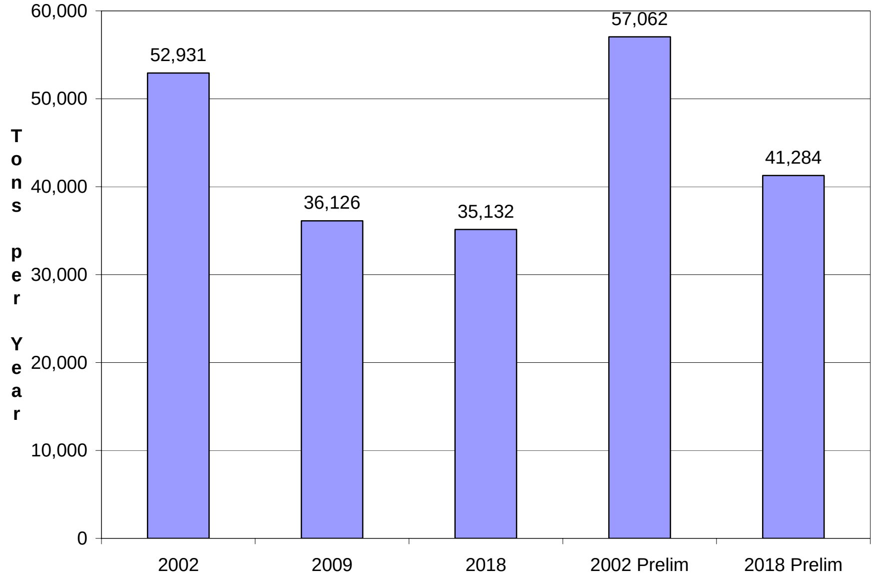


Figure 2.3-11. Locomotive SO_2 Emissions

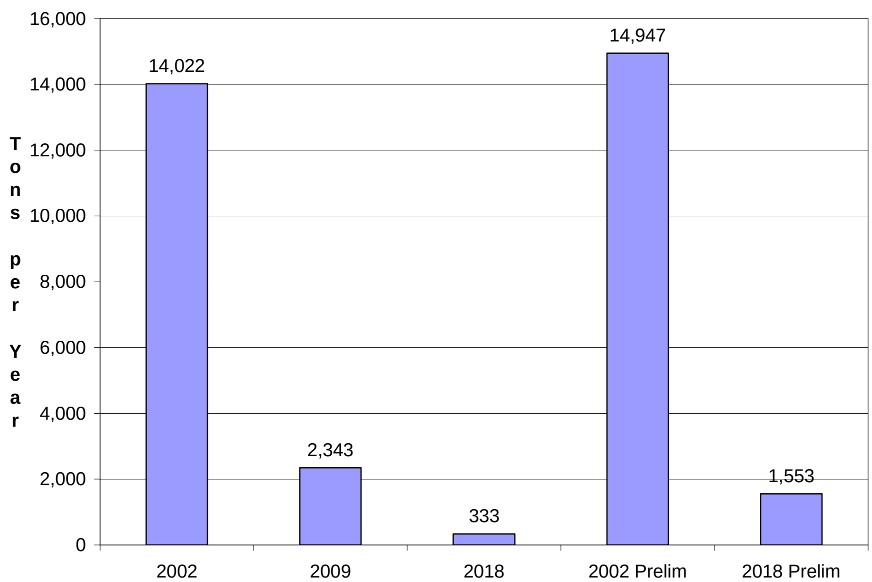


Figure 2.3-12. Total Aircraft, Locomotive, and CMV VOC Emissions

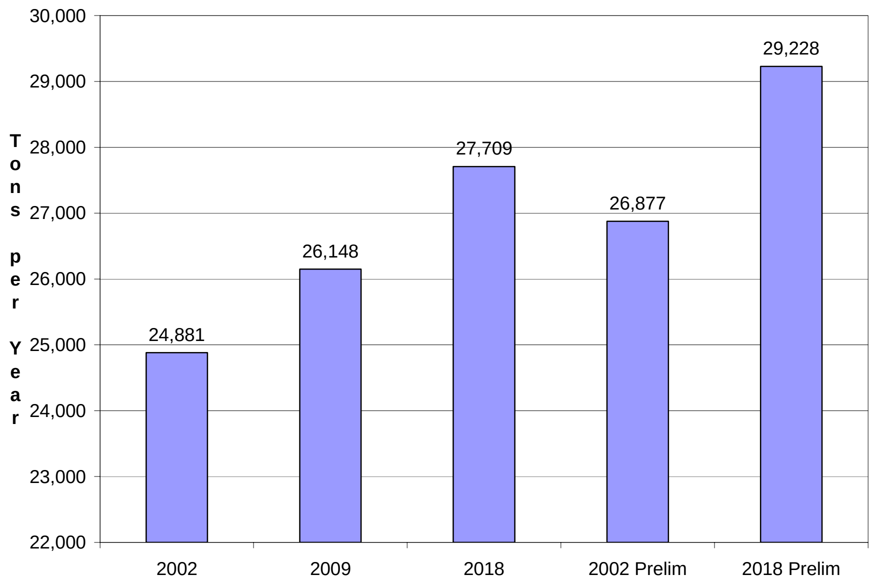
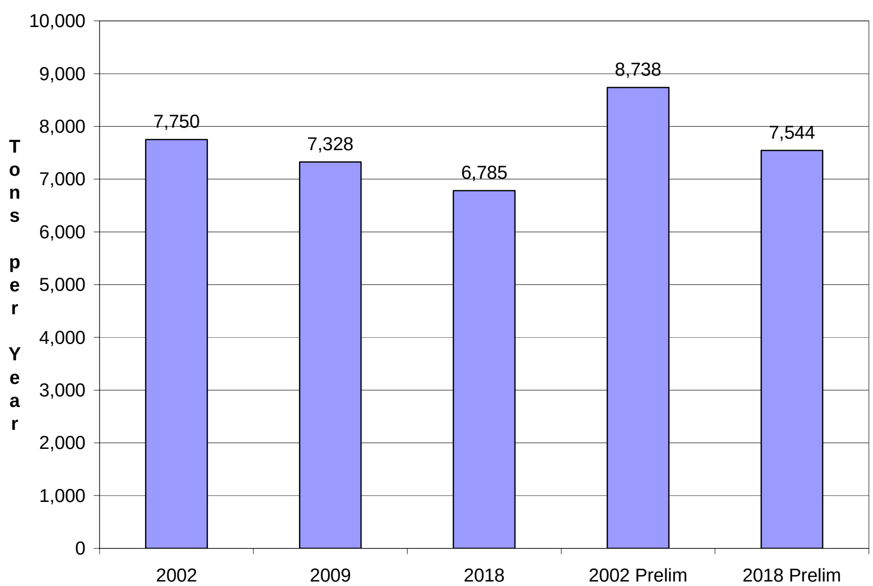


Figure 2.3-13. Locomotive VOC Emissions



2.3.3.3 Differences between 2009/2018

Methodologically, there was no difference in the way that 2009 and 2018 emissions were calculated for mobile sources. The actual value of the growth factors were different for each type of mobile source considered, but the calculation methods were identical.

2.3.4 Quality Assurance steps

Throughout the inventory development process, quality assurance steps were performed to ensure that no double counting of emissions occurred, to ensure that a full and complete inventory was developed for VISTAS, and to make sure that projection calculations were working correctly. Quality assurance was an important component to the inventory development process and MACTEC performed the following QA steps on mobile source components of the 2009 and revised 2018 projection inventories:

1. All final files (NONROAD only) were run through EPA's Format and Content checking software. Input data files for MOBILE and VMT growth estimates were reviewed by the corresponding SIWG and by the VISTAS Emission Inventory Technical Advisor.

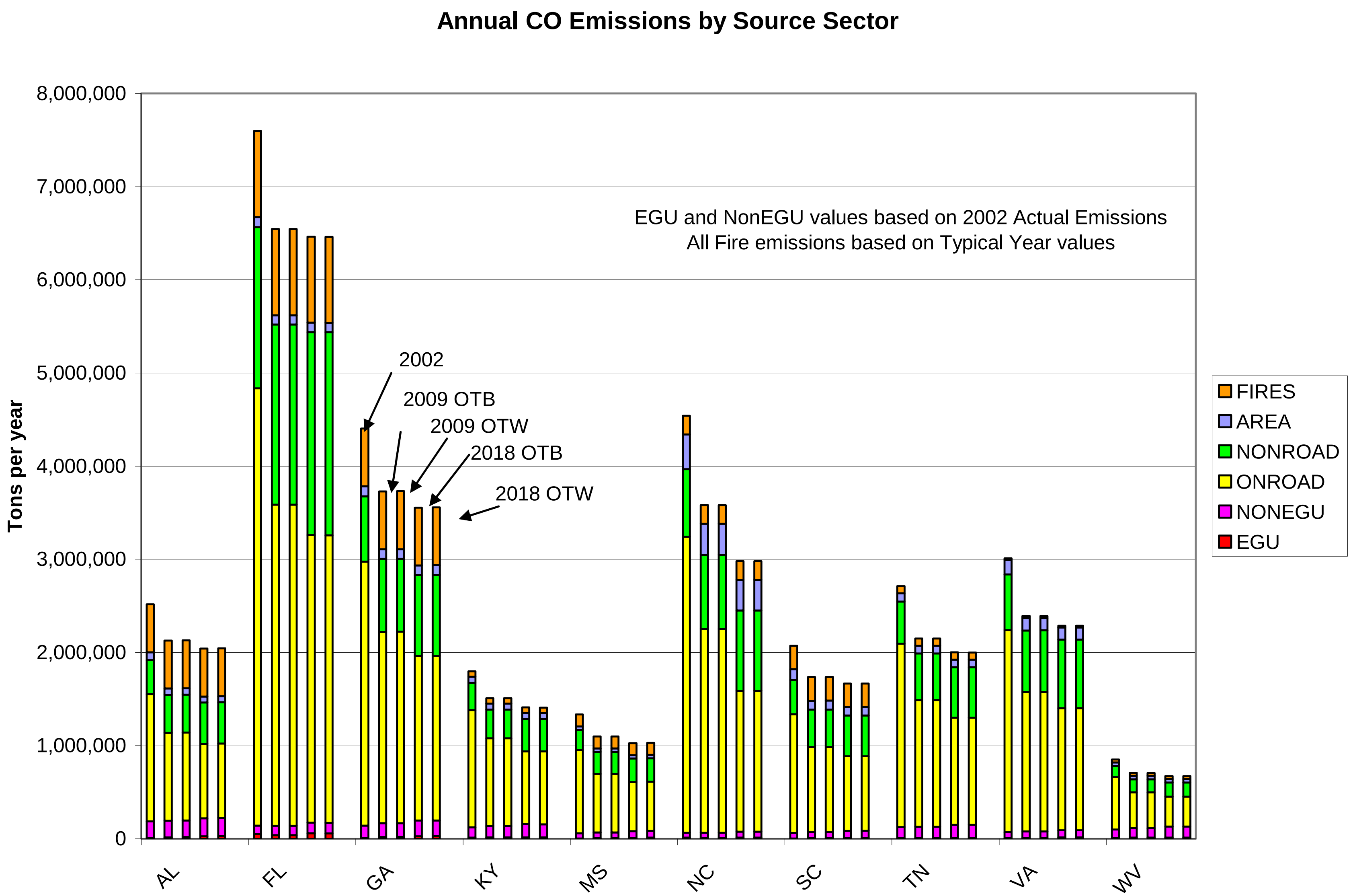
2. SCC level emission summaries were prepared and evaluated to ensure that emissions were consistent and that there were no missing sources (NONROAD only).

3. Tier comparisons (by pollutant) were developed between the revised 2002 base year inventory and the 2009 and 2018 projection inventories (NONROAD only)

4. Data product summaries were provided to both the VISTAS Emission Inventory Technical Advisor and to the SIWG representatives for review and comment. Changes based on these comments were implemented in the files.

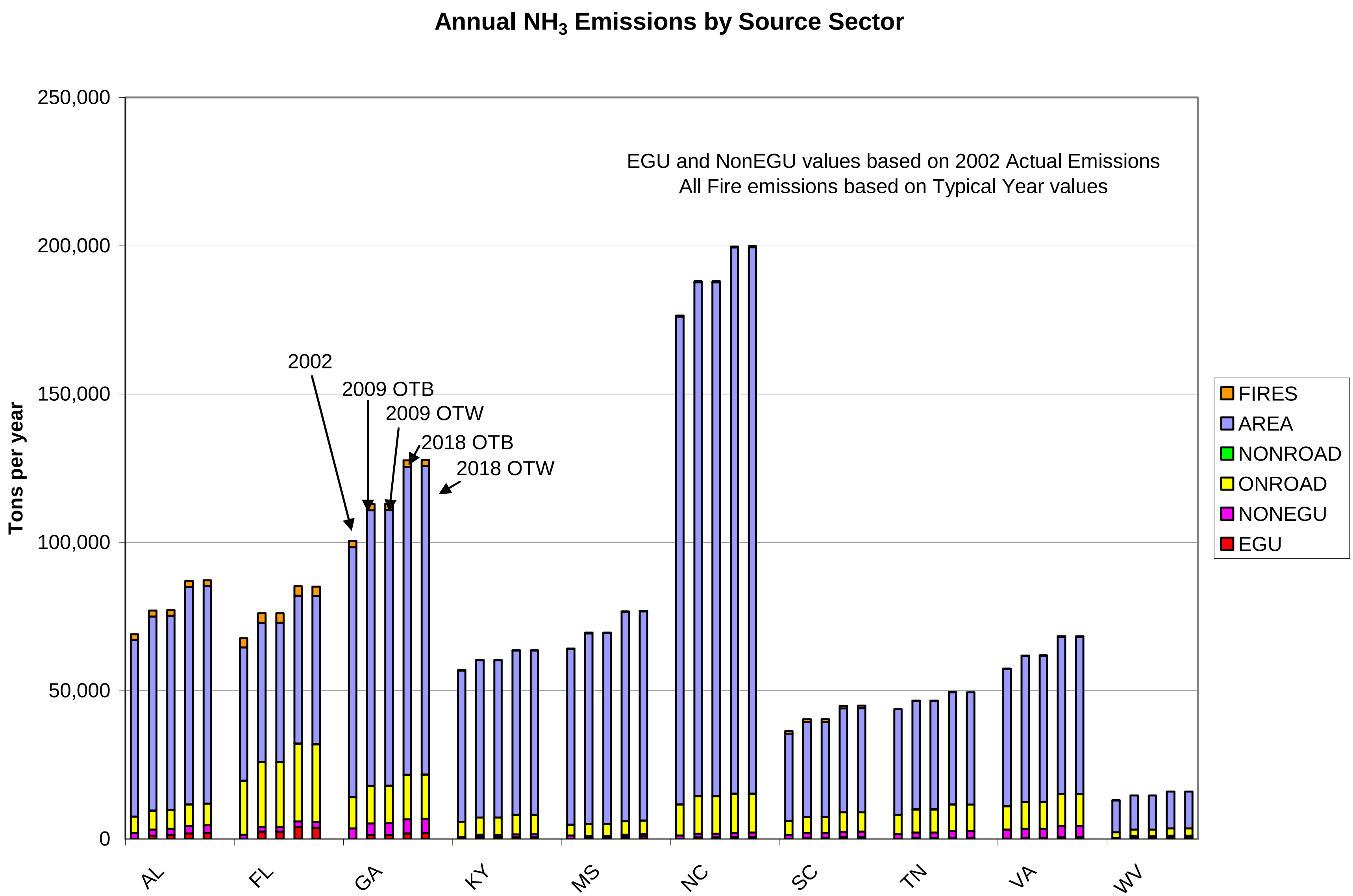
5. Version numbering was used for all inventory files developed. The version numbering process used a decimal system to track major and minor changes. For example, a major change would result in a version going from 1.0 to 2.0. A minor change would cause a version number to go from 1.0 to 1.1. Minor changes resulting from largely editorial changes would result in a change from 1.00 to 1.01.

Appendix A: State Emission Totals by Pollutant and Sector


Annual CO Emissions by Source Sector
Tons per year
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
EGU and NonEGU values based on 2002 Actual Emissions
All Fire emissions based on Typical Year values
2002
2009 OTB
2009 OTW
2018 OTB
2018 OTW
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV
FIRES
AREA
NONROAD
ONROAD
NONEGU
EGU

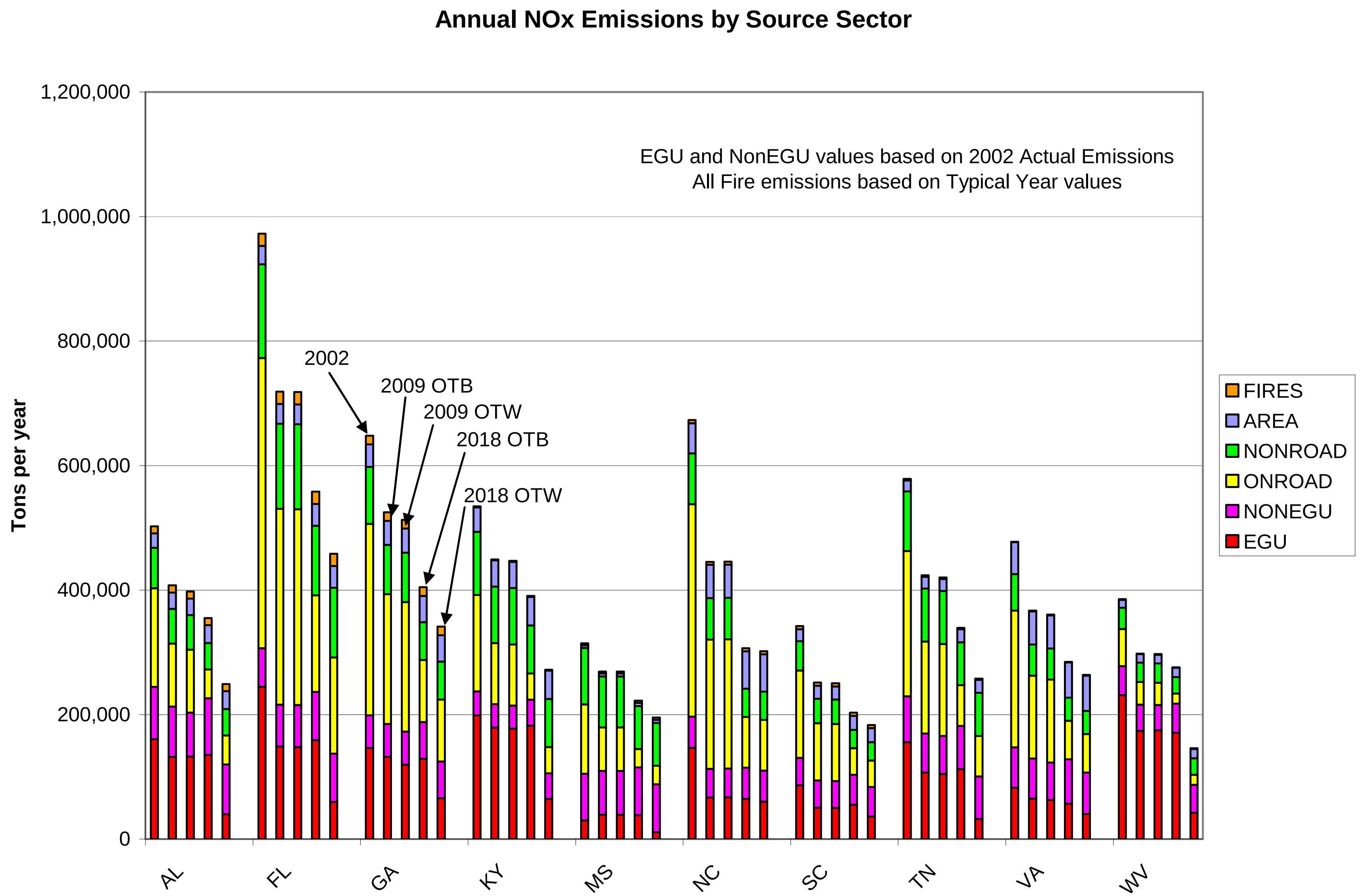
Annual CO Emissions by Source Sector

Name	EGU	NONEGU	ONROAD	NONROAD	AREA	FIRES	YEAR	Basis
	11,243	174,306	1,366,056	367,038	83,958	514,120	2002	OTB - Actual 2002
	16,494	177,145	942,793	408,424	68,882	514,120	2009	OTB - Actual 2002
AL	19,205	177,145	942,793	408,424	68,882	514,120	2009	OTW - Actual 2002
	26,600	194,801	797,966	443,100	63,773	514,120	2018	OTB - Actual 2002
	29,893	194,801	797,966	443,100	63,773	514,120	2018	OTW - Actual 2002
	51,278	89,970	4,693,893	1,731,519	105,849	923,310	2002	OTB - Actual 2002
	40,642	98,325	3,446,095	1,934,550	101,356	923,310	2009	OTB - Actual 2002
FL	40,641	98,325	3,446,095	1,934,550	101,356	923,310	2009	OTW - Actual 2002
	59,793	113,923	3,086,330	2,179,296	100,952	923,310	2018	OTB - Actual 2002
	57,759	113,923	3,086,330	2,179,296	100,952	923,310	2018	OTW - Actual 2002
	9,248	131,413	2,833,468	700,427	107,889	620,342	2002	OTB - Actual 2002
	19,170	147,835	2,053,694	783,990	103,579	620,342	2009	OTB - Actual 2002
GA	20,024	147,835	2,053,694	783,990	103,579	620,342	2009	OTW - Actual 2002
	27,152	169,156	1,765,020	868,018	105,059	620,342	2018	OTB - Actual 2002
	28,895	169,156	1,765,020	868,018	105,059	620,342	2018	OTW - Actual 2002
	12,374	110,181	1,260,682	289,967	66,752	56,686	2002	OTB - Actual 2002
	15,273	121,981	942,350	306,884	64,806	56,686	2009	OTB - Actual 2002
KY	15,119	121,981	942,350	306,884	64,806	56,686	2009	OTW - Actual 2002
	16,974	139,395	782,423	349,285	65,297	56,686	2018	OTB - Actual 2002
	14,954	139,395	782,423	349,285	65,297	56,686	2018	OTW - Actual 2002
	2,714	57,158	894,639	213,779	37,905	128,471	2002	OTB - Actual 2002
	6,714	60,709	628,151	237,297	37,161	128,471	2009	OTB - Actual 2002
MS	6,954	60,709	628,151	237,297	37,161	128,471	2009	OTW - Actual 2002
	10,553	70,454	528,898	252,658	36,425	128,471	2018	OTB - Actual 2002
	12,928	70,454	528,898	252,658	36,425	128,471	2018	OTW - Actual 2002
	11,922	52,539	3,176,811	725,734	373,585	200,564	2002	OTB - Actual 2002
	11,091	54,791	2,184,901	797,360	332,443	200,564	2009	OTB - Actual 2002
NC	11,170	54,791	2,184,901	797,360	332,443	200,564	2009	OTW - Actual 2002
	13,482	63,699	1,510,848	863,536	327,871	200,564	2018	OTB - Actual 2002
	13,777	63,699	1,510,848	863,536	327,871	200,564	2018	OTW - Actual 2002
	3,699	59,605	1,275,161	367,575	113,714	253,005	2002	OTB - Actual 2002
	6,316	65,612	912,280	402,871	95,826	253,005	2009	OTB - Actual 2002
SC	6,526	65,612	912,280	402,871	95,826	253,005	2009	OTW - Actual 2002
	10,175	75,209	800,619	438,027	89,343	253,005	2018	OTB - Actual 2002
	10,671	75,209	800,619	438,027	89,343	253,005	2018	OTW - Actual 2002
	6,414	119,453	1,967,658	451,480	89,235	78,370	2002	OTB - Actual 2002
	6,750	121,420	1,361,408	500,186	82,196	78,370	2009	OTB - Actual 2002
TN	6,651	121,420	1,361,408	500,186	82,196	78,370	2009	OTW - Actual 2002
	7,074	143,845	1,150,516	540,143	81,242	78,370	2018	OTB - Actual 2002
	6,509	143,845	1,150,516	540,143	81,242	78,370	2018	OTW - Actual 2002
	6,294	64,395	2,170,508	595,311	155,873	19,159	2002	OTB - Actual 2002
	9,811	69,822	1,495,771	661,295	133,738	19,159	2009	OTB - Actual 2002
VA	10,245	69,822	1,495,771	661,295	133,738	19,159	2009	OTW - Actual 2002
	14,788	77,590	1,310,698	734,294	129,037	19,159	2018	OTB - Actual 2002
	14,839	77,590	1,310,698	734,294	129,037	19,159	2018	OTW - Actual 2002
	10,303	89,917	560,717	119,089	39,546	32,656	2002	OTB - Actual 2002
	12,622	100,292	385,994	138,999	37,704	32,656	2009	OTB - Actual 2002
WV	12,328	100,292	385,994	138,999	37,704	32,656	2009	OTW - Actual 2002
	13,064	119,367	319,030	152,932	36,809	32,656	2018	OTB - Actual 2002
	12,992	119,367	319,030	152,932	36,809	32,656	2018	OTW - Actual 2002


Annual NH_3 Emissions by Source Sector
Tons per year
250,000
200,000
150,000
100,000
50,000
0
EGU and NonEGU values based on 2002 Actual Emissions
All Fire emissions based on Typical Year values
2002
2009 OTB
2009 OTW
2018 OTB
2018 OTW
FIRES
AREA
NONROAD
ONROAD
NONEGU
EGU
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV

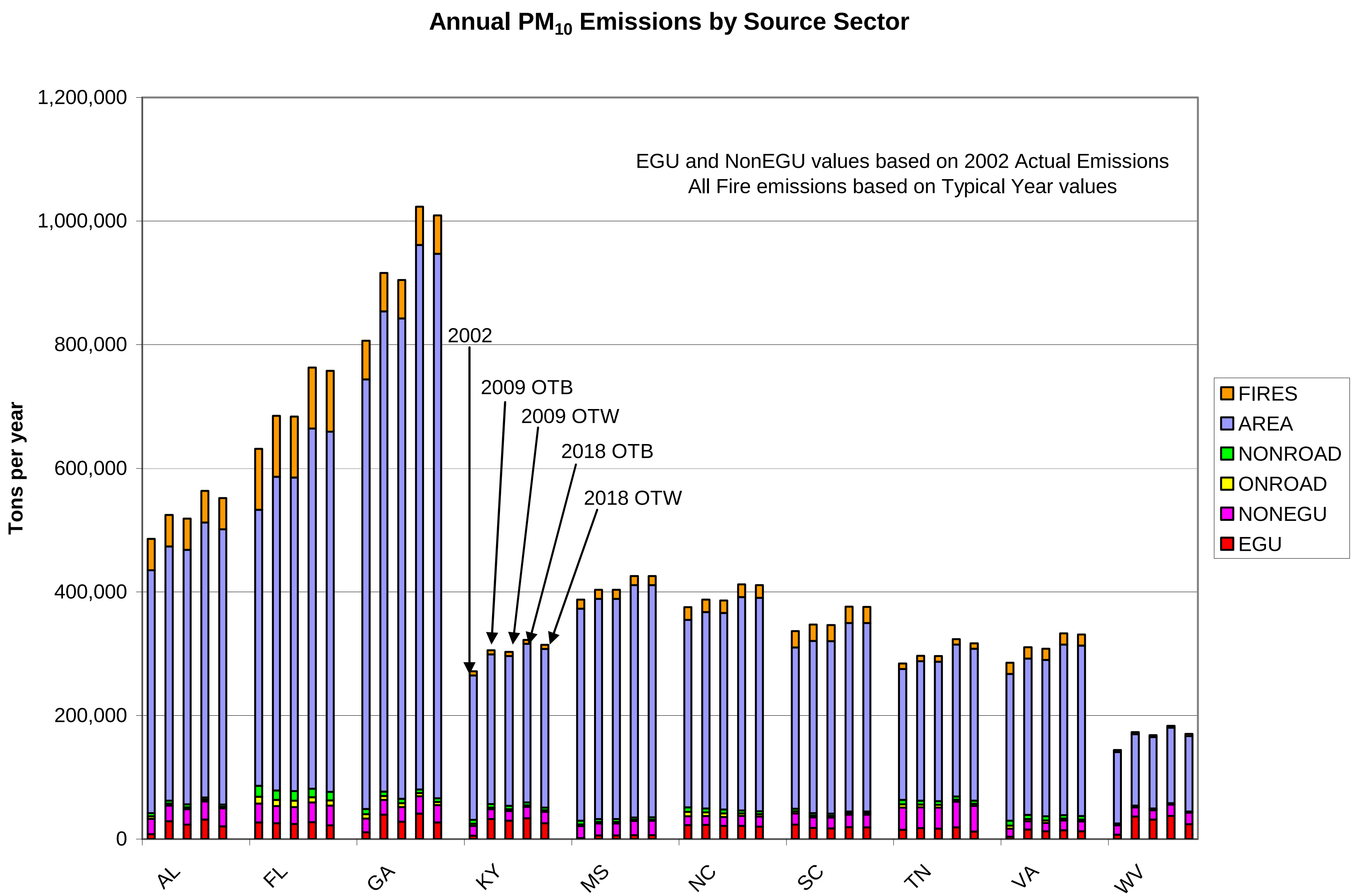
Annual NH_3 Emissions by Source Sector

Name	EGU	NONEGU	ONROAD	NONROAD	AREA	FIRES	YEAR	Basis
	90	1,883	5,576	32	59,486	1,957	2002	OTB - Actual 2002
	1,128	2,112	6,350	35	65,441	1,957	2009	OTB - Actual 2002
AL	1,344	2,112	6,350	35	65,441	1,957	2009	OTW - Actual 2002
	1,909	2,456	7,296	40	73,346	1,957	2018	OTB - Actual 2002
	2,173	2,456	7,296	40	73,346	1,957	2018	OTW - Actual 2002
	58	1,432	18,078	108	44,902	3,157	2002	OTB - Actual 2002
	2,524	1,605	21,737	119	46,950	3,157	2009	OTB - Actual 2002
FL	2,524	1,605	21,737	119	46,950	3,157	2009	OTW - Actual 2002
	4,022	1,905	26,154	138	49,889	3,157	2018	OTB - Actual 2002
	3,865	1,905	26,154	138	49,889	3,157	2018	OTW - Actual 2002
	5	3,613	10,524	54	84,230	2,153	2002	OTB - Actual 2002
	1,305	3,963	12,660	60	92,838	2,153	2009	OTB - Actual 2002
GA	1,376	3,963	12,660	60	92,838	2,153	2009	OTW - Actual 2002
	1,912	4,799	14,871	71	103,911	2,153	2018	OTB - Actual 2002
	2,057	4,799	14,871	71	103,911	2,153	2018	OTW - Actual 2002
	0	674	5,044	28	51,097	110	2002	OTB - Actual 2002
	717	733	5,795	30	53,023	110	2009	OTB - Actual 2002
KY	710	733	5,795	30	53,023	110	2009	OTW - Actual 2002
	763	839	6,584	36	55,356	110	2018	OTB - Actual 2002
	771	839	6,584	36	55,356	110	2018	OTW - Actual 2002
	64	1,169	3,577	23	59,262	177	2002	OTB - Actual 2002
	388	667	4,026	26	64,289	177	2009	OTB - Actual 2002
MS	407	667	4,026	26	64,289	177	2009	OTW - Actual 2002
	686	761	4,565	30	70,565	177	2018	OTB - Actual 2002
	872	761	4,565	30	70,565	177	2018	OTW - Actual 2002
	36	1,171	10,455	61	164,467	324	2002	OTB - Actual 2002
	577	1,255	12,637	68	173,187	324	2009	OTB - Actual 2002
NC	574	1,255	12,637	68	173,187	324	2009	OTW - Actual 2002
	740	1,412	13,077	79	184,167	324	2018	OTB - Actual 2002
	781	1,412	13,077	79	184,167	324	2018	OTW - Actual 2002
	0	1,411	4,684	29	29,447	908	2002	OTB - Actual 2002
	409	1,578	5,510	32	31,966	908	2009	OTB - Actual 2002
SC	422	1,578	5,510	32	31,966	908	2009	OTW - Actual 2002
	702	1,779	6,472	37	35,082	908	2018	OTB - Actual 2002
	742	1,779	6,472	37	35,082	908	2018	OTW - Actual 2002
	0	1,628	6,616	41	35,571	46	2002	OTB - Actual 2002
	406	1,861	7,738	45	36,578	46	2009	OTB - Actual 2002
TN	400	1,861	7,738	45	36,578	46	2009	OTW - Actual 2002
	427	2,240	8,962	53	37,812	46	2018	OTB - Actual 2002
	394	2,240	8,962	53	37,812	46	2018	OTW - Actual 2002
	127	3,104	7,837	44	46,221	159	2002	OTB - Actual 2002
	396	3,057	9,066	48	49,173	159	2009	OTB - Actual 2002
VA	439	3,057	9,066	48	49,173	159	2009	OTW - Actual 2002
	759	3,620	10,757	57	53,023	159	2018	OTB - Actual 2002
	783	3,620	10,757	57	53,023	159	2018	OTW - Actual 2002
	13	331	1,933	10	10,779	12	2002	OTB - Actual 2002
	691	342	2,183	11	11,461	12	2009	OTB - Actual 2002
WV	673	342	2,183	11	11,461	12	2009	OTW - Actual 2002
	722	416	2,484	13	12,390	12	2018	OTB - Actual 2002
	719	416	2,484	13	12,390	12	2018	OTW - Actual 2002


Annual NOx Emissions by Source Sector
EGU and NonEGU values based on 2002 Actual Emissions
All Fire emissions based on Typical Year values
Tons per year
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
2002
2009 OTB
2009 OTW
2018 OTB
2018 OTW
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV
FIRES
AREA
NONROAD
ONROAD
NONEGU
EGU

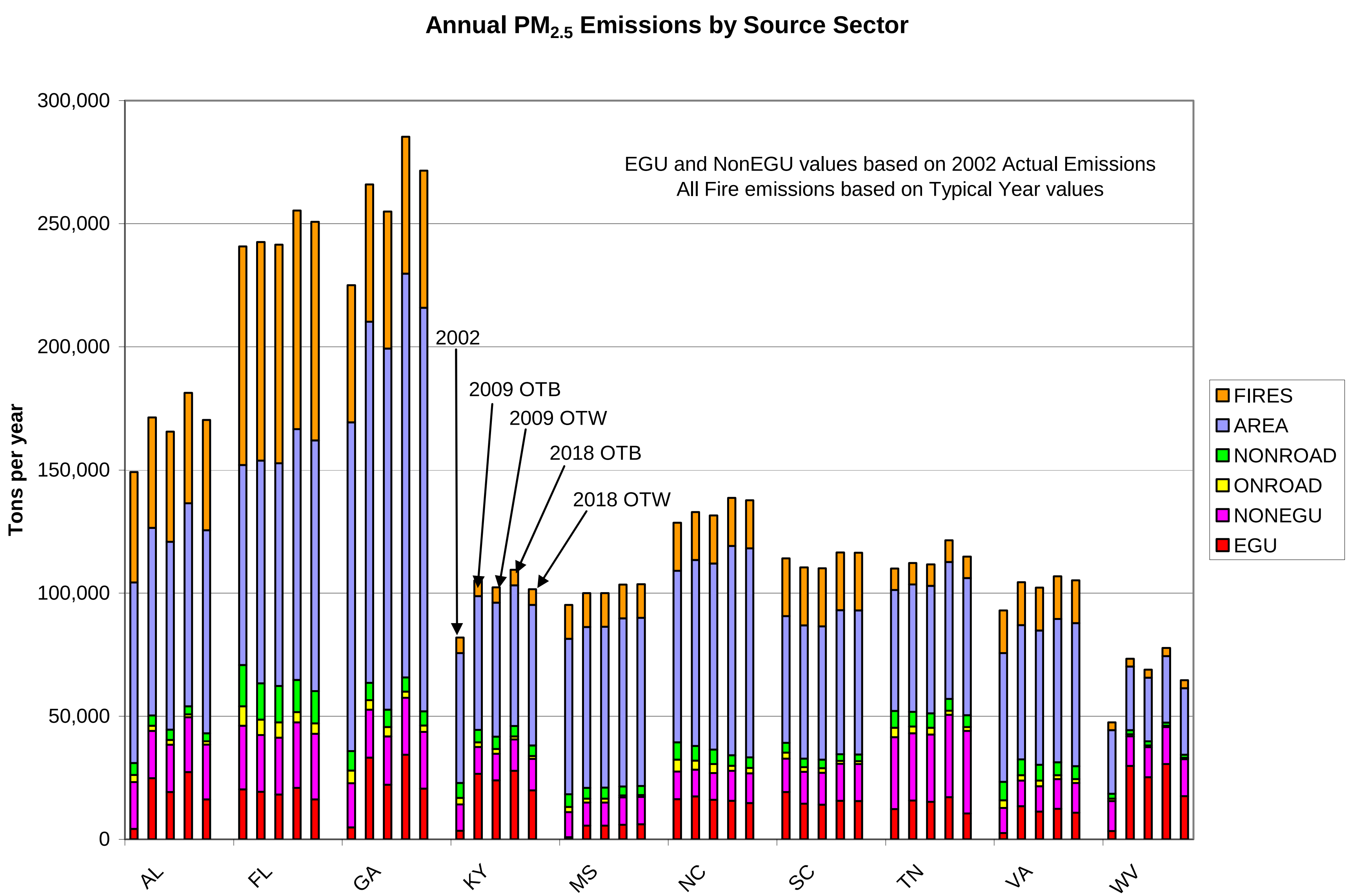
Annual NO_x Emissions by Source Sector

Name	EGU	NONEGU	ONROAD	NONROAD	AREA	FIRES	YEAR	Basis
	160,480	83,868	158,423	64,891	23,444	11,456	2002	OTB - Actual 2002
	131,988	80,738	101,323	55,494	26,482	11,456	2009	OTB - Actual 2002
AL	132,323	70,644	101,323	55,494	26,482	11,456	2009	OTW - Actual 2002
	135,010	91,052	46,222	42,573	28,754	11,456	2018	OTB - Actual 2002
	39,942	80,031	46,222	42,573	28,754	11,456	2018	OTW - Actual 2002
	244,541	62,138	466,098	150,519	29,477	19,791	2002	OTB - Actual 2002
	148,522	67,533	314,307	136,851	31,821	19,791	2009	OTB - Actual 2002
FL	147,801	67,533	314,307	136,851	31,821	19,791	2009	OTW - Actual 2002
	159,004	77,551	154,611	111,959	35,047	19,791	2018	OTB - Actual 2002
	59,446	77,551	154,611	111,959	35,047	19,791	2018	OTW - Actual 2002
	146,143	52,388	308,013	91,386	36,105	13,882	2002	OTB - Actual 2002
	131,901	53,008	208,393	79,049	38,876	13,882	2009	OTB - Actual 2002
GA	119,425	53,008	208,393	79,049	38,876	13,882	2009	OTW - Actual 2002
	128,938	59,005	99,821	60,650	42,260	13,882	2018	OTB - Actual 2002
	65,559	59,005	99,821	60,650	42,260	13,882	2018	OTW - Actual 2002
	198,726	38,483	154,899	101,261	39,507	1,460	2002	OTB - Actual 2002
	178,930	37,960	97,912	90,803	42,122	1,460	2009	OTB - Actual 2002
KY	177,272	37,201	97,912	90,803	42,122	1,460	2009	OTW - Actual 2002
	182,192	41,776	42,104	77,295	45,597	1,460	2018	OTB - Actual 2002
	64,674	40,948	42,104	77,295	45,597	1,460	2018	OTW - Actual 2002
	29,976	74,685	111,791	90,686	4,200	3,328	2002	OTB - Actual 2002
	38,911	70,463	69,949	81,780	4,789	3,328	2009	OTB - Actual 2002
MS	38,978	70,463	69,949	81,780	4,789	3,328	2009	OTW - Actual 2002
	38,355	76,738	29,717	68,781	5,230	3,328	2018	OTB - Actual 2002
	11,206	76,738	29,717	68,781	5,230	3,328	2018	OTW - Actual 2002
	146,465	50,317	341,198	81,448	48,730	5,005	2002	OTB - Actual 2002
	66,598	46,242	207,648	66,382	53,550	5,005	2009	OTB - Actual 2002
NC	67,051	46,242	207,648	66,382	53,550	5,005	2009	OTW - Actual 2002
	64,537	50,044	81,706	45,146	60,073	5,005	2018	OTB - Actual 2002
	59,917	50,044	81,706	45,146	60,073	5,005	2018	OTW - Actual 2002
	86,264	44,129	140,428	46,789	19,332	5,270	2002	OTB - Actual 2002
	50,433	43,799	91,696	39,544	20,852	5,270	2009	OTB - Actual 2002
SC	50,128	42,944	91,696	39,544	20,852	5,270	2009	OTW - Actual 2002
	55,103	48,314	42,354	29,512	22,467	5,270	2018	OTB - Actual 2002
	36,264	47,403	42,354	29,512	22,467	5,270	2018	OTW - Actual 2002
	155,762	73,431	233,324	95,968	17,829	2,232	2002	OTB - Actual 2002
	106,979	62,435	147,757	85,084	19,148	2,232	2009	OTB - Actual 2002
TN	104,528	61,176	147,757	85,084	19,148	2,232	2009	OTW - Actual 2002
	112,411	69,374	65,242	69,093	20,928	2,232	2018	OTB - Actual 2002
	32,411	67,999	65,242	69,093	20,928	2,232	2018	OTW - Actual 2002
	82,435	64,865	219,602	58,524	51,418	978	2002	OTB - Actual 2002
	64,950	64,298	133,170	50,120	53,344	978	2009	OTB - Actual 2002
VA	62,810	60,027	133,170	50,120	53,344	978	2009	OTW - Actual 2002
	56,716	71,480	61,881	36,970	56,668	978	2018	OTB - Actual 2002
	40,045	66,931	61,881	36,970	56,668	978	2018	OTW - Actual 2002
	230,950	46,710	59,612	34,442	12,687	944	2002	OTB - Actual 2002
	173,977	42,140	36,049	31,148	13,816	944	2009	OTB - Actual 2002
WV	174,572	40,469	36,049	31,148	13,816	944	2009	OTW - Actual 2002
	170,522	46,846	16,274	26,279	15,079	944	2018	OTB - Actual 2002
	42,227	44,944	16,274	26,279	15,079	944	2018	OTW - Actual 2002


Annual PM10 Emissions by Source Sector
Tons per year
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
EGU and NonEGU values based on 2002 Actual Emissions
All Fire emissions based on Typical Year values
2002
2009 OTB
2009 OTW
2018 OTB
2018 OTW
FIRES
AREA
NONROAD
ONROAD
NONEGU
EGU
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV

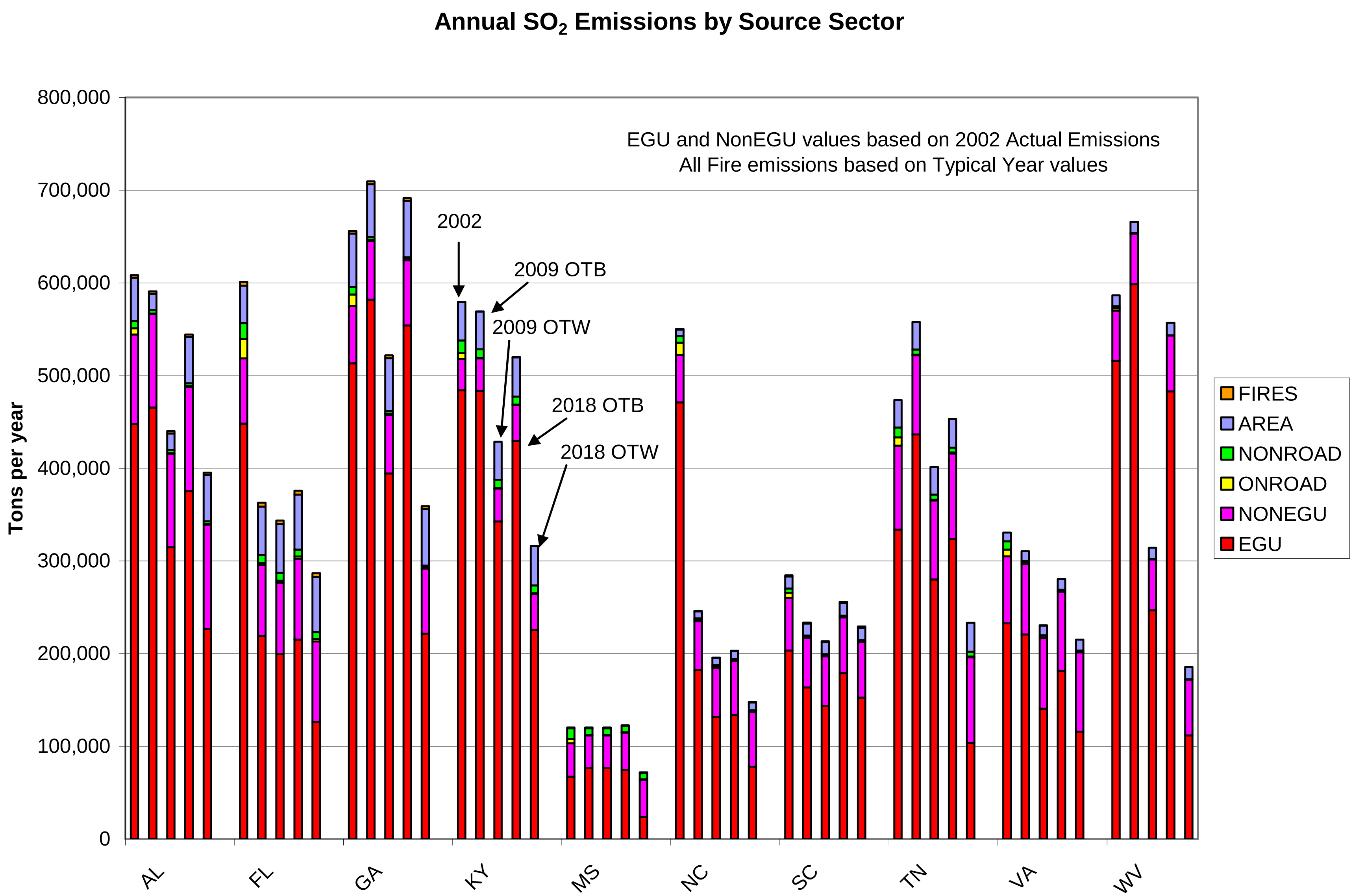
Annual PM_{10} Emissions by Source Sector

Name	EGU	NONEGU	ONROAD	NONROAD	AREA	FIRES	YEAR	Basis
	7,834	24,957	3,898	5,331	393,093	50,833	2002	OTB - Actual 2002
	29,053	25,161	3,188	4,597	411,614	50,833	2009	OTB - Actual 2002
AL	23,250	25,161	3,188	4,597	411,614	50,833	2009	OTW - Actual 2002
	31,815	29,278	2,488	3,690	445,168	50,833	2018	OTB - Actual 2002
	20,450	29,278	2,488	3,690	445,168	50,833	2018	OTW - Actual 2002
	26,912	30,331	11,253	17,692	446,821	98,470	2002	OTB - Actual 2002
	25,779	27,531	9,953	15,630	507,515	98,470	2009	OTB - Actual 2002
FL	24,493	27,531	9,953	15,630	507,515	98,470	2009	OTW - Actual 2002
	27,320	31,890	8,489	13,827	582,832	98,470	2018	OTB - Actual 2002
	22,204	31,890	8,489	13,827	582,832	98,470	2018	OTW - Actual 2002
	11,148	22,055	7,236	8,295	695,320	62,336	2002	OTB - Actual 2002
	39,580	23,861	6,103	7,368	776,935	62,336	2009	OTB - Actual 2002
GA	28,118	23,861	6,103	7,368	776,935	62,336	2009	OTW - Actual 2002
	41,221	28,177	4,995	6,068	880,800	62,336	2018	OTB - Actual 2002
	26,905	28,177	4,995	6,068	880,800	62,336	2018	OTW - Actual 2002
	5,711	15,615	3,720	6,389	233,559	6,667	2002	OTB - Actual 2002
	32,406	15,858	3,002	5,312	242,345	6,667	2009	OTB - Actual 2002
KY	29,606	15,858	3,002	5,312	242,345	6,667	2009	OTW - Actual 2002
	33,784	18,587	2,283	4,602	256,544	6,667	2018	OTB - Actual 2002
	25,733	18,587	2,283	4,602	256,544	6,667	2018	OTW - Actual 2002
	1,467	19,622	2,856	5,551	343,377	14,693	2002	OTB - Actual 2002
	5,864	19,439	2,290	4,754	356,516	14,693	2009	OTB - Actual 2002
MS	5,883	19,439	2,290	4,754	356,516	14,693	2009	OTW - Actual 2002
	6,268	23,145	1,688	3,873	375,931	14,693	2018	OTB - Actual 2002
	6,459	23,145	1,688	3,873	375,931	14,693	2018	OTW - Actual 2002
	22,480	14,511	6,905	7,449	303,492	20,488	2002	OTB - Actual 2002
	23,028	14,301	5,861	6,210	317,847	20,488	2009	OTB - Actual 2002
NC	21,459	14,301	5,861	6,210	317,847	20,488	2009	OTW - Actual 2002
	21,417	16,002	4,299	4,474	345,275	20,488	2018	OTB - Actual 2002
	20,258	16,002	4,299	4,474	345,275	20,488	2018	OTW - Actual 2002
	23,423	18,149	3,446	4,211	260,858	26,304	2002	OTB - Actual 2002
	18,023	17,368	2,878	3,593	278,852	26,304	2009	OTB - Actual 2002
SC	17,493	17,368	2,878	3,593	278,852	26,304	2009	OTW - Actual 2002
	19,290	20,272	2,258	2,889	304,940	26,304	2018	OTB - Actual 2002
	19,182	20,272	2,258	2,889	304,940	26,304	2018	OTW - Actual 2002
	14,954	35,983	5,338	7,145	211,903	8,875	2002	OTB - Actual 2002
	17,735	33,838	4,238	6,218	225,650	8,875	2009	OTB - Actual 2002
TN	17,159	33,838	4,238	6,218	225,650	8,875	2009	OTW - Actual 2002
	19,103	41,466	3,199	5,019	245,893	8,875	2018	OTB - Actual 2002
	12,432	41,466	3,199	5,019	245,893	8,875	2018	OTW - Actual 2002
	3,824	13,242	4,537	7,928	237,577	18,160	2002	OTB - Actual 2002
	15,343	13,470	3,760	6,763	252,924	18,160	2009	OTB - Actual 2002
VA	12,804	13,470	3,760	6,763	252,924	18,160	2009	OTW - Actual 2002
	14,390	15,661	3,343	5,564	275,790	18,160	2018	OTB - Actual 2002
	12,653	15,661	3,343	5,564	275,790	18,160	2018	OTW - Actual 2002
	7,188	14,865	1,395	2,072	115,346	3,276	2002	OTB - Actual 2002
	36,442	14,926	1,096	1,819	115,410	3,276	2009	OTB - Actual 2002
WV	31,780	14,926	1,096	1,819	115,410	3,276	2009	OTW - Actual 2002
	37,425	18,433	844	1,381	121,964	3,276	2018	OTB - Actual 2002
	24,253	18,433	844	1,381	121,964	3,276	2018	OTW - Actual 2002


Annual $PM_{2.5}$ Emissions by Source Sector
EGU and NonEGU values based on 2002 Actual Emissions
All Fire emissions based on Typical Year values
Tons per year
300,000
250,000
200,000
150,000
100,000
50,000
0
2002
2009 OTB
2009 OTW
2018 OTB
2018 OTW
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV
FIRES
AREA
NONROAD
ONROAD
NONEGU
EGU

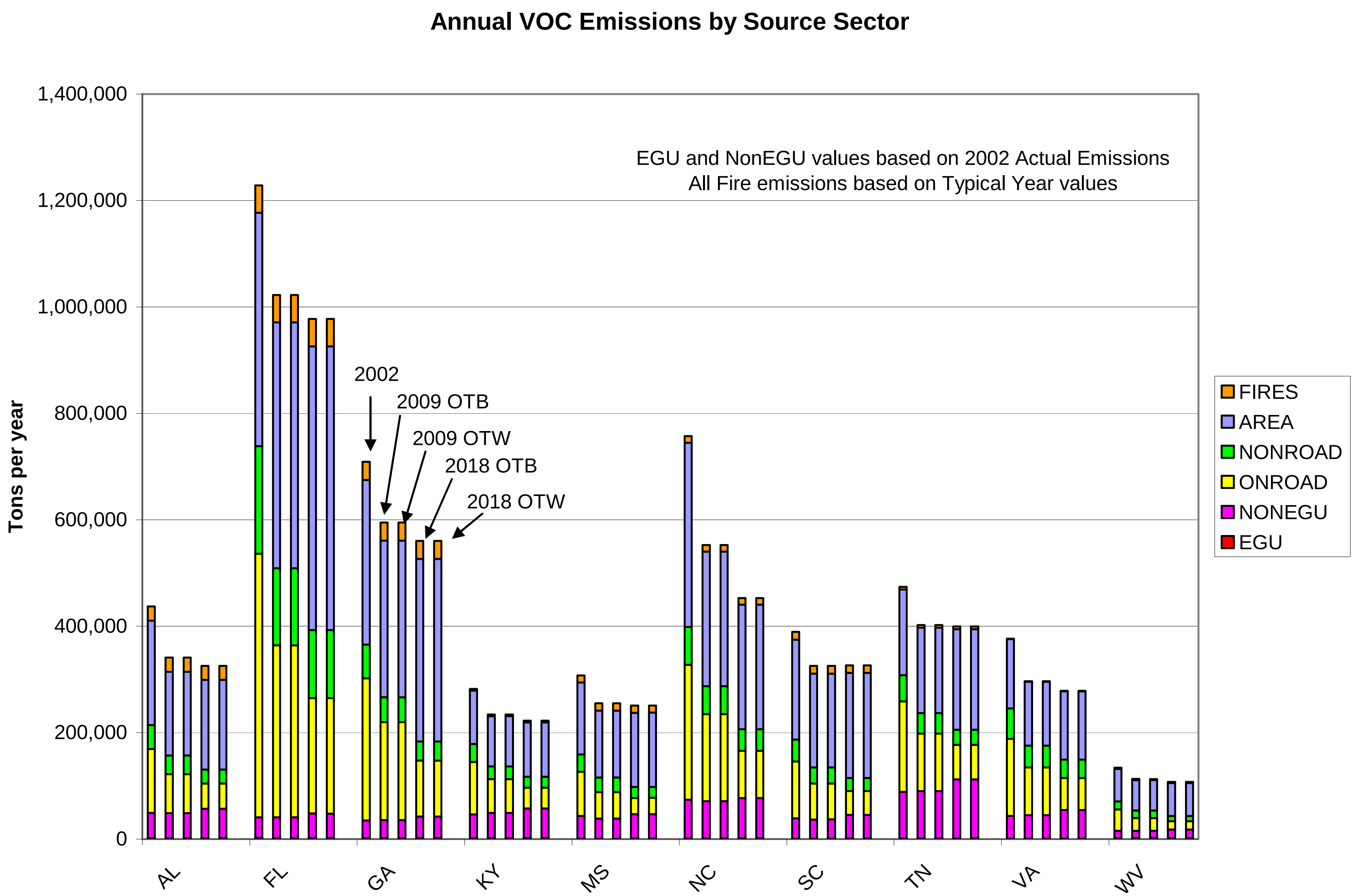
Annual $PM_{2.5}$ Emissions by Source Sector

Name	EGU	NONEGU	ONROAD	NONROAD	AREA	FIRES	YEAR	Basis
	4,274	19,016	2,794	4,877	73,352	44,812	2002	OTB - Actual 2002
	24,875	19,184	2,049	4,144	76,248	44,812	2009	OTB - Actual 2002
AL	19,190	19,184	2,049	4,144	76,248	44,812	2009	OTW - Actual 2002
	27,280	22,268	1,262	3,231	82,449	44,812	2018	OTB - Actual 2002
	16,279	22,268	1,262	3,231	82,449	44,812	2018	OTW - Actual 2002
	20,305	25,842	7,852	16,739	81,341	88,756	2002	OTB - Actual 2002
	19,307	23,063	6,216	14,786	90,487	88,756	2009	OTB - Actual 2002
FL	18,186	23,063	6,216	14,786	90,487	88,756	2009	OTW - Actual 2002
	20,848	26,622	4,242	13,044	101,872	88,756	2018	OTB - Actual 2002
	16,278	26,622	4,242	13,044	101,872	88,756	2018	OTW - Actual 2002
	4,888	17,890	5,158	7,899	133,542	55,712	2002	OTB - Actual 2002
	33,111	19,562	3,869	7,014	146,691	55,712	2009	OTB - Actual 2002
GA	22,163	19,562	3,869	7,014	146,691	55,712	2009	OTW - Actual 2002
	34,361	23,110	2,517	5,769	163,925	55,712	2018	OTB - Actual 2002
	20,549	23,110	2,517	5,769	163,925	55,712	2018	OTW - Actual 2002
	3,443	10,730	2,693	5,998	52,765	6,310	2002	OTB - Actual 2002
	26,640	10,837	1,941	4,978	54,397	6,310	2009	OTB - Actual 2002
KY	23,915	10,837	1,941	4,978	54,397	6,310	2009	OTW - Actual 2002
	27,857	12,738	1,160	4,289	57,110	6,310	2018	OTB - Actual 2002
	19,915	12,738	1,160	4,289	57,110	6,310	2018	OTW - Actual 2002
	912	10,132	2,109	5,200	63,135	13,680	2002	OTB - Actual 2002
	5,511	9,459	1,522	4,440	65,321	13,680	2009	OTB - Actual 2002
MS	5,530	9,459	1,522	4,440	65,321	13,680	2009	OTW - Actual 2002
	5,919	11,068	876	3,597	68,338	13,680	2018	OTB - Actual 2002
	6,110	11,068	876	3,597	68,338	13,680	2018	OTW - Actual 2002
	16,305	11,207	4,816	7,079	69,663	19,491	2002	OTB - Actual 2002
	17,449	10,888	3,643	5,889	75,570	19,491	2009	OTB - Actual 2002
NC	16,034	10,888	3,643	5,889	75,570	19,491	2009	OTW - Actual 2002
	15,636	12,136	2,158	4,215	85,018	19,491	2018	OTB - Actual 2002
	14,702	12,136	2,158	4,215	85,018	19,491	2018	OTW - Actual 2002
	19,162	13,565	2,496	3,985	51,413	23,511	2002	OTB - Actual 2002
	14,471	12,977	1,870	3,396	54,230	23,511	2009	OTB - Actual 2002
SC	14,079	12,977	1,870	3,396	54,230	23,511	2009	OTW - Actual 2002
	15,601	15,092	1,154	2,718	58,441	23,511	2018	OTB - Actual 2002
	15,509	15,092	1,154	2,718	58,441	23,511	2018	OTW - Actual 2002
	12,311	29,131	3,919	6,756	49,131	8,730	2002	OTB - Actual 2002
	15,770	27,313	2,782	5,873	51,753	8,730	2009	OTB - Actual 2002
TN	15,228	27,313	2,782	5,873	51,753	8,730	2009	OTW - Actual 2002
	17,103	33,502	1,643	4,724	55,712	8,730	2018	OTB - Actual 2002
	10,514	33,502	1,643	4,724	55,712	8,730	2018	OTW - Actual 2002
	2,560	10,211	3,090	7,486	52,271	17,361	2002	OTB - Actual 2002
	13,451	10,368	2,254	6,388	54,587	17,361	2009	OTB - Actual 2002
VA	11,237	10,368	2,254	6,388	54,587	17,361	2009	OTW - Actual 2002
	12,366	12,062	1,641	5,241	58,141	17,361	2018	OTB - Actual 2002
	10,755	12,062	1,641	5,241	58,141	17,361	2018	OTW - Actual 2002
	3,369	12,154	1,003	1,941	25,850	3,239	2002	OTB - Actual 2002
	29,773	12,138	703	1,699	25,835	3,239	2009	OTB - Actual 2002
WV	25,251	12,138	703	1,699	25,835	3,239	2009	OTW - Actual 2002
	30,628	15,045	428	1,284	27,088	3,239	2018	OTB - Actual 2002
	17,548	15,045	428	1,284	27,088	3,239	2018	OTW - Actual 2002


Annual SO_2 Emissions by Source Sector
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
Tons per year
EGU and NonEGU values based on 2002 Actual Emissions
All Fire emissions based on Typical Year values
2002
2009 OTB
2009 OTW
2018 OTB
2018 OTW
FIRES
AREA
NONROAD
ONROAD
NONEGU
EGU
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV

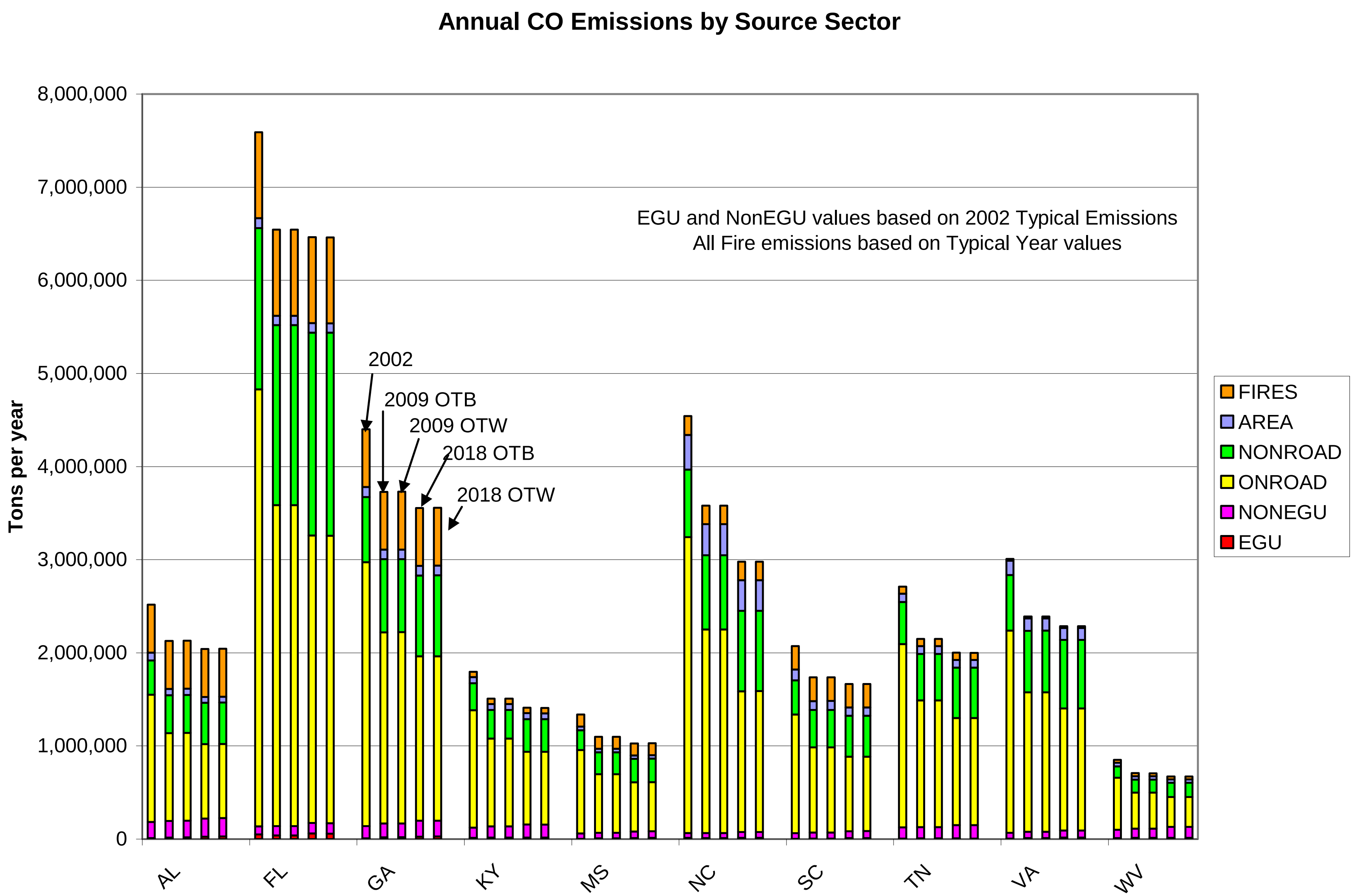
Annual SO_2 Emissions by Source Sector

Name	EGU	NONEGU	ONROAD	NONROAD	AREA	FIRES	YEAR	Basis
	447,862	96,447	6,885	7,539	47,074	2,559	2002	OTB - Actual 2002
	465,576	100,845	635	3,463	17,818	2,559	2009	OTB - Actual 2002
AL	314,841	100,845	635	3,463	17,818	2,559	2009	OTW - Actual 2002
	375,305	112,771	720	2,815	49,975	2,559	2018	OTB - Actual 2002
	226,506	112,771	720	2,815	49,975	2,559	2018	OTW - Actual 2002
	448,046	70,675	20,872	17,023	40,537	4,129	2002	OTB - Actual 2002
	219,072	76,851	2,120	8,380	52,390	4,129	2009	OTB - Actual 2002
FL	199,834	76,851	2,120	8,380	52,390	4,129	2009	OTW - Actual 2002
	215,177	87,065	2,533	7,511	59,413	4,129	2018	OTB - Actual 2002
	126,280	87,065	2,533	7,511	59,413	4,129	2018	OTW - Actual 2002
	513,266	62,044	12,155	8,145	57,555	2,815	2002	OTB - Actual 2002
	582,078	63,348	1,254	2,588	57,377	2,815	2009	OTB - Actual 2002
GA	394,425	63,348	1,254	2,588	57,377	2,815	2009	OTW - Actual 2002
	554,013	70,386	1,458	1,702	61,155	2,815	2018	OTB - Actual 2002
	221,615	70,386	1,458	1,702	61,155	2,815	2018	OTW - Actual 2002
	484,059	34,027	5,974	13,739	41,805	136	2002	OTB - Actual 2002
	483,235	35,479	585	9,092	40,779	136	2009	OTB - Actual 2002
KY	342,670	35,479	585	9,092	40,779	136	2009	OTW - Actual 2002
	429,418	38,816	651	8,536	42,326	136	2018	OTB - Actual 2002
	225,772	38,816	651	8,536	42,326	136	2018	OTW - Actual 2002
	67,339	36,049	4,604	11,551	771	100	2002	OTB - Actual 2002
	76,855	35,028	397	7,232	637	100	2009	OTB - Actual 2002
MS	76,855	35,028	397	7,232	637	100	2009	OTW - Actual 2002
	74,505	40,318	441	6,638	831	100	2018	OTB - Actual 2002
	23,768	40,318	441	6,638	831	100	2018	OTW - Actual 2002
	471,030	51,082	13,343	7,207	7,096	423	2002	OTB - Actual 2002
	182,356	52,693	1,311	1,798	7,607	423	2009	OTB - Actual 2002
NC	132,054	52,693	1,311	1,798	7,607	423	2009	OTW - Actual 2002
	133,691	58,671	1,323	838	8,273	423	2018	OTB - Actual 2002
	78,205	58,671	1,323	838	8,273	423	2018	OTW - Actual 2002
	203,587	56,329	5,958	4,449	12,900	1,187	2002	OTB - Actual 2002
	163,560	53,746	556	1,633	12,945	1,187	2009	OTB - Actual 2002
SC	143,492	53,746	556	1,633	12,945	1,187	2009	OTW - Actual 2002
	178,938	60,300	643	1,195	13,517	1,187	2018	OTB - Actual 2002
	152,457	60,300	643	1,195	13,517	1,187	2018	OTW - Actual 2002
	333,934	90,375	9,184	10,413	29,897	59	2002	OTB - Actual 2002
	436,453	85,275	831	5,649	29,787	59	2009	OTB - Actual 2002
TN	279,931	85,275	831	5,649	29,787	59	2009	OTW - Actual 2002
	323,654	92,396	944	5,205	31,047	59	2018	OTB - Actual 2002
	103,602	92,396	944	5,205	31,047	59	2018	OTW - Actual 2002
	232,747	72,360	7,218	8,796	9,510	99	2002	OTB - Actual 2002
	220,686	76,081	900	2,248	10,619	99	2009	OTB - Actual 2002
VA	140,665	76,081	900	2,248	10,619	99	2009	OTW - Actual 2002
	181,338	85,351	1,059	1,217	11,479	99	2018	OTB - Actual 2002
	115,987	85,351	1,059	1,217	11,479	99	2018	OTW - Actual 2002
	516,109	54,044	2,489	2,305	11,667	16	2002	OTB - Actual 2002
	598,555	54,701	227	392	12,156	16	2009	OTB - Actual 2002
WV	246,851	54,701	227	392	12,156	16	2009	OTW - Actual 2002
	482,959	60,141	255	56	13,450	16	2018	OTB - Actual 2002
	111,937	60,141	255	56	13,450	16	2018	OTW - Actual 2002


Annual VOC Emissions by Source Sector
EGU and NonEGU values based on 2002 Actual Emissions
All Fire emissions based on Typical Year values
Tons per year
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
2002
2009 OTB
2009 OTW
2018 OTB
2018 OTW
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV
FIRES
AREA
NONROAD
ONROAD
NONEGU
EGU

Annual VOC Emissions by Source Sector

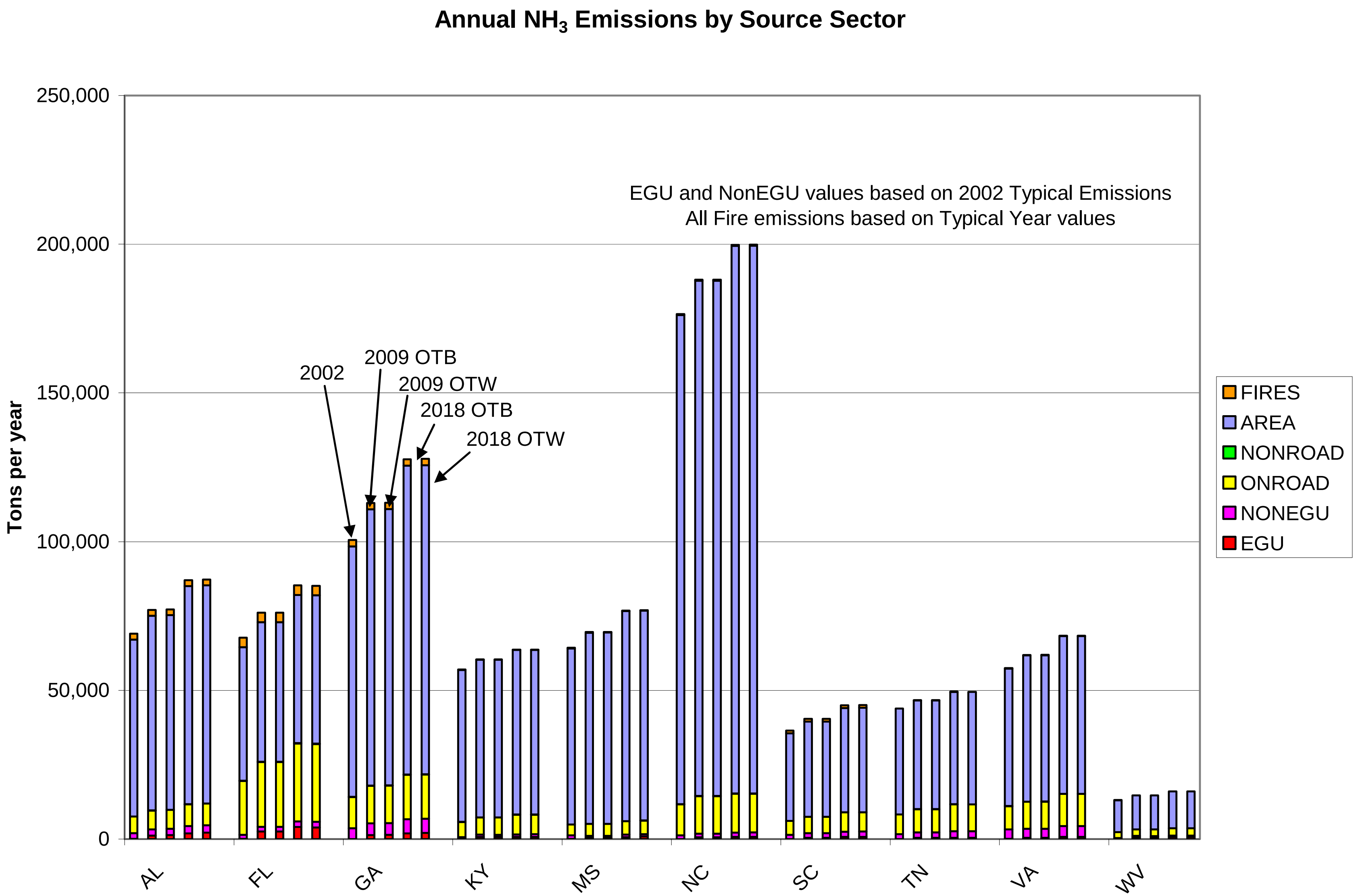
Name	EGU	NONEGU	ONROAD	NONROAD	AREA	FIRES	YEAR	Basis
	1,438	47,893	119,790	44,978	196,538	26,526	2002	OTB - Actual 2002
	1,261	47,600	72,848	35,498	157,405	26,526	2009	OTB - Actual 2002
AL	1,312	47,600	72,848	35,498	157,405	26,526	2009	OTW - Actual 2002
	1,574	55,373	47,296	26,338	168,507	26,526	2018	OTB - Actual 2002
	1,612	55,373	47,296	26,338	168,507	26,526	2018	OTW - Actual 2002
	2,295	38,700	495,225	201,960	439,019	51,527	2002	OTB - Actual 2002
	1,562	39,255	323,290	144,749	462,198	51,527	2009	OTB - Actual 2002
FL	1,559	39,255	323,290	144,749	462,198	51,527	2009	OTW - Actual 2002
	2,052	46,049	216,620	128,131	533,141	51,527	2018	OTB - Actual 2002
	1,988	46,049	216,620	128,131	533,141	51,527	2018	OTW - Actual 2002
	1,178	33,736	267,378	63,337	309,411	33,918	2002	OTB - Actual 2002
	1,497	34,153	184,239	46,722	294,204	33,918	2009	OTB - Actual 2002
GA	1,499	34,153	184,239	46,722	294,204	33,918	2009	OTW - Actual 2002
	1,794	40,354	105,507	36,014	342,661	33,918	2018	OTB - Actual 2002
	1,790	40,354	105,507	36,014	342,661	33,918	2018	OTW - Actual 2002
	1,464	44,856	98,311	34,156	100,174	3,338	2002	OTB - Actual 2002
	1,594	47,733	63,258	23,980	94,253	3,338	2009	OTB - Actual 2002
KY	1,580	47,733	63,258	23,980	94,253	3,338	2009	OTW - Actual 2002
	1,635	55,729	39,084	20,795	102,117	3,338	2018	OTB - Actual 2002
	1,616	55,729	39,084	20,795	102,117	3,338	2018	OTW - Actual 2002
	473	43,379	82,810	32,401	135,106	13,625	2002	OTB - Actual 2002
	584	38,119	49,670	27,650	125,382	13,625	2009	OTB - Actual 2002
MS	590	38,119	49,670	27,650	125,382	13,625	2009	OTW - Actual 2002
	766	45,966	30,734	20,576	139,419	13,625	2018	OTB - Actual 2002
	827	45,966	30,734	20,576	139,419	13,625	2018	OTW - Actual 2002
	1,042	72,945	253,374	71,378	346,060	12,499	2002	OTB - Actual 2002
	1,100	70,146	163,803	52,430	252,553	12,499	2009	OTB - Actual 2002
NC	1,093	70,146	163,803	52,430	252,553	12,499	2009	OTW - Actual 2002
	1,183	75,985	88,620	40,576	234,207	12,499	2018	OTB - Actual 2002
	1,172	75,985	88,620	40,576	234,207	12,499	2018	OTW - Actual 2002
	434	38,493	106,792	41,374	187,466	14,666	2002	OTB - Actual 2002
	601	36,410	67,281	30,531	176,104	14,666	2009	OTB - Actual 2002
SC	626	36,410	67,281	30,531	176,104	14,666	2009	OTW - Actual 2002
	745	44,586	44,700	24,989	196,946	14,666	2018	OTB - Actual 2002
	754	44,586	44,700	24,989	196,946	14,666	2018	OTW - Actual 2002
	833	88,059	169,914	49,056	161,069	5,153	2002	OTB - Actual 2002
	866	89,128	108,200	38,686	160,265	5,153	2009	OTB - Actual 2002
TN	854	89,128	108,200	38,686	160,265	5,153	2009	OTW - Actual 2002
	899	111,372	64,665	28,667	188,977	5,153	2018	OTB - Actual 2002
	826	111,372	64,665	28,667	188,977	5,153	2018	OTW - Actual 2002
	679	43,227	144,684	57,050	129,792	912	2002	OTB - Actual 2002
	546	44,359	89,678	40,897	120,022	912	2009	OTB - Actual 2002
VA	503	44,359	89,678	40,897	120,022	912	2009	OTW - Actual 2002
	694	53,968	60,454	34,412	128,160	912	2018	OTB - Actual 2002
	674	53,968	60,454	34,412	128,160	912	2018	OTW - Actual 2002
	1,176	14,599	40,066	14,805	61,490	2,184	2002	OTB - Actual 2002
	1,442	14,015	23,907	14,249	57,082	2,184	2009	OTB - Actual 2002
WV	1,397	14,015	23,907	14,249	57,082	2,184	2009	OTW - Actual 2002
	1,471	16,636	15,463	9,500	62,164	2,184	2018	OTB - Actual 2002
	1,456	16,636	15,463	9,500	62,164	2,184	2018	OTW - Actual 2002



Annual CO Emissions by Source Sector
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
Tons per year
EGU and NonEGU values based on 2002 Typical Emissions
All Fire emissions based on Typical Year values
2002
2009 OTB
2009 OTW
2018 OTB
2018 OTW
FIRES
AREA
NONROAD
ONROAD
NONEGU
EGU
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV

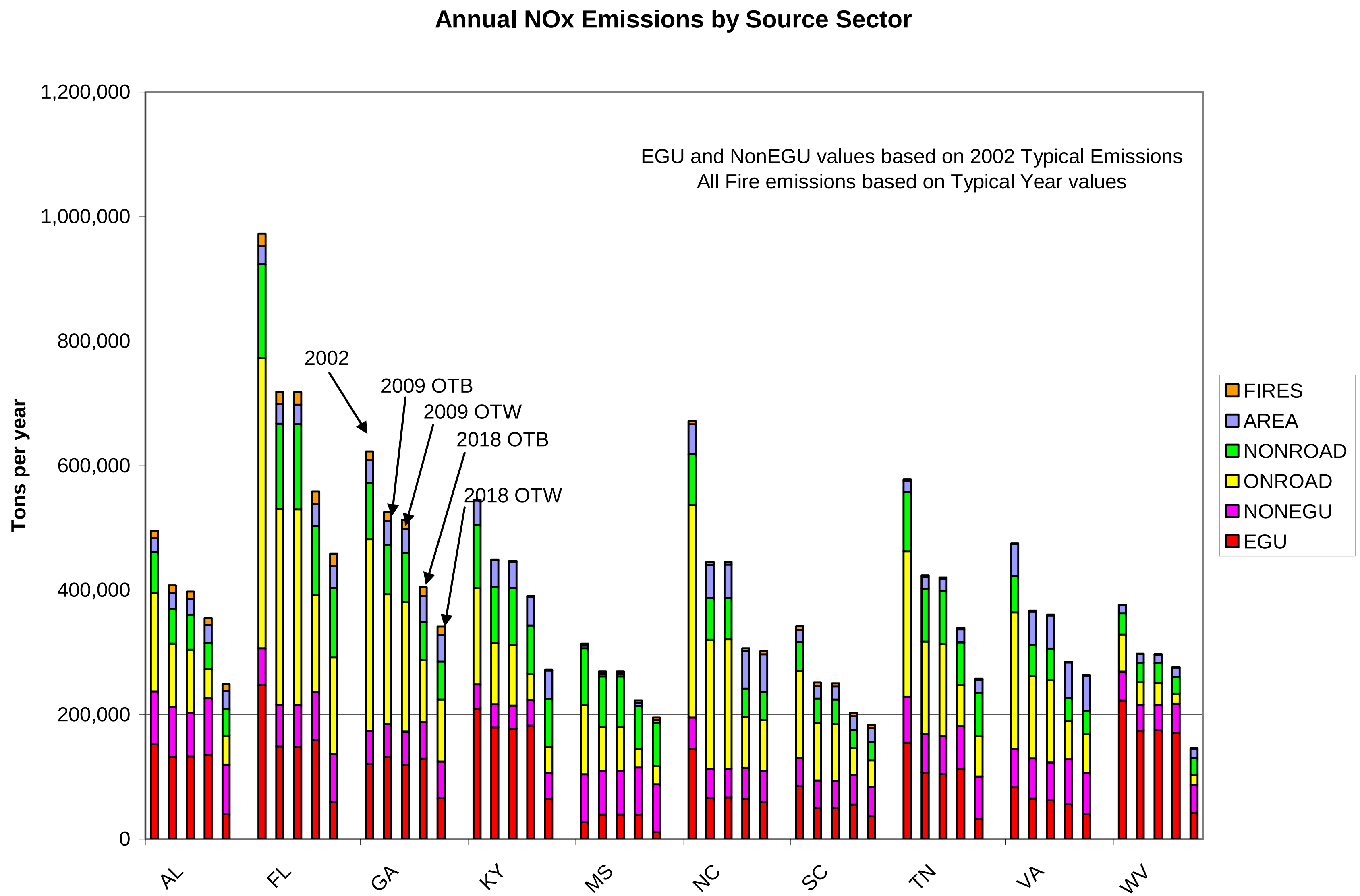
Annual CO Emissions by Source Sector

Name	AREA	EGU	FIRES	NONEGU	NONROAD	ONROAD	YEAR	Basis
	83,958	10,812	514,120	174,306	367,038	1,366,056	2002	OTB - Typical 2002
	68,882	16,494	514,120	177,145	408,424	942,793	2009	OTB - Typical 2002
AL	68,882	19,205	514,120	177,145	408,424	942,793	2009	OTW - Typical 2002
	63,773	26,600	514,120	194,801	443,100	797,966	2018	OTB - Typical 2002
	63,773	29,893	514,120	194,801	443,100	797,966	2018	OTW - Typical 2002
	105,849	51,165	923,310	84,920	1,731,519	4,693,893	2002	OTB - Typical 2002
	101,356	40,642	923,310	98,325	1,934,550	3,446,095	2009	OTB - Typical 2002
FL	101,356	40,641	923,310	98,325	1,934,550	3,446,095	2009	OTW - Typical 2002
	100,952	59,793	923,310	113,923	2,179,296	3,086,330	2018	OTB - Typical 2002
	100,952	57,759	923,310	113,923	2,179,296	3,086,330	2018	OTW - Typical 2002
	107,889	8,098	620,342	131,417	700,427	2,833,468	2002	OTB - Typical 2002
	103,579	19,170	620,342	147,835	783,990	2,053,694	2009	OTB - Typical 2002
GA	103,579	20,024	620,342	147,835	783,990	2,053,694	2009	OTW - Typical 2002
	105,059	27,152	620,342	169,156	868,018	1,765,020	2018	OTB - Typical 2002
	105,059	28,895	620,342	169,156	868,018	1,765,020	2018	OTW - Typical 2002
	66,752	12,888	56,686	110,141	289,967	1,260,682	2002	OTB - Typical 2002
	64,806	15,273	56,686	121,981	306,884	942,350	2009	OTB - Typical 2002
KY	64,806	15,119	56,686	121,981	306,884	942,350	2009	OTW - Typical 2002
	65,297	16,974	56,686	139,395	349,285	782,423	2018	OTB - Typical 2002
	65,297	14,954	56,686	139,395	349,285	782,423	2018	OTW - Typical 2002
	37,905	3,831	128,471	57,711	213,779	894,639	2002	OTB - Typical 2002
	37,161	6,714	128,471	60,709	237,297	628,151	2009	OTB - Typical 2002
MS	37,161	6,954	128,471	60,709	237,297	628,151	2009	OTW - Typical 2002
	36,425	10,553	128,471	70,454	252,658	528,898	2018	OTB - Typical 2002
	36,425	12,928	128,471	70,454	252,658	528,898	2018	OTW - Typical 2002
	373,585	12,027	200,564	52,542	725,734	3,176,811	2002	OTB - Typical 2002
	332,443	11,091	200,564	54,791	797,360	2,184,901	2009	OTB - Typical 2002
NC	332,443	11,170	200,564	54,791	797,360	2,184,901	2009	OTW - Typical 2002
	327,871	13,482	200,564	63,699	863,536	1,510,848	2018	OTB - Typical 2002
	327,871	13,777	200,564	63,699	863,536	1,510,848	2018	OTW - Typical 2002
	113,714	3,675	253,005	59,605	367,575	1,275,161	2002	OTB - Typical 2002
	95,826	6,316	253,005	65,612	402,871	912,280	2009	OTB - Typical 2002
SC	95,826	6,526	253,005	65,612	402,871	912,280	2009	OTW - Typical 2002
	89,343	10,175	253,005	75,209	438,027	800,619	2018	OTB - Typical 2002
	89,343	10,671	253,005	75,209	438,027	800,619	2018	OTW - Typical 2002
	89,235	6,339	78,370	119,405	451,480	1,967,658	2002	OTB - Typical 2002
	82,196	6,750	78,370	121,420	500,186	1,361,408	2009	OTB - Typical 2002
TN	82,196	6,651	78,370	121,420	500,186	1,361,408	2009	OTW - Typical 2002
	81,242	7,074	78,370	143,845	540,143	1,150,516	2018	OTB - Typical 2002
	81,242	6,509	78,370	143,845	540,143	1,150,516	2018	OTW - Typical 2002
	155,873	5,958	19,159	62,534	595,311	2,170,508	2002	OTB - Typical 2002
	133,738	9,811	19,159	69,822	661,295	1,495,771	2009	OTB - Typical 2002
VA	133,738	10,245	19,159	69,822	661,295	1,495,771	2009	OTW - Typical 2002
	129,037	14,788	19,159	77,590	734,294	1,310,698	2018	OTB - Typical 2002
	129,037	14,839	19,159	77,590	734,294	1,310,698	2018	OTW - Typical 2002
	39,546	9,927	32,656	89,928	119,089	560,717	2002	OTB - Typical 2002
	37,704	12,622	32,656	100,292	138,999	385,994	2009	OTB - Typical 2002
WV	37,704	12,328	32,656	100,292	138,999	385,994	2009	OTW - Typical 2002
	36,809	13,064	32,656	119,367	152,932	319,030	2018	OTB - Typical 2002
	36,809	12,992	32,656	119,367	152,932	319,030	2018	OTW - Typical 2002


Annual NH_3 Emissions by Source Sector
Tons per year
250,000
200,000
150,000
100,000
50,000
0
EGU and NonEGU values based on 2002 Typical Emissions
All Fire emissions based on Typical Year values
2002
2009 OTB
2009 OTW
2018 OTB
2018 OTW
FIRES
AREA
NONROAD
ONROAD
NONEGU
EGU
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV

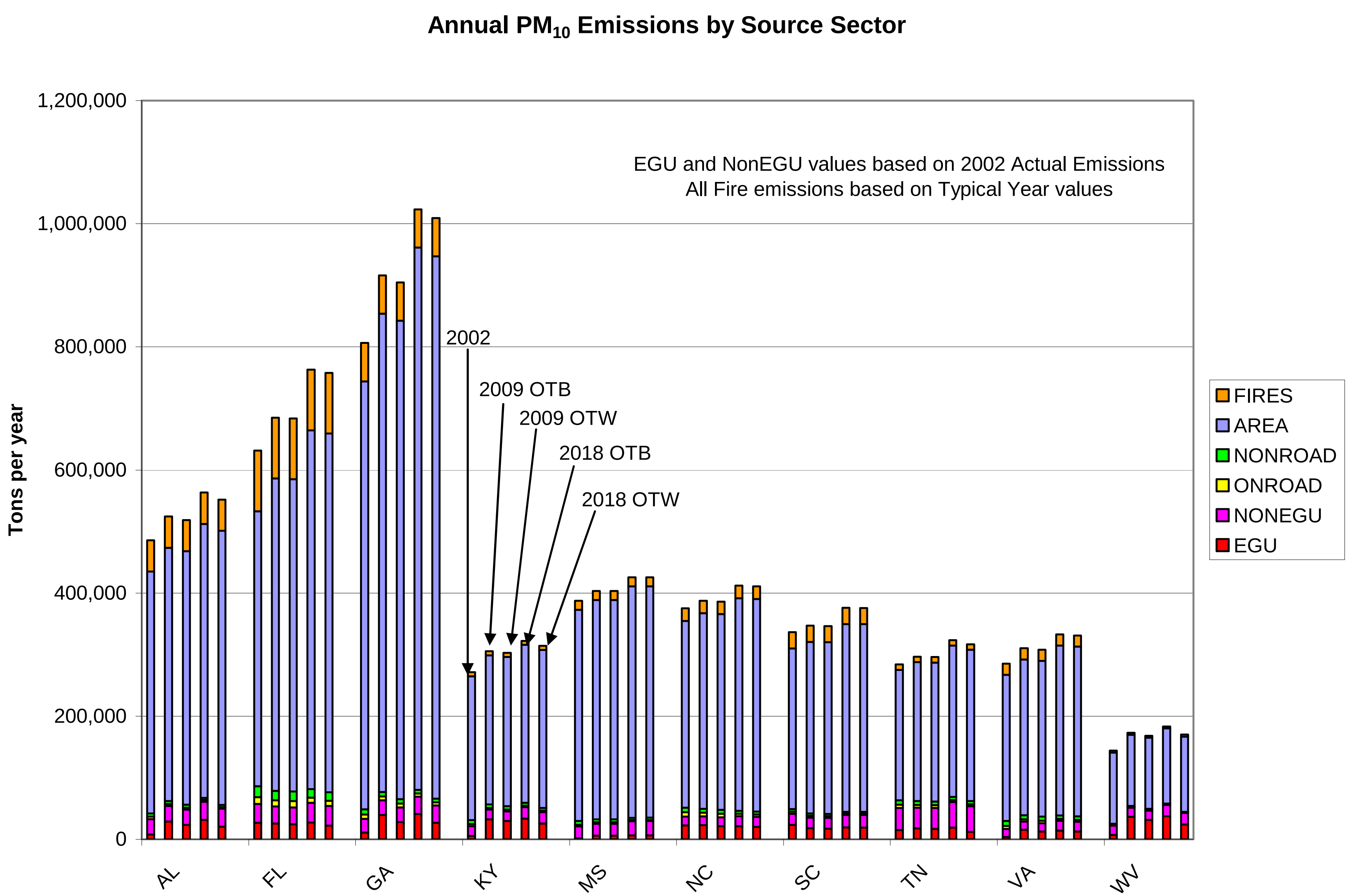
Annual NH_3 Emissions by Source Sector

Name	EGU	NONEGU	ONROAD	NONROAD	AREA	FIRES	YEAR	Basis
	89	1,883	5,576	32	59,486	1,957	2002	OTB - Typical 2002
	1,128	2,112	6,350	35	65,441	1,957	2009	OTB - Typical 2002
AL	1,344	2,112	6,350	35	65,441	1,957	2009	OTW - Typical 2002
	1,909	2,456	7,296	40	73,346	1,957	2018	OTB - Typical 2002
	2,173	2,456	7,296	40	73,346	1,957	2018	OTW - Typical 2002
	53	1,383	18,078	108	44,902	3,157	2002	OTB - Typical 2002
	2,524	1,605	21,737	119	46,950	3,157	2009	OTB - Typical 2002
FL	2,524	1,605	21,737	119	46,950	3,157	2009	OTW - Typical 2002
	4,022	1,905	26,154	138	49,889	3,157	2018	OTB - Typical 2002
	3,865	1,905	26,154	138	49,889	3,157	2018	OTW - Typical 2002
	5	3,613	10,524	54	84,230	2,153	2002	OTB - Typical 2002
	1,305	3,963	12,660	60	92,838	2,153	2009	OTB - Typical 2002
GA	1,376	3,963	12,660	60	92,838	2,153	2009	OTW - Typical 2002
	1,912	4,799	14,871	71	103,911	2,153	2018	OTB - Typical 2002
	2,057	4,799	14,871	71	103,911	2,153	2018	OTW - Typical 2002
	0	674	5,044	28	51,097	110	2002	OTB - Typical 2002
	717	733	5,795	30	53,023	110	2009	OTB - Typical 2002
KY	710	733	5,795	30	53,023	110	2009	OTW - Typical 2002
	763	839	6,584	36	55,356	110	2018	OTB - Typical 2002
	771	839	6,584	36	55,356	110	2018	OTW - Typical 2002
	97	1,169	3,577	23	59,262	177	2002	OTB - Typical 2002
	388	667	4,026	26	64,289	177	2009	OTB - Typical 2002
MS	407	667	4,026	26	64,289	177	2009	OTW - Typical 2002
	686	761	4,565	30	70,565	177	2018	OTB - Typical 2002
	872	761	4,565	30	70,565	177	2018	OTW - Typical 2002
	35	1,171	10,455	61	164,467	324	2002	OTB - Typical 2002
	577	1,255	12,637	68	173,187	324	2009	OTB - Typical 2002
NC	574	1,255	12,637	68	173,187	324	2009	OTW - Typical 2002
	740	1,412	13,077	79	184,167	324	2018	OTB - Typical 2002
	781	1,412	13,077	79	184,167	324	2018	OTW - Typical 2002
	0	1,411	4,684	29	29,447	908	2002	OTB - Typical 2002
	409	1,578	5,510	32	31,966	908	2009	OTB - Typical 2002
SC	422	1,578	5,510	32	31,966	908	2009	OTW - Typical 2002
	702	1,779	6,472	37	35,082	908	2018	OTB - Typical 2002
	742	1,779	6,472	37	35,082	908	2018	OTW - Typical 2002
	0	1,620	6,616	41	35,571	46	2002	OTB - Typical 2002
	406	1,861	7,738	45	36,578	46	2009	OTB - Typical 2002
TN	400	1,861	7,738	45	36,578	46	2009	OTW - Typical 2002
	427	2,240	8,962	53	37,812	46	2018	OTB - Typical 2002
	394	2,240	8,962	53	37,812	46	2018	OTW - Typical 2002
	122	3,097	7,837	44	46,221	159	2002	OTB - Typical 2002
	396	3,057	9,066	48	49,173	159	2009	OTB - Typical 2002
VA	439	3,057	9,066	48	49,173	159	2009	OTW - Typical 2002
	759	3,620	10,757	57	53,023	159	2018	OTB - Typical 2002
	783	3,620	10,757	57	53,023	159	2018	OTW - Typical 2002
	12	331	1,933	10	10,779	12	2002	OTB - Typical 2002
	691	342	2,183	11	11,461	12	2009	OTB - Typical 2002
WV	673	342	2,183	11	11,461	12	2009	OTW - Typical 2002
	722	416	2,484	13	12,390	12	2018	OTB - Typical 2002
	719	416	2,484	13	12,390	12	2018	OTW - Typical 2002


Annual NOx Emissions by Source Sector
EGU and NonEGU values based on 2002 Typical Emissions
All Fire emissions based on Typical Year values
Tons per year
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
2002
2009 OTB
2009 OTW
2018 OTB
2018 OTW
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV
FIRES
AREA
NONROAD
ONROAD
NONEGU
EGU

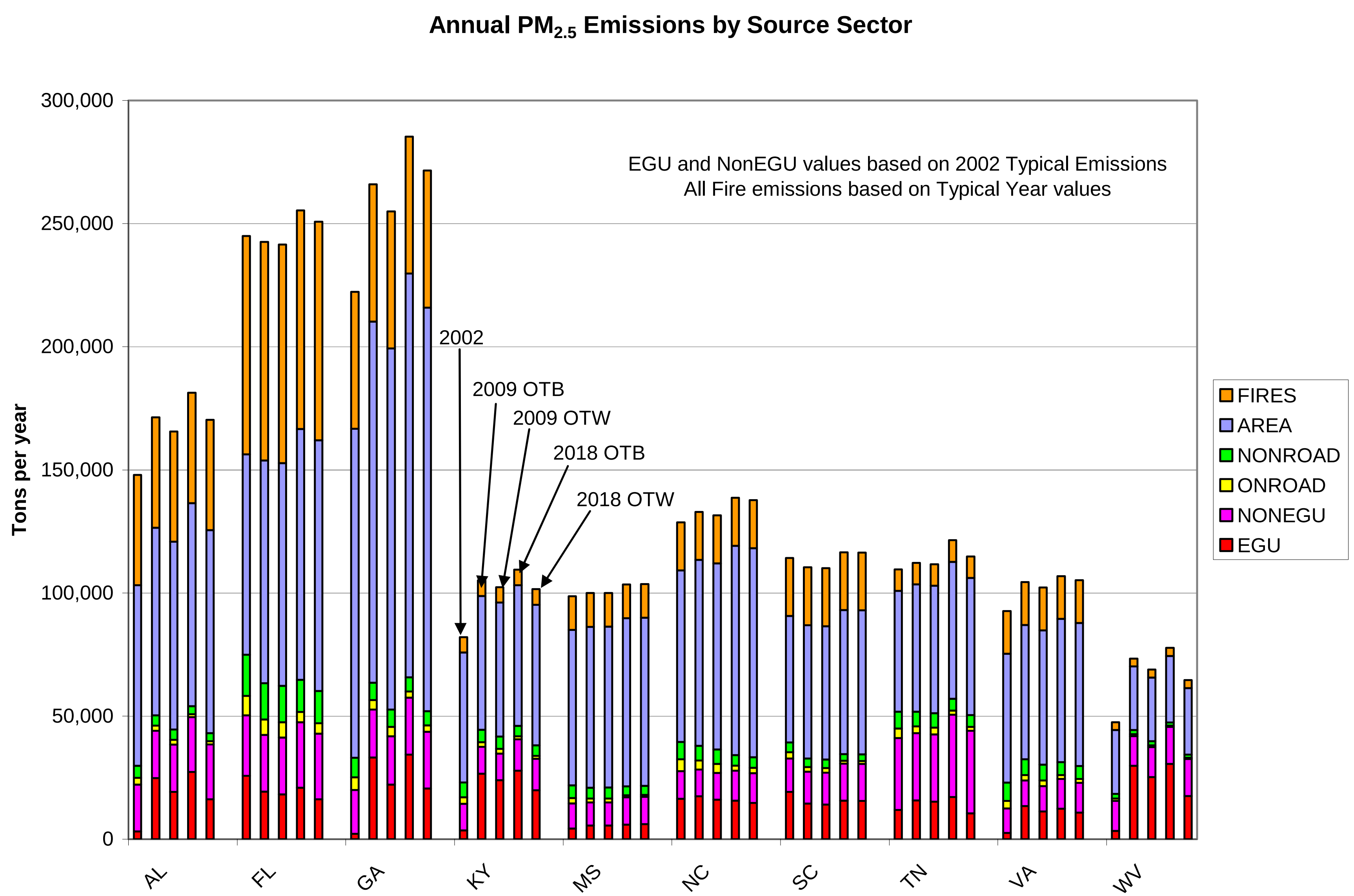
Annual NO_x Emissions by Source Sector

Name	EGU	NONEGU	ONROAD	NONROAD	AREA	FIRES	YEAR	Basis
	153,349	83,868	158,423	64,891	23,444	11,456	2002	OTB - Typical 2002
	131,988	80,738	101,323	55,494	26,482	11,456	2009	OTB - Typical 2002
AL	132,323	70,644	101,323	55,494	26,482	11,456	2009	OTW - Typical 2002
	135,010	91,052	46,222	42,573	28,754	11,456	2018	OTB - Typical 2002
	39,942	80,031	46,222	42,573	28,754	11,456	2018	OTW - Typical 2002
	247,099	59,517	466,098	150,519	29,477	19,791	2002	OTB - Typical 2002
	148,522	67,533	314,307	136,851	31,821	19,791	2009	OTB - Typical 2002
FL	147,801	67,533	314,307	136,851	31,821	19,791	2009	OTW - Typical 2002
	159,004	77,551	154,611	111,959	35,047	19,791	2018	OTB - Typical 2002
	59,446	77,551	154,611	111,959	35,047	19,791	2018	OTW - Typical 2002
	120,785	52,425	308,013	91,386	36,105	13,882	2002	OTB - Typical 2002
	131,901	53,008	208,393	79,049	38,876	13,882	2009	OTB - Typical 2002
GA	119,425	53,008	208,393	79,049	38,876	13,882	2009	OTW - Typical 2002
	128,938	59,005	99,821	60,650	42,260	13,882	2018	OTB - Typical 2002
	65,559	59,005	99,821	60,650	42,260	13,882	2018	OTW - Typical 2002
	209,802	38,460	154,899	101,261	39,507	1,460	2002	OTB - Typical 2002
	178,930	37,960	97,912	90,803	42,122	1,460	2009	OTB - Typical 2002
KY	177,272	37,201	97,912	90,803	42,122	1,460	2009	OTW - Typical 2002
	182,192	41,776	42,104	77,295	45,597	1,460	2018	OTB - Typical 2002
	64,674	40,948	42,104	77,295	45,597	1,460	2018	OTW - Typical 2002
	27,254	76,906	111,791	90,686	4,200	3,328	2002	OTB - Typical 2002
	38,911	70,463	69,949	81,780	4,789	3,328	2009	OTB - Typical 2002
MS	38,978	70,463	69,949	81,780	4,789	3,328	2009	OTW - Typical 2002
	38,355	76,738	29,717	68,781	5,230	3,328	2018	OTB - Typical 2002
	11,206	76,738	29,717	68,781	5,230	3,328	2018	OTW - Typical 2002
	144,730	50,393	341,198	81,448	48,730	5,005	2002	OTB - Typical 2002
	66,598	46,242	207,648	66,382	53,550	5,005	2009	OTB - Typical 2002
NC	67,051	46,242	207,648	66,382	53,550	5,005	2009	OTW - Typical 2002
	64,537	50,044	81,706	45,146	60,073	5,005	2018	OTB - Typical 2002
	59,917	50,044	81,706	45,146	60,073	5,005	2018	OTW - Typical 2002
	85,555	44,123	140,428	46,789	19,332	5,270	2002	OTB - Typical 2002
	50,433	43,799	91,696	39,544	20,852	5,270	2009	OTB - Typical 2002
SC	50,128	42,944	91,696	39,544	20,852	5,270	2009	OTW - Typical 2002
	55,103	48,314	42,354	29,512	22,467	5,270	2018	OTB - Typical 2002
	36,264	47,403	42,354	29,512	22,467	5,270	2018	OTW - Typical 2002
	155,028	73,384	233,324	95,968	17,829	2,232	2002	OTB - Typical 2002
	106,979	62,435	147,757	85,084	19,148	2,232	2009	OTB - Typical 2002
TN	104,528	61,176	147,757	85,084	19,148	2,232	2009	OTW - Typical 2002
	112,411	69,374	65,242	69,093	20,928	2,232	2018	OTB - Typical 2002
	32,411	67,999	65,242	69,093	20,928	2,232	2018	OTW - Typical 2002
	82,911	61,528	219,602	58,524	51,418	978	2002	OTB - Typical 2002
	64,950	64,298	133,170	50,120	53,344	978	2009	OTB - Typical 2002
VA	62,810	60,027	133,170	50,120	53,344	978	2009	OTW - Typical 2002
	56,716	71,480	61,881	36,970	56,668	978	2018	OTB - Typical 2002
	40,045	66,931	61,881	36,970	56,668	978	2018	OTW - Typical 2002
	222,090	46,715	59,612	34,442	12,687	944	2002	OTB - Typical 2002
	173,977	42,140	36,049	31,148	13,816	944	2009	OTB - Typical 2002
WV	174,572	40,469	36,049	31,148	13,816	944	2009	OTW - Typical 2002
	170,522	46,846	16,274	26,279	15,079	944	2018	OTB - Typical 2002
	42,227	44,944	16,274	26,279	15,079	944	2018	OTW - Typical 2002


Annual PM10 Emissions by Source Sector
EGU and NonEGU values based on 2002 Actual Emissions
All Fire emissions based on Typical Year values
Tons per year
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
2002
2009 OTB
2009 OTW
2018 OTB
2018 OTW
FIRES
AREA
NONROAD
ONROAD
NONEGU
EGU
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV

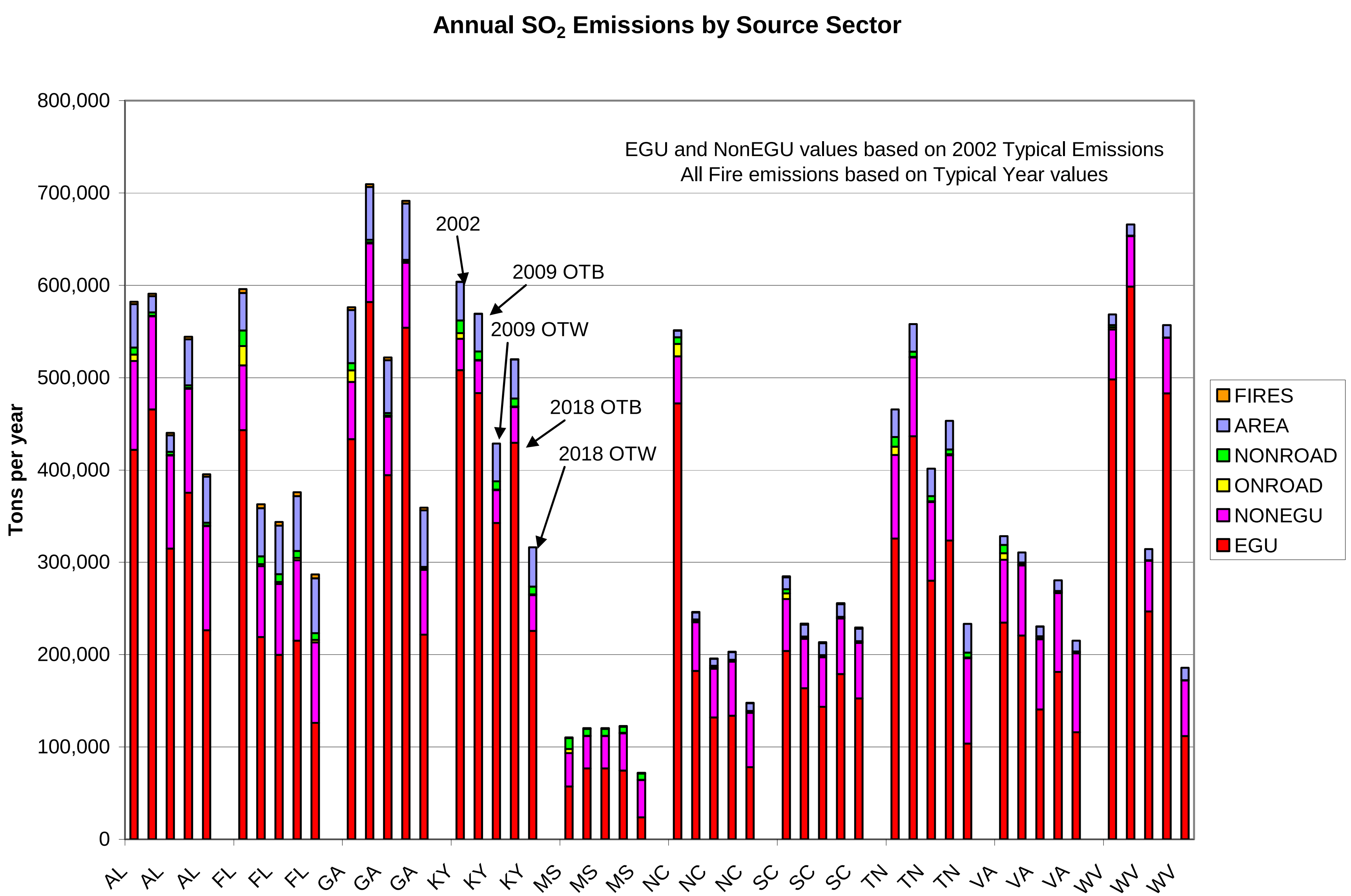
Annual PM_{10} Emissions by Source Sector

Name	EGU	NONEGU	ONROAD	NONROAD	AREA	FIRES	YEAR	Basis
	5,737	24,957	3,898	5,331	393,093	50,833	2002	OTB - Typical 2002
	29,053	25,161	3,188	4,597	411,614	50,833	2009	OTB - Typical 2002
AL	23,250	25,161	3,188	4,597	411,614	50,833	2009	OTW - Typical 2002
	31,815	29,278	2,488	3,690	445,168	50,833	2018	OTB - Typical 2002
	20,450	29,278	2,488	3,690	445,168	50,833	2018	OTW - Typical 2002
	33,182	28,882	11,253	17,692	446,821	98,470	2002	OTB - Typical 2002
	25,779	27,531	9,953	15,630	507,515	98,470	2009	OTB - Typical 2002
FL	24,493	27,531	9,953	15,630	507,515	98,470	2009	OTW - Typical 2002
	27,320	31,890	8,489	13,827	582,832	98,470	2018	OTB - Typical 2002
	22,204	31,890	8,489	13,827	582,832	98,470	2018	OTW - Typical 2002
	5,447	22,058	7,236	8,295	695,320	62,336	2002	OTB - Typical 2002
	39,580	23,861	6,103	7,368	776,935	62,336	2009	OTB - Typical 2002
GA	28,118	23,861	6,103	7,368	776,935	62,336	2009	OTW - Typical 2002
	41,221	28,177	4,995	6,068	880,800	62,336	2018	OTB - Typical 2002
	26,905	28,177	4,995	6,068	880,800	62,336	2018	OTW - Typical 2002
	6,000	15,613	3,720	6,389	233,559	6,667	2002	OTB - Typical 2002
	32,406	15,858	3,002	5,312	242,345	6,667	2009	OTB - Typical 2002
KY	29,606	15,858	3,002	5,312	242,345	6,667	2009	OTW - Typical 2002
	33,784	18,587	2,283	4,602	256,544	6,667	2018	OTB - Typical 2002
	25,733	18,587	2,283	4,602	256,544	6,667	2018	OTW - Typical 2002
	4,783	19,680	2,856	5,551	343,377	14,693	2002	OTB - Typical 2002
	5,864	19,439	2,290	4,754	356,516	14,693	2009	OTB - Typical 2002
MS	5,883	19,439	2,290	4,754	356,516	14,693	2009	OTW - Typical 2002
	6,268	23,145	1,688	3,873	375,931	14,693	2018	OTB - Typical 2002
	6,459	23,145	1,688	3,873	375,931	14,693	2018	OTW - Typical 2002
	22,689	14,507	6,905	7,449	303,492	20,488	2002	OTB - Typical 2002
	23,028	14,301	5,861	6,210	317,847	20,488	2009	OTB - Typical 2002
NC	21,459	14,301	5,861	6,210	317,847	20,488	2009	OTW - Typical 2002
	21,417	16,002	4,299	4,474	345,275	20,488	2018	OTB - Typical 2002
	20,258	16,002	4,299	4,474	345,275	20,488	2018	OTW - Typical 2002
	23,492	18,149	3,446	4,211	260,858	26,304	2002	OTB - Typical 2002
	18,023	17,368	2,878	3,593	278,852	26,304	2009	OTB - Typical 2002
SC	17,493	17,368	2,878	3,593	278,852	26,304	2009	OTW - Typical 2002
	19,290	20,272	2,258	2,889	304,940	26,304	2018	OTB - Typical 2002
	19,182	20,272	2,258	2,889	304,940	26,304	2018	OTW - Typical 2002
	14,537	35,982	5,338	7,145	211,903	8,875	2002	OTB - Typical 2002
	17,735	33,838	4,238	6,218	225,650	8,875	2009	OTB - Typical 2002
TN	17,159	33,838	4,238	6,218	225,650	8,875	2009	OTW - Typical 2002
	19,103	41,466	3,199	5,019	245,893	8,875	2018	OTB - Typical 2002
	12,432	41,466	3,199	5,019	245,893	8,875	2018	OTW - Typical 2002
	3,790	12,799	4,537	7,928	237,577	18,160	2002	OTB - Typical 2002
	15,343	13,470	3,760	6,763	252,924	18,160	2009	OTB - Typical 2002
VA	12,804	13,470	3,760	6,763	252,924	18,160	2009	OTW - Typical 2002
	14,390	15,661	3,343	5,564	275,790	18,160	2018	OTB - Typical 2002
	12,653	15,661	3,343	5,564	275,790	18,160	2018	OTW - Typical 2002
	7,145	14,866	1,395	2,072	115,346	3,276	2002	OTB - Typical 2002
	36,442	14,926	1,096	1,819	115,410	3,276	2009	OTB - Typical 2002
WV	31,780	14,926	1,096	1,819	115,410	3,276	2009	OTW - Typical 2002
	37,425	18,433	844	1,381	121,964	3,276	2018	OTB - Typical 2002
	24,253	18,433	844	1,381	121,964	3,276	2018	OTW - Typical 2002


Annual $PM_{2.5}$ Emissions by Source Sector
EGU and NonEGU values based on 2002 Typical Emissions
All Fire emissions based on Typical Year values
300,000
250,000
200,000
150,000
100,000
50,000
0
Tons per year
2002
2009 OTB
2009 OTW
2018 OTB
2018 OTW
FIRES
AREA
NONROAD
ONROAD
NONEGU
EGU
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV

Annual $PM_{2.5}$ Emissions by Source Sector

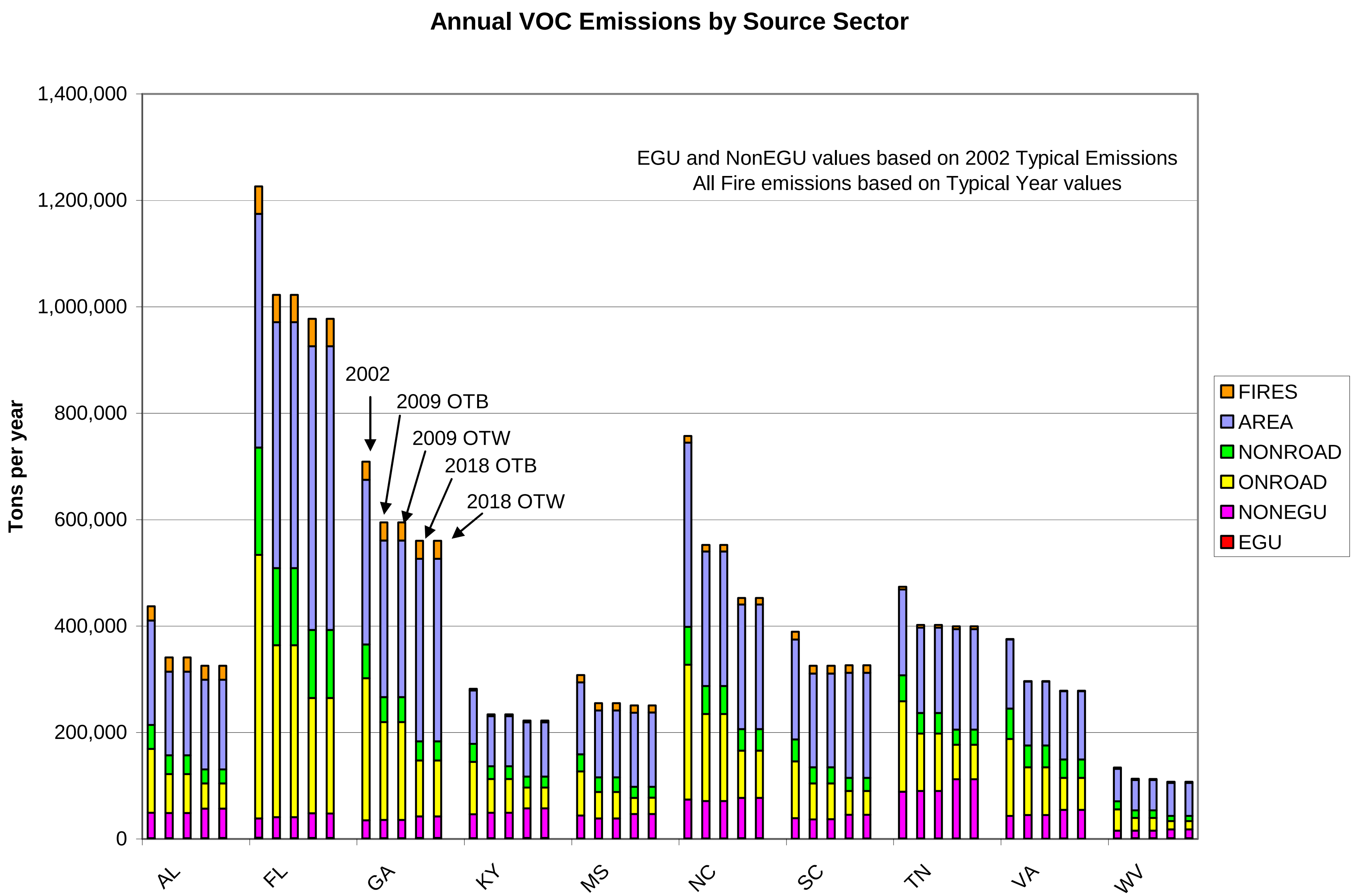
Name	EGU	NONEGU	ONROAD	NONROAD	AREA	FIRES	YEAR	Basis
	3,131	19,016	2,794	4,877	73,352	44,812	2002	OTB - Typical 2002
	24,875	19,184	2,049	4,144	76,248	44,812	2009	OTB - Typical 2002
AL	19,190	19,184	2,049	4,144	76,248	44,812	2009	OTW - Typical 2002
	27,280	22,268	1,262	3,231	82,449	44,812	2018	OTB - Typical 2002
	16,279	22,268	1,262	3,231	82,449	44,812	2018	OTW - Typical 2002
	25,761	24,569	7,852	16,739	81,341	88,756	2002	OTB - Typical 2002
	19,307	23,063	6,216	14,786	90,487	88,756	2009	OTB - Typical 2002
FL	18,186	23,063	6,216	14,786	90,487	88,756	2009	OTW - Typical 2002
	20,848	26,622	4,242	13,044	101,872	88,756	2018	OTB - Typical 2002
	16,278	26,622	4,242	13,044	101,872	88,756	2018	OTW - Typical 2002
	2,137	17,893	5,158	7,899	133,542	55,712	2002	OTB - Typical 2002
	33,111	19,562	3,869	7,014	146,691	55,712	2009	OTB - Typical 2002
GA	22,163	19,562	3,869	7,014	146,691	55,712	2009	OTW - Typical 2002
	34,361	23,110	2,517	5,769	163,925	55,712	2018	OTB - Typical 2002
	20,549	23,110	2,517	5,769	163,925	55,712	2018	OTW - Typical 2002
	3,605	10,729	2,693	5,998	52,765	6,310	2002	OTB - Typical 2002
	26,640	10,837	1,941	4,978	54,397	6,310	2009	OTB - Typical 2002
KY	23,915	10,837	1,941	4,978	54,397	6,310	2009	OTW - Typical 2002
	27,857	12,738	1,160	4,289	57,110	6,310	2018	OTB - Typical 2002
	19,915	12,738	1,160	4,289	57,110	6,310	2018	OTW - Typical 2002
	4,384	10,187	2,109	5,200	63,135	13,680	2002	OTB - Typical 2002
	5,511	9,459	1,522	4,440	65,321	13,680	2009	OTB - Typical 2002
MS	5,530	9,459	1,522	4,440	65,321	13,680	2009	OTW - Typical 2002
	5,919	11,068	876	3,597	68,338	13,680	2018	OTB - Typical 2002
	6,110	11,068	876	3,597	68,338	13,680	2018	OTW - Typical 2002
	16,428	11,204	4,816	7,079	69,663	19,491	2002	OTB - Typical 2002
	17,449	10,888	3,643	5,889	75,570	19,491	2009	OTB - Typical 2002
NC	16,034	10,888	3,643	5,889	75,570	19,491	2009	OTW - Typical 2002
	15,636	12,136	2,158	4,215	85,018	19,491	2018	OTB - Typical 2002
	14,702	12,136	2,158	4,215	85,018	19,491	2018	OTW - Typical 2002
	19,238	13,565	2,496	3,985	51,413	23,511	2002	OTB - Typical 2002
	14,471	12,977	1,870	3,396	54,230	23,511	2009	OTB - Typical 2002
SC	14,079	12,977	1,870	3,396	54,230	23,511	2009	OTW - Typical 2002
	15,601	15,092	1,154	2,718	58,441	23,511	2018	OTB - Typical 2002
	15,509	15,092	1,154	2,718	58,441	23,511	2018	OTW - Typical 2002
	11,918	29,130	3,919	6,756	49,131	8,730	2002	OTB - Typical 2002
	15,770	27,313	2,782	5,873	51,753	8,730	2009	OTB - Typical 2002
TN	15,228	27,313	2,782	5,873	51,753	8,730	2009	OTW - Typical 2002
	17,103	33,502	1,643	4,724	55,712	8,730	2018	OTB - Typical 2002
	10,514	33,502	1,643	4,724	55,712	8,730	2018	OTW - Typical 2002
	2,559	9,868	3,090	7,486	52,271	17,361	2002	OTB - Typical 2002
	13,451	10,368	2,254	6,388	54,587	17,361	2009	OTB - Typical 2002
VA	11,237	10,368	2,254	6,388	54,587	17,361	2009	OTW - Typical 2002
	12,366	12,062	1,641	5,241	58,141	17,361	2018	OTB - Typical 2002
	10,755	12,062	1,641	5,241	58,141	17,361	2018	OTW - Typical 2002
	3,356	12,154	1,003	1,941	25,850	3,239	2002	OTB - Typical 2002
	29,773	12,138	703	1,699	25,835	3,239	2009	OTB - Typical 2002
WV	25,251	12,138	703	1,699	25,835	3,239	2009	OTW - Typical 2002
	30,628	15,045	428	1,284	27,088	3,239	2018	OTB - Typical 2002
	17,548	15,045	428	1,284	27,088	3,239	2018	OTW - Typical 2002



Annual SO_2 Emissions by Source Sector
Tons per year
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
EGU and NonEGU values based on 2002 Typical Emissions
All Fire emissions based on Typical Year values
2002
2009 OTB
2009 OTW
2018 OTB
2018 OTW
FIRES
AREA
NONROAD
ONROAD
NONEGU
EGU
AL
AL
AL
FL
FL
FL
GA
GA
GA
KY
KY
KY
MS
MS
MS
NC
NC
NC
SC
SC
SC
TN
TN
TN
VA
VA
VA
WV
WV
WV

Annual SO_2 Emissions by Source Sector

Name	EGU	NONEGU	ONROAD	NONROAD	AREA	FIRES	YEAR	Basis
AL	421,734	96,447	6,885	7,539	47,074	2,559	2002	OTB - Typical 2002
AL	465,576	100,845	635	3,463	17,818	2,559	2009	OTB - Typical 2002
AL	314,841	100,845	635	3,463	17,818	2,559	2009	OTW - Typical 2002
AL	375,305	112,771	720	2,815	49,975	2,559	2018	OTB - Typical 2002
AL	226,506	112,771	720	2,815	49,975	2,559	2018	OTW - Typical 2002
FL	443,152	70,165	20,872	17,023	40,537	4,129	2002	OTB - Typical 2002
FL	219,072	76,851	2,120	8,380	52,390	4,129	2009	OTB - Typical 2002
FL	199,834	76,851	2,120	8,380	52,390	4,129	2009	OTW - Typical 2002
FL	215,177	87,065	2,533	7,511	59,413	4,129	2018	OTB - Typical 2002
FL	126,280	87,065	2,533	7,511	59,413	4,129	2018	OTW - Typical 2002
GA	433,513	62,032	12,155	8,145	57,555	2,815	2002	OTB - Typical 2002
GA	582,078	63,348	1,254	2,588	57,377	2,815	2009	OTB - Typical 2002
GA	394,425	63,348	1,254	2,588	57,377	2,815	2009	OTW - Typical 2002
GA	554,013	70,386	1,458	1,702	61,155	2,815	2018	OTB - Typical 2002
GA	221,615	70,386	1,458	1,702	61,155	2,815	2018	OTW - Typical 2002
KY	508,139	34,026	5,974	13,739	41,805	136	2002	OTB - Typical 2002
KY	483,235	35,479	585	9,092	40,779	136	2009	OTB - Typical 2002
KY	342,670	35,479	585	9,092	40,779	136	2009	OTW - Typical 2002
KY	429,418	38,816	651	8,536	42,326	136	2018	OTB - Typical 2002
KY	225,772	38,816	651	8,536	42,326	136	2018	OTW - Typical 2002
MS	57,263	36,071	4,604	11,551	771	100	2002	OTB - Typical 2002
MS	76,855	35,028	397	7,232	637	100	2009	OTB - Typical 2002
MS	76,855	35,028	397	7,232	637	100	2009	OTW - Typical 2002
MS	74,505	40,318	441	6,638	831	100	2018	OTB - Typical 2002
MS	23,768	40,318	441	6,638	831	100	2018	OTW - Typical 2002
NC	472,192	51,049	13,343	7,207	7,096	423	2002	OTB - Typical 2002
NC	182,356	52,693	1,311	1,798	7,607	423	2009	OTB - Typical 2002
NC	132,054	52,693	1,311	1,798	7,607	423	2009	OTW - Typical 2002
NC	133,691	58,671	1,323	838	8,273	423	2018	OTB - Typical 2002
NC	78,205	58,671	1,323	838	8,273	423	2018	OTW - Typical 2002
SC	203,978	56,329	5,958	4,449	12,900	1,187	2002	OTB - Typical 2002
SC	163,560	53,746	556	1,633	12,945	1,187	2009	OTB - Typical 2002
SC	143,492	53,746	556	1,633	12,945	1,187	2009	OTW - Typical 2002
SC	178,938	60,300	643	1,195	13,517	1,187	2018	OTB - Typical 2002
SC	152,457	60,300	643	1,195	13,517	1,187	2018	OTW - Typical 2002
TN	325,779	90,374	9,184	10,413	29,897	59	2002	OTB - Typical 2002
TN	436,453	85,275	831	5,649	29,787	59	2009	OTB - Typical 2002
TN	279,931	85,275	831	5,649	29,787	59	2009	OTW - Typical 2002
TN	323,654	92,396	944	5,205	31,047	59	2018	OTB - Typical 2002
TN	103,602	92,396	944	5,205	31,047	59	2018	OTW - Typical 2002
VA	234,714	68,038	7,218	8,796	9,510	99	2002	OTB - Typical 2002
VA	220,686	76,081	900	2,248	10,619	99	2009	OTB - Typical 2002
VA	140,665	76,081	900	2,248	10,619	99	2009	OTW - Typical 2002
VA	181,338	85,351	1,059	1,217	11,479	99	2018	OTB - Typical 2002
VA	115,987	85,351	1,059	1,217	11,479	99	2018	OTW - Typical 2002
WV	497,991	54,045	2,489	2,305	11,667	16	2002	OTB - Typical 2002
WV	598,555	54,701	227	392	12,156	16	2009	OTB - Typical 2002
WV	246,851	54,701	227	392	12,156	16	2009	OTW - Typical 2002
WV	482,959	60,141	255	56	13,450	16	2018	OTB - Typical 2002
WV	111,937	60,141	255	56	13,450	16	2018	OTW - Typical 2002


Annual VOC Emissions by Source Sector
EGU and NonEGU values based on 2002 Typical Emissions
All Fire emissions based on Typical Year values
Tons per year
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
2002
2009 OTB
2009 OTW
2018 OTB
2018 OTW
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV
FIRES
AREA
NONROAD
ONROAD
NONEGU
EGU

Annual VOC Emissions by Source Sector

Name	EGU	NONEGU	ONROAD	NONROAD	AREA	FIRES	YEAR	Basis
	1,501	47,893	119,790	44,978	196,538	26,526	2002	OTB - Typical 2002
	1,261	47,600	72,848	35,498	157,405	26,526	2009	OTB - Typical 2002
AL	1,312	47,600	72,848	35,498	157,405	26,526	2009	OTW - Typical 2002
	1,574	55,373	47,296	26,338	168,507	26,526	2018	OTB - Typical 2002
	1,612	55,373	47,296	26,338	168,507	26,526	2018	OTW - Typical 2002
	2,362	36,301	495,225	201,960	439,019	51,527	2002	OTB - Typical 2002
	1,562	39,255	323,290	144,749	462,198	51,527	2009	OTB - Typical 2002
FL	1,559	39,255	323,290	144,749	462,198	51,527	2009	OTW - Typical 2002
	2,052	46,049	216,620	128,131	533,141	51,527	2018	OTB - Typical 2002
	1,988	46,049	216,620	128,131	533,141	51,527	2018	OTW - Typical 2002
	984	33,753	267,378	63,337	309,411	33,918	2002	OTB - Typical 2002
	1,497	34,153	184,239	46,722	294,204	33,918	2009	OTB - Typical 2002
GA	1,499	34,153	184,239	46,722	294,204	33,918	2009	OTW - Typical 2002
	1,794	40,354	105,507	36,014	342,661	33,918	2018	OTB - Typical 2002
	1,790	40,354	105,507	36,014	342,661	33,918	2018	OTW - Typical 2002
	1,518	44,854	98,311	34,156	100,174	3,338	2002	OTB - Typical 2002
	1,594	47,733	63,258	23,980	94,253	3,338	2009	OTB - Typical 2002
KY	1,580	47,733	63,258	23,980	94,253	3,338	2009	OTW - Typical 2002
	1,635	55,729	39,084	20,795	102,117	3,338	2018	OTB - Typical 2002
	1,616	55,729	39,084	20,795	102,117	3,338	2018	OTW - Typical 2002
	696	43,401	82,810	32,401	135,106	13,625	2002	OTB - Typical 2002
	584	38,119	49,670	27,650	125,382	13,625	2009	OTB - Typical 2002
MS	590	38,119	49,670	27,650	125,382	13,625	2009	OTW - Typical 2002
	766	45,966	30,734	20,576	139,419	13,625	2018	OTB - Typical 2002
	827	45,966	30,734	20,576	139,419	13,625	2018	OTW - Typical 2002
	1,043	72,856	253,374	71,378	346,060	12,499	2002	OTB - Typical 2002
	1,100	70,146	163,803	52,430	252,553	12,499	2009	OTB - Typical 2002
NC	1,093	70,146	163,803	52,430	252,553	12,499	2009	OTW - Typical 2002
	1,183	75,985	88,620	40,576	234,207	12,499	2018	OTB - Typical 2002
	1,172	75,985	88,620	40,576	234,207	12,499	2018	OTW - Typical 2002
	438	38,493	106,792	41,374	187,466	14,666	2002	OTB - Typical 2002
	601	36,410	67,281	30,531	176,104	14,666	2009	OTB - Typical 2002
SC	626	36,410	67,281	30,531	176,104	14,666	2009	OTW - Typical 2002
	745	44,586	44,700	24,989	196,946	14,666	2018	OTB - Typical 2002
	754	44,586	44,700	24,989	196,946	14,666	2018	OTW - Typical 2002
	819	87,975	169,914	49,056	161,069	5,153	2002	OTB - Typical 2002
	866	89,128	108,200	38,686	160,265	5,153	2009	OTB - Typical 2002
TN	854	89,128	108,200	38,686	160,265	5,153	2009	OTW - Typical 2002
	899	111,372	64,665	28,667	188,977	5,153	2018	OTB - Typical 2002
	826	111,372	64,665	28,667	188,977	5,153	2018	OTW - Typical 2002
	672	42,589	144,684	57,050	129,792	912	2002	OTB - Typical 2002
	546	44,359	89,678	40,897	120,022	912	2009	OTB - Typical 2002
VA	503	44,359	89,678	40,897	120,022	912	2009	OTW - Typical 2002
	694	53,968	60,454	34,412	128,160	912	2018	OTB - Typical 2002
	674	53,968	60,454	34,412	128,160	912	2018	OTW - Typical 2002
	1,128	14,599	40,066	14,805	61,490	2,184	2002	OTB - Typical 2002
	1,442	14,015	23,907	14,249	57,082	2,184	2009	OTB - Typical 2002
WV	1,397	14,015	23,907	14,249	57,082	2,184	2009	OTW - Typical 2002
	1,471	16,636	15,463	9,500	62,164	2,184	2018	OTB - Typical 2002
	1,456	16,636	15,463	9,500	62,164	2,184	2018	OTW - Typical 2002

Appendix B: State VMT Totals

Million Miles Per Year

2002	LDGV	LDGT1	LDGT2	HDDV	LDDV	LDDT	HDDV	MC	TOTAL
AL	31,982	12,728	4,347	1,630	63	69	4,709	196	55,723
FL	105,340	40,835	13,945	5,079	206	220	12,465	591	178,681
GA	61,660	24,394	8,331	3,103	121	132	8,673	371	106,785
KY	28,751	12,189	3,366	1,606	55	55	4,827	171	51,020
MS	23,933	6,724	439	1,025	330	125	3,610	92	36,278
NC	51,189	30,339	10,787	4,119	230	230	9,440	461	106,795
SC	26,672	10,750	3,671	1,395	52	58	4,306	171	47,074
TN	30,809	20,272	6,922	2,943	52	111	6,810	397	68,316
VA	36,336	24,784	8,667	2,148	61	139	4,969	369	77,472
WV	9,010	5,931	2,028	732	25	37	1,664	117	19,544

2009	LDGV	LDGT1	LDGT2	HDDV	LDDV	LDDT	HDDV	MC	TOTAL
AL	30,638	18,598	5,511	2,069	65	72	5,976	249	63,178
FL	107,641	62,449	18,697	6,820	215	230	16,743	794	213,590
GA	61,569	36,641	10,933	4,077	126	137	11,374	487	125,343
KY	28,006	16,984	4,428	1,983	58	57	5,983	231	57,729
MS	23,641	10,131	573	1,341	356	135	4,719	120	41,017
NC	48,495	43,484	15,122	4,576	40	224	10,928	527	123,396
SC	26,451	16,119	4,796	1,824	55	61	5,617	223	55,147
TN	28,775	28,650	8,521	3,627	52	111	8,391	490	78,615
VA	33,663	34,814	10,597	2,624	61	137	6,073	451	88,419
WV	8,128	8,205	2,427	878	25	37	1,995	140	21,835

2018	LDGV	LDGT1	LDGT2	HDDV	LDDV	LDDT	HDDV	MC	TOTAL
AL	31,706	23,562	6,990	2,634	67	84	7,607	317	72,966
FL	116,576	83,385	24,996	9,156	221	301	22,491	1,066	258,191
GA	65,214	47,687	14,245	5,332	129	171	14,853	637	148,269
KY	29,353	21,058	5,558	2,463	60	66	7,454	288	66,300
MS	24,787	12,984	736	1,727	372	159	6,076	155	46,996
NC	42,247	51,568	18,260	4,985	279	279	11,396	553	129,566
SC	27,930	20,880	6,220	2,375	57	75	7,306	290	65,133
TN	29,253	35,702	10,629	4,538	52	130	10,500	613	91,417
VA	35,030	44,438	13,543	3,358	62	164	7,770	578	104,944
WV	8,130	10,025	2,969	1,078	25	41	2,451	172	24,891

Appendix C: State Tier 1 Emission Totals

State	Year	TIER1	TIER 1 NAME	CO	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
AL	2002	01	FUEL COMB. ELEC. UTIL.	11,212	90	161,055	7,572	4,081	447,814	2,260
AL	2002	02	FUEL COMB. INDUSTRIAL	67,198	234	51,518	6,472	3,600	35,754	2,274
AL	2002	03	FUEL COMB. OTHER	70,498	169	19,237	6,411	5,527	39,605	56,120
AL	2002	04	CHEMICAL & ALLIED PRODUCT MFG	5,721	35	2,032	1,220	888	12,770	9,430
AL	2002	05	METALS PROCESSING	38,246	376	6,011	8,019	7,214	14,039	3,299
AL	2002	06	PETROLEUM & RELATED	13,606	0	878	194	155	22,991	4,024
AL	2002	07	OTHER INDUSTRIAL PROCESSES	47,676	1,468	25,252	22,544	9,471	17,904	25,304
AL	2002	08	SOLVENT UTILIZATION	216	0	226	149	126	3	116,945
AL	2002	09	STORAGE & TRANSPORT	174	0	230	1,086	636	13	19,720
AL	2002	10	WASTE DISPOSAL & RECYCLING	86,302	10	3,465	13,960	13,073	489	11,334
AL	2002	11	HIGHWAY VEHICLES	1,366,056	5,576	158,423	3,898	2,794	6,885	119,790
AL	2002	12	OFF-HIGHWAY	367,038	32	64,891	5,170	4,852	7,539	44,978
AL	2002	14	MISCELLANEOUS	442,778	61,032	9,343	409,252	96,706	2,559	21,686
	2002 Total			2,516,722	69,023	502,563	485,946	149,124	608,366	437,164
AL	2009	01	FUEL COMB. ELEC. UTIL.	18,761	1,267	133,210	23,315	19,214	314,899	2,326
AL	2009	02	FUEL COMB. INDUSTRIAL	65,503	331	36,986	5,748	3,241	35,173	2,104
AL	2009	03	FUEL COMB. OTHER	54,427	82	21,707	5,107	4,836	10,651	32,373
AL	2009	04	CHEMICAL & ALLIED PRODUCT MFG	5,930	38	2,265	1,137	842	13,655	9,346
AL	2009	05	METALS PROCESSING	39,082	500	6,056	8,041	7,225	16,643	3,322
AL	2009	06	PETROLEUM & RELATED	13,238	0	858	219	175	22,492	3,353
AL	2009	07	OTHER INDUSTRIAL PROCESSES	52,004	1,571	26,340	24,043	10,157	19,383	26,519
AL	2009	08	SOLVENT UTILIZATION	247	0	257	164	139	4	105,208
AL	2009	09	STORAGE & TRANSPORT	192	0	253	995	532	14	15,408
AL	2009	10	WASTE DISPOSAL & RECYCLING	87,224	11	3,631	14,502	13,483	588	11,203
AL	2009	11	HIGHWAY VEHICLES	942,793	6,350	101,323	3,188	2,049	635	72,848
AL	2009	12	OFF-HIGHWAY	408,424	35	55,494	4,393	4,113	3,463	35,498
AL	2009	14	MISCELLANEOUS	442,746	67,055	9,342	427,791	99,621	2,559	21,680
	2009 Total			2,130,569	77,239	397,721	518,644	165,626	440,161	341,188
AL	2018	01	FUEL COMB. ELEC. UTIL.	29,062	2,061	40,822	20,515	16,293	226,575	2,750
AL	2018	02	FUEL COMB. INDUSTRIAL	63,927	390	40,397	6,188	3,564	37,093	2,319
AL	2018	03	FUEL COMB. OTHER	47,774	188	23,314	6,253	5,320	42,515	22,989
AL	2018	04	CHEMICAL & ALLIED PRODUCT MFG	7,163	46	2,795	1,383	1,024	16,503	11,570
AL	2018	05	METALS PROCESSING	49,219	674	7,349	9,456	8,458	21,754	4,147
AL	2018	06	PETROLEUM & RELATED	13,000	0	848	255	205	22,231	3,436
AL	2018	07	OTHER INDUSTRIAL PROCESSES	60,452	1,732	30,831	27,545	11,764	21,843	30,267
AL	2018	08	SOLVENT UTILIZATION	301	0	317	200	169	4	127,227
AL	2018	09	STORAGE & TRANSPORT	234	0	307	1,172	626	17	13,707
AL	2018	10	WASTE DISPOSAL & RECYCLING	88,757	13	3,863	15,342	14,142	716	11,933
AL	2018	11	HIGHWAY VEHICLES	797,966	7,296	46,222	2,488	1,262	720	47,296
AL	2018	12	OFF-HIGHWAY	443,100	40	42,573	3,430	3,193	2,815	26,338
AL	2018	14	MISCELLANEOUS	442,697	74,827	9,341	457,680	104,283	2,559	21,672
	2018 Total			2,043,654	87,268	248,978	551,907	170,302	395,346	325,652

State Tier 1 Emission Totals

State	Year	TIER1	TIER 1 NAME	CO	NH3	NOX	PM10	PM2.5	SO2	VOC
FL	2002	01	FUEL COMB. ELEC. UTIL.	59,315	67	261,523	21,387	15,643	453,631	2,524
FL	2002	02	FUEL COMB. INDUSTRIAL	64,798	131	45,157	20,442	18,547	42,524	4,219
FL	2002	03	FUEL COMB. OTHER	75,306	99	11,923	11,939	11,549	20,078	23,273
FL	2002	04	CHEMICAL & ALLIED PRODUCT MFG	745	1,101	2,221	1,868	1,488	34,462	15,156
FL	2002	05	METALS PROCESSING	1,404	1	194	449	334	882	82
FL	2002	06	PETROLEUM & RELATED	1,070	0	560	259	129	470	724
FL	2002	07	OTHER INDUSTRIAL PROCESSES	18,586	19	12,325	17,873	6,967	6,515	27,002
FL	2002	08	SOLVENT UTILIZATION	0	0	1	128	110	0	304,582
FL	2002	09	STORAGE & TRANSPORT	161	0	561	1,645	720	38	93,009
FL	2002	10	WASTE DISPOSAL & RECYCLING	175,989	351	6,123	22,142	21,604	659	17,449
FL	2002	11	HIGHWAY VEHICLES	4,693,893	18,078	466,098	11,253	7,852	20,872	495,225
FL	2002	12	OFF-HIGHWAY	1,731,519	108	150,519	17,692	16,739	17,023	201,960
FL	2002	14	MISCELLANEOUS	773,032	47,781	15,361	504,401	139,150	4,129	43,522
	2002 Total			7,595,820	67,736	972,564	631,479	240,834	601,283	1,228,727
FL	2009	01	FUEL COMB. ELEC. UTIL.	50,304	2,528	168,872	25,226	18,756	206,857	2,012
FL	2009	02	FUEL COMB. INDUSTRIAL	70,622	148	46,923	16,769	15,093	48,829	4,503
FL	2009	03	FUEL COMB. OTHER	67,324	118	11,699	11,482	10,993	25,574	16,930
FL	2009	04	CHEMICAL & ALLIED PRODUCT MFG	943	1,231	2,658	2,101	1,674	38,282	19,832
FL	2009	05	METALS PROCESSING	1,730	1	200	409	282	1,133	92
FL	2009	06	PETROLEUM & RELATED	1,354	0	708	328	164	594	814
FL	2009	07	OTHER INDUSTRIAL PROCESSES	19,156	26	13,580	19,933	7,668	7,013	27,581
FL	2009	08	SOLVENT UTILIZATION	0	0	1	144	124	0	340,232
FL	2009	09	STORAGE & TRANSPORT	199	0	606	1,126	482	42	81,438
FL	2009	10	WASTE DISPOSAL & RECYCLING	178,075	396	6,307	22,998	22,382	750	17,276
FL	2009	11	HIGHWAY VEHICLES	3,446,095	21,737	314,307	9,953	6,216	2,120	323,290
FL	2009	12	OFF-HIGHWAY	1,934,550	119	136,851	15,630	14,786	8,380	144,749
FL	2009	14	MISCELLANEOUS	773,925	49,786	15,392	557,494	142,875	4,129	43,830
	2009 Total			6,544,277	76,092	718,104	683,592	241,494	343,703	1,022,578
FL	2018	01	FUEL COMB. ELEC. UTIL.	69,462	3,869	84,504	23,018	16,904	133,713	2,529
FL	2018	02	FUEL COMB. INDUSTRIAL	81,092	160	51,703	19,215	17,279	55,813	5,140
FL	2018	03	FUEL COMB. OTHER	62,302	132	12,529	11,028	10,502	27,734	14,059
FL	2018	04	CHEMICAL & ALLIED PRODUCT MFG	1,252	1,448	3,352	2,599	2,089	44,470	26,697
FL	2018	05	METALS PROCESSING	2,220	2	255	530	363	1,512	119
FL	2018	06	PETROLEUM & RELATED	1,721	0	900	417	208	755	1,002
FL	2018	07	OTHER INDUSTRIAL PROCESSES	21,376	35	15,912	23,708	8,938	7,806	31,108
FL	2018	08	SOLVENT UTILIZATION	0	0	1	168	145	0	412,784
FL	2018	09	STORAGE & TRANSPORT	241	0	671	1,357	582	48	76,578
FL	2018	10	WASTE DISPOSAL & RECYCLING	180,978	484	6,570	24,175	23,451	906	18,381
FL	2018	11	HIGHWAY VEHICLES	3,086,330	26,154	154,611	8,489	4,242	2,533	216,620
FL	2018	12	OFF-HIGHWAY	2,179,296	138	111,959	13,827	13,044	7,511	128,131
FL	2018	14	MISCELLANEOUS	775,300	52,686	15,439	629,180	153,068	4,129	44,308
	2018 Total			6,461,570	85,109	458,405	757,712	250,813	286,931	977,456

State Tier 1 Emission Totals

State	Year	TIER1	TIER 1 NAME	CO	NH3	NOX	PM10	PM2.5	SO2	VOC
GA	2002	01	FUEL COMB. ELEC. UTIL.	9,712	5	147,517	11,224	4,939	514,952	1,244
GA	2002	02	FUEL COMB. INDUSTRIAL	59,492	27	53,039	12,002	7,883	88,791	3,923
GA	2002	03	FUEL COMB. OTHER	63,314	17	14,465	10,263	10,168	10,740	27,226
GA	2002	04	CHEMICAL & ALLIED PRODUCT MFG	5,387	920	2,277	409	320	2,721	6,507
GA	2002	05	METALS PROCESSING	330	0	60	147	94	0	70
GA	2002	06	PETROLEUM & RELATED	41	0	3	69	44	68	175
GA	2002	07	OTHER INDUSTRIAL PROCESSES	28,060	2,666	13,979	39,894	13,326	15,280	26,993
GA	2002	08	SOLVENT UTILIZATION	4	0	22	13	13	0	234,744
GA	2002	09	STORAGE & TRANSPORT	39	0	6	583	360	0	32,779
GA	2002	10	WASTE DISPOSAL & RECYCLING	203,892	16	6,872	29,227	28,311	312	18,964
GA	2002	11	HIGHWAY VEHICLES	2,833,468	10,524	308,013	7,236	5,158	12,155	267,378
GA	2002	12	OFF-HIGHWAY	700,427	54	91,386	8,295	7,899	8,145	63,337
GA	2002	14	MISCELLANEOUS	498,622	86,349	10,279	687,028	146,572	2,815	25,618
	2002 Total			4,402,788	100,579	647,917	806,389	225,088	655,980	708,956
GA	2009	01	FUEL COMB. ELEC. UTIL.	20,497	1,376	120,878	28,195	22,216	396,199	1,570
GA	2009	02	FUEL COMB. INDUSTRIAL	62,117	29	53,722	11,143	7,325	89,174	4,049
GA	2009	03	FUEL COMB. OTHER	55,617	20	16,503	9,556	9,437	11,509	17,422
GA	2009	04	CHEMICAL & ALLIED PRODUCT MFG	6,044	1,032	2,531	454	356	2,743	7,785
GA	2009	05	METALS PROCESSING	363	0	61	159	100	0	47
GA	2009	06	PETROLEUM & RELATED	50	0	4	83	54	82	155
GA	2009	07	OTHER INDUSTRIAL PROCESSES	30,089	2,902	13,766	45,634	15,040	15,083	28,439
GA	2009	08	SOLVENT UTILIZATION	4	0	25	14	14	0	232,675
GA	2009	09	STORAGE & TRANSPORT	45	0	7	650	401	0	27,323
GA	2009	10	WASTE DISPOSAL & RECYCLING	218,460	18	7,419	31,955	30,900	360	18,711
GA	2009	11	HIGHWAY VEHICLES	2,053,694	12,660	208,393	6,103	3,869	1,254	184,239
GA	2009	12	OFF-HIGHWAY	783,990	60	79,049	7,368	7,014	2,588	46,722
GA	2009	14	MISCELLANEOUS	498,495	94,954	10,276	763,407	158,285	2,815	25,595
	2009 Total			3,729,465	113,050	512,634	904,720	255,010	521,808	594,733
GA	2018	01	FUEL COMB. ELEC. UTIL.	29,480	2,057	67,241	27,000	20,613	223,548	1,877
GA	2018	02	FUEL COMB. INDUSTRIAL	66,498	31	57,560	11,649	7,673	95,546	4,289
GA	2018	03	FUEL COMB. OTHER	51,990	21	18,492	9,004	8,878	12,667	13,291
GA	2018	04	CHEMICAL & ALLIED PRODUCT MFG	7,076	1,208	2,982	541	426	3,436	10,186
GA	2018	05	METALS PROCESSING	421	0	76	185	118	0	55
GA	2018	06	PETROLEUM & RELATED	63	0	5	105	68	104	195
GA	2018	07	OTHER INDUSTRIAL PROCESSES	33,743	3,559	15,909	55,469	18,226	17,432	33,335
GA	2018	08	SOLVENT UTILIZATION	5	0	30	22	22	0	284,594
GA	2018	09	STORAGE & TRANSPORT	54	0	9	764	471	0	24,912
GA	2018	10	WASTE DISPOSAL & RECYCLING	235,736	22	8,128	35,280	34,038	423	20,411
GA	2018	11	HIGHWAY VEHICLES	1,765,020	14,871	99,821	4,995	2,517	1,458	105,507
GA	2018	12	OFF-HIGHWAY	868,018	71	60,650	6,068	5,769	1,702	36,014
GA	2018	14	MISCELLANEOUS	498,386	106,021	10,274	858,198	172,762	2,815	25,576
	2018 Total			3,556,490	127,861	341,177	1,009,280	271,581	359,132	560,243

State Tier 1 Emission Totals

State	Year	TIER1	TIER 1 NAME	CO	NH3	NOX	PM10	PM2.5	SO2	VOC
KY	2002	01	FUEL COMB. ELEC. UTIL.	12,619	0	198,817	4,700	2,802	484,057	1,487
KY	2002	02	FUEL COMB. INDUSTRIAL	14,109	182	60,674	2,154	1,463	41,825	1,565
KY	2002	03	FUEL COMB. OTHER	40,806	55	4,997	7,679	7,352	9,647	12,711
KY	2002	04	CHEMICAL & ALLIED PRODUCT MFG	176	214	296	774	581	2,345	3,462
KY	2002	05	METALS PROCESSING	89,197	6	1,082	3,394	2,718	12,328	1,508
KY	2002	06	PETROLEUM & RELATED	4,304	335	2,519	308	205	5,747	2,895
KY	2002	07	OTHER INDUSTRIAL PROCESSES	6,493	78	6,517	29,410	9,144	3,333	25,388
KY	2002	08	SOLVENT UTILIZATION	0	10	9	317	241	1	61,833
KY	2002	09	STORAGE & TRANSPORT	33	8	15	1,920	1,177	3	23,652
KY	2002	10	WASTE DISPOSAL & RECYCLING	51,579	8	2,684	11,267	10,515	605	10,052
KY	2002	11	HIGHWAY VEHICLES	1,260,682	5,044	154,899	3,720	2,693	5,974	98,311
KY	2002	12	OFF-HIGHWAY	289,967	28	101,261	6,389	5,998	13,739	34,156
KY	2002	14	MISCELLANEOUS	26,677	50,986	566	199,630	37,050	136	5,279
	2002 Total			1,796,641	56,954	534,335	271,661	81,938	579,740	282,299
KY	2009	01	FUEL COMB. ELEC. UTIL.	15,374	710	177,560	29,637	23,934	342,678	1,606
KY	2009	02	FUEL COMB. INDUSTRIAL	14,763	190	60,573	2,077	1,447	39,796	1,462
KY	2009	03	FUEL COMB. OTHER	37,124	59	5,648	7,264	6,968	9,924	9,416
KY	2009	04	CHEMICAL & ALLIED PRODUCT MFG	179	249	300	841	633	2,384	3,643
KY	2009	05	METALS PROCESSING	99,428	7	1,156	3,234	2,527	13,735	1,772
KY	2009	06	PETROLEUM & RELATED	4,572	351	2,655	310	218	6,039	2,908
KY	2009	07	OTHER INDUSTRIAL PROCESSES	7,212	84	6,674	29,709	9,357	3,634	27,547
KY	2009	08	SOLVENT UTILIZATION	0	10	11	364	279	1	63,592
KY	2009	09	STORAGE & TRANSPORT	38	9	18	1,582	973	3	19,057
KY	2009	10	WASTE DISPOSAL & RECYCLING	53,355	9	2,898	11,810	10,964	735	9,850
KY	2009	11	HIGHWAY VEHICLES	942,350	5,795	97,912	3,002	1,941	585	63,258
KY	2009	12	OFF-HIGHWAY	306,884	30	90,803	5,312	4,978	9,092	23,980
KY	2009	14	MISCELLANEOUS	26,545	52,899	563	207,648	38,160	136	6,051
	2009 Total			1,507,826	60,401	446,770	302,789	102,379	428,740	234,142
KY	2018	01	FUEL COMB. ELEC. UTIL.	15,232	771	65,008	25,770	19,937	225,781	1,646
KY	2018	02	FUEL COMB. INDUSTRIAL	15,890	209	65,166	2,231	1,571	41,008	1,599
KY	2018	03	FUEL COMB. OTHER	35,209	61	6,145	6,987	6,698	9,959	8,069
KY	2018	04	CHEMICAL & ALLIED PRODUCT MFG	219	317	367	1,040	775	2,884	4,389
KY	2018	05	METALS PROCESSING	114,470	9	1,508	3,882	3,053	15,800	2,343
KY	2018	06	PETROLEUM & RELATED	4,914	373	2,835	327	227	6,433	3,053
KY	2018	07	OTHER INDUSTRIAL PROCESSES	8,303	93	7,872	32,497	10,596	4,141	31,393
KY	2018	08	SOLVENT UTILIZATION	0	12	14	459	351	1	74,808
KY	2018	09	STORAGE & TRANSPORT	44	10	21	1,840	1,129	4	18,080
KY	2018	10	WASTE DISPOSAL & RECYCLING	55,685	11	3,185	12,524	11,559	902	10,518
KY	2018	11	HIGHWAY VEHICLES	782,423	6,584	42,104	2,283	1,160	651	39,084
KY	2018	12	OFF-HIGHWAY	349,285	36	77,295	4,602	4,289	8,536	20,795
KY	2018	14	MISCELLANEOUS	26,364	55,211	559	219,973	40,175	136	6,901
	2018 Total			1,408,039	63,697	272,077	314,416	101,521	316,236	222,678

State Tier 1 Emission Totals

State	Year	TIER1	TIER 1 NAME	CO	NH3	NOX	PM10	PM2.5	SO2	VOC
MS	2002	01	FUEL COMB. ELEC. UTIL.	5,390	64	44,557	1,750	1,255	67,440	674
MS	2002	02	FUEL COMB. INDUSTRIAL	22,624	28	47,278	4,893	3,521	9,734	7,999
MS	2002	03	FUEL COMB. OTHER	36,752	34	4,502	5,445	5,414	789	22,923
MS	2002	04	CHEMICAL & ALLIED PRODUCT MFG	15,410	361	1,725	849	440	1,663	2,381
MS	2002	05	METALS PROCESSING	1,031	0	115	122	58	36	371
MS	2002	06	PETROLEUM & RELATED	975	20	1,187	790	335	15,560	20,788
MS	2002	07	OTHER INDUSTRIAL PROCESSES	13,880	747	9,201	27,451	7,955	8,863	15,524
MS	2002	08	SOLVENT UTILIZATION	45	7	105	219	178	1	80,760
MS	2002	09	STORAGE & TRANSPORT	74	0	80	124	38	40	26,618
MS	2002	10	WASTE DISPOSAL & RECYCLING	45,709	9	1,399	4,886	4,780	31	3,926
MS	2002	11	HIGHWAY VEHICLES	894,639	3,577	111,791	2,856	2,109	4,604	82,810
MS	2002	12	OFF-HIGHWAY	213,779	23	90,686	5,551	5,200	11,551	32,401
MS	2002	14	MISCELLANEOUS	84,357	59,400	2,040	332,631	63,885	103	10,618
	2002 Total			1,334,666	64,274	314,666	387,568	95,167	120,414	307,794
MS	2009	01	FUEL COMB. ELEC. UTIL.	9,660	407	53,580	6,305	5,922	76,961	812
MS	2009	02	FUEL COMB. INDUSTRIAL	24,846	30	43,502	3,673	2,723	9,351	8,210
MS	2009	03	FUEL COMB. OTHER	36,030	36	5,118	5,481	5,449	651	18,052
MS	2009	04	CHEMICAL & ALLIED PRODUCT MFG	16,141	405	1,955	941	488	1,880	2,622
MS	2009	05	METALS PROCESSING	1,098	0	128	129	62	37	402
MS	2009	06	PETROLEUM & RELATED	1,087	22	1,254	882	372	15,300	13,254
MS	2009	07	OTHER INDUSTRIAL PROCESSES	14,175	197	8,355	31,183	8,499	8,251	16,281
MS	2009	08	SOLVENT UTILIZATION	50	8	118	239	194	1	80,975
MS	2009	09	STORAGE & TRANSPORT	92	0	100	112	35	49	22,712
MS	2009	10	WASTE DISPOSAL & RECYCLING	45,782	10	1,405	4,912	4,795	37	3,783
MS	2009	11	HIGHWAY VEHICLES	628,151	4,026	69,949	2,290	1,522	397	49,670
MS	2009	12	OFF-HIGHWAY	237,297	26	81,780	4,754	4,440	7,232	27,650
MS	2009	14	MISCELLANEOUS	84,335	64,424	2,042	342,674	65,452	103	10,613
	2009 Total			1,098,743	69,592	269,287	403,575	99,952	120,249	255,036
MS	2018	01	FUEL COMB. ELEC. UTIL.	15,639	872	25,831	6,887	6,503	23,882	1,049
MS	2018	02	FUEL COMB. INDUSTRIAL	27,939	33	47,460	4,194	3,087	9,327	9,131
MS	2018	03	FUEL COMB. OTHER	35,269	37	5,593	5,419	5,377	828	15,997
MS	2018	04	CHEMICAL & ALLIED PRODUCT MFG	20,175	475	2,337	1,132	588	2,242	3,300
MS	2018	05	METALS PROCESSING	1,357	0	167	160	79	48	461
MS	2018	06	PETROLEUM & RELATED	1,224	23	1,409	974	409	18,827	14,221
MS	2018	07	OTHER INDUSTRIAL PROCESSES	16,260	216	9,970	38,233	10,335	9,653	20,302
MS	2018	08	SOLVENT UTILIZATION	60	9	141	301	244	1	99,021
MS	2018	09	STORAGE & TRANSPORT	115	0	124	137	42	62	21,837
MS	2018	10	WASTE DISPOSAL & RECYCLING	45,933	12	1,425	4,973	4,827	43	3,910
MS	2018	11	HIGHWAY VEHICLES	528,898	4,565	29,717	1,688	876	441	30,734
MS	2018	12	OFF-HIGHWAY	252,658	30	68,781	3,873	3,597	6,638	20,576
MS	2018	14	MISCELLANEOUS	84,305	70,699	2,046	357,818	67,704	104	10,608
	2018 Total			1,029,833	76,970	195,000	425,790	103,669	72,096	251,146

State Tier 1 Emission Totals

State	Year	TIER1	TIER 1 NAME	CO	NH3	NOX	PM10	PM2.5	SO2	VOC
NC	2002	01	FUEL COMB. ELEC. UTIL.	13,885	27	151,849	22,650	16,498	477,990	988
NC	2002	02	FUEL COMB. INDUSTRIAL	52,826	651	60,748	32,238	26,827	34,983	3,465
NC	2002	03	FUEL COMB. OTHER	218,096	2,309	16,649	30,369	1,776	4,107	186,654
NC	2002	04	CHEMICAL & ALLIED PRODUCT MFG	13,952	535	859	866	538	5,736	4,313
NC	2002	05	METALS PROCESSING	5,876	60	201	564	467	1,010	2,512
NC	2002	06	PETROLEUM & RELATED	461	0	174	104	52	283	140
NC	2002	07	OTHER INDUSTRIAL PROCESSES	8,552	479	7,380	25,305	8,903	3,427	17,819
NC	2002	08	SOLVENT UTILIZATION	484	308	229	1,036	998	26	157,781
NC	2002	09	STORAGE & TRANSPORT	66	46	53	639	354	1	30,912
NC	2002	10	WASTE DISPOSAL & RECYCLING	240,120	249	10,812	11,904	12,934	1,646	23,349
NC	2002	11	HIGHWAY VEHICLES	3,176,811	10,455	341,198	6,905	4,816	13,343	253,374
NC	2002	12	OFF-HIGHWAY	725,734	61	81,448	7,449	7,079	7,207	71,378
NC	2002	14	MISCELLANEOUS	84,292	161,334	1,562	235,295	47,319	423	4,612
	2002 Total			4,541,154	176,515	673,163	375,323	128,560	550,182	757,296
NC	2009	01	FUEL COMB. ELEC. UTIL.	13,348	575	70,137	21,866	16,415	139,515	1,174
NC	2009	02	FUEL COMB. INDUSTRIAL	56,184	699	60,161	34,792	28,866	35,236	3,509
NC	2009	03	FUEL COMB. OTHER	159,959	2,711	18,687	23,803	1,890	4,217	105,369
NC	2009	04	CHEMICAL & ALLIED PRODUCT MFG	14,732	599	933	981	607	6,286	4,956
NC	2009	05	METALS PROCESSING	6,360	67	208	630	532	1,131	2,784
NC	2009	06	PETROLEUM & RELATED	575	0	217	129	65	353	166
NC	2009	07	OTHER INDUSTRIAL PROCESSES	9,163	479	8,001	28,123	9,451	3,701	17,219
NC	2009	08	SOLVENT UTILIZATION	554	331	216	952	914	24	140,694
NC	2009	09	STORAGE & TRANSPORT	75	52	55	644	343	1	30,746
NC	2009	10	WASTE DISPOSAL & RECYCLING	253,860	307	11,671	11,889	13,240	1,889	25,084
NC	2009	11	HIGHWAY VEHICLES	2,184,901	12,637	207,648	5,861	3,643	1,311	163,803
NC	2009	12	OFF-HIGHWAY	797,360	68	66,382	6,210	5,889	1,798	52,430
NC	2009	14	MISCELLANEOUS	84,155	169,521	1,559	250,281	49,661	423	4,588
	2009 Total			3,581,226	188,045	445,877	386,164	131,514	195,886	552,523
NC	2018	01	FUEL COMB. ELEC. UTIL.	16,303	782	63,239	20,706	15,120	86,385	1,268
NC	2018	02	FUEL COMB. INDUSTRIAL	64,314	801	66,143	40,755	33,879	38,813	3,937
NC	2018	03	FUEL COMB. OTHER	132,462	2,847	20,242	20,161	1,988	4,171	71,844
NC	2018	04	CHEMICAL & ALLIED PRODUCT MFG	18,463	702	1,105	1,175	726	7,414	6,162
NC	2018	05	METALS PROCESSING	7,578	76	256	775	661	1,336	3,482
NC	2018	06	PETROLEUM & RELATED	739	0	279	166	83	454	213
NC	2018	07	OTHER INDUSTRIAL PROCESSES	10,609	511	9,174	33,841	11,177	4,345	19,761
NC	2018	08	SOLVENT UTILIZATION	658	368	218	859	820	23	154,195
NC	2018	09	STORAGE & TRANSPORT	91	60	67	727	367	2	30,915
NC	2018	10	WASTE DISPOSAL & RECYCLING	270,665	387	12,759	11,914	13,693	2,208	27,515
NC	2018	11	HIGHWAY VEHICLES	1,510,848	13,077	81,706	4,299	2,158	1,323	88,620
NC	2018	12	OFF-HIGHWAY	863,536	79	45,146	4,474	4,215	838	40,576
NC	2018	14	MISCELLANEOUS	84,027	180,150	1,556	270,941	52,831	423	4,567
	2018 Total			2,980,293	199,840	301,890	410,793	137,718	147,735	453,056

State Tier 1 Emission Totals

State	Year	TIER1	TIER 1 NAME	CO	NH3	NOX	PM10	PM2.5	SO2	VOC
SC	2002	01	FUEL COMB. ELEC. UTIL.	6,990	0	88,241	23,511	19,269	206,399	470
SC	2002	02	FUEL COMB. INDUSTRIAL	31,771	97	38,081	5,582	4,218	44,958	1,338
SC	2002	03	FUEL COMB. OTHER	75,800	65	4,367	6,320	6,244	4,318	49,171
SC	2002	04	CHEMICAL & ALLIED PRODUCT MFG	2,526	173	25	589	343	59	29,914
SC	2002	05	METALS PROCESSING	13,833	0	450	1,434	1,188	4,160	660
SC	2002	06	PETROLEUM & RELATED	248	0	283	62	15	170	114
SC	2002	07	OTHER INDUSTRIAL PROCESSES	9,502	1,237	15,145	18,463	9,099	12,128	16,338
SC	2002	08	SOLVENT UTILIZATION	0	1	1	110	97	0	88,878
SC	2002	09	STORAGE & TRANSPORT	10	0	4	489	247	0	26,345
SC	2002	10	WASTE DISPOSAL & RECYCLING	67,908	10	4,063	9,190	8,666	625	15,291
SC	2002	11	HIGHWAY VEHICLES	1,275,161	4,684	140,428	3,446	2,496	5,958	106,792
SC	2002	12	OFF-HIGHWAY	367,575	29	46,789	4,211	3,985	4,449	41,374
SC	2002	14	MISCELLANEOUS	221,436	30,183	4,335	262,984	58,265	1,187	12,535
	2002 Total			2,072,760	36,478	342,212	336,391	114,132	284,411	389,220
SC	2009	01	FUEL COMB. ELEC. UTIL.	10,051	422	52,638	17,643	14,216	146,505	664
SC	2009	02	FUEL COMB. INDUSTRIAL	34,607	104	37,437	4,109	3,190	39,631	1,427
SC	2009	03	FUEL COMB. OTHER	55,315	72	5,068	5,891	5,817	4,821	27,844
SC	2009	04	CHEMICAL & ALLIED PRODUCT MFG	2,798	173	26	629	364	60	34,270
SC	2009	05	METALS PROCESSING	15,632	0	449	1,479	1,222	4,856	663
SC	2009	06	PETROLEUM & RELATED	302	0	340	73	18	200	131
SC	2009	07	OTHER INDUSTRIAL PROCESSES	10,480	1,403	14,637	20,333	9,800	13,443	15,838
SC	2009	08	SOLVENT UTILIZATION	1	1	1	126	111	0	96,484
SC	2009	09	STORAGE & TRANSPORT	13	0	5	515	260	0	21,957
SC	2009	10	WASTE DISPOSAL & RECYCLING	70,383	11	4,260	9,579	9,025	668	15,998
SC	2009	11	HIGHWAY VEHICLES	912,280	5,510	91,696	2,878	1,870	556	67,281
SC	2009	12	OFF-HIGHWAY	402,871	32	39,544	3,593	3,396	1,633	30,531
SC	2009	14	MISCELLANEOUS	221,389	32,688	4,333	279,641	60,774	1,187	12,527
	2009 Total			1,736,120	40,415	250,434	346,487	110,062	213,560	325,615
SC	2018	01	FUEL COMB. ELEC. UTIL.	14,550	742	38,871	19,348	15,661	155,780	797
SC	2018	02	FUEL COMB. INDUSTRIAL	38,470	112	39,773	4,503	3,498	42,474	1,558
SC	2018	03	FUEL COMB. OTHER	45,775	75	5,624	5,566	5,489	5,167	19,062
SC	2018	04	CHEMICAL & ALLIED PRODUCT MFG	3,296	212	32	780	452	74	44,389
SC	2018	05	METALS PROCESSING	18,853	0	587	1,858	1,561	5,920	867
SC	2018	06	PETROLEUM & RELATED	389	0	438	94	23	257	166
SC	2018	07	OTHER INDUSTRIAL PROCESSES	12,136	1,566	17,174	24,154	11,553	15,863	18,771
SC	2018	08	SOLVENT UTILIZATION	1	1	1	163	144	0	121,585
SC	2018	09	STORAGE & TRANSPORT	16	0	6	630	319	0	20,070
SC	2018	10	WASTE DISPOSAL & RECYCLING	73,407	13	4,567	10,095	9,491	738	17,166
SC	2018	11	HIGHWAY VEHICLES	800,619	6,472	42,354	2,258	1,154	643	44,700
SC	2018	12	OFF-HIGHWAY	438,027	37	29,512	2,889	2,718	1,195	24,989
SC	2018	14	MISCELLANEOUS	221,335	35,790	4,332	303,507	64,362	1,187	12,517
	2018 Total			1,666,873	45,020	183,271	375,844	116,426	229,299	326,637

State Tier 1 Emission Totals

State	Year	TIER1	TIER 1 NAME	CO	NH3	NOX	PM10	PM2.5	SO2	VOC
TN	2002	01	FUEL COMB. ELEC. UTIL.	7,090	0	157,314	14,637	12,165	334,140	927
TN	2002	02	FUEL COMB. INDUSTRIAL	15,629	7	47,674	8,959	7,420	79,164	2,067
TN	2002	03	FUEL COMB. OTHER	77,814	26	16,040	8,270	7,552	17,252	18,327
TN	2002	04	CHEMICAL & ALLIED PRODUCT MFG	36,910	1,518	1,242	3,064	2,154	6,516	34,313
TN	2002	05	METALS PROCESSING	42,625	14	1,216	7,590	7,036	6,050	7,229
TN	2002	06	PETROLEUM & RELATED	481	0	305	199	231	385	1,843
TN	2002	07	OTHER INDUSTRIAL PROCESSES	11,738	56	16,243	30,647	13,466	10,156	30,044
TN	2002	08	SOLVENT UTILIZATION	279	1	5,065	2,102	1,831	60	111,246
TN	2002	09	STORAGE & TRANSPORT	22	24	105	1,101	727	134	26,633
TN	2002	10	WASTE DISPOSAL & RECYCLING	89,697	34	3,818	14,958	14,356	350	20,193
TN	2002	11	HIGHWAY VEHICLES	1,967,658	6,616	233,324	5,338	3,919	9,184	169,914
TN	2002	12	OFF-HIGHWAY	451,480	41	95,968	7,145	6,756	10,413	49,056
TN	2002	14	MISCELLANEOUS	11,186	35,567	231	180,190	32,364	59	2,295
	2002 Total			2,712,610	43,903	578,545	284,198	109,977	473,862	474,085
TN	2009	01	FUEL COMB. ELEC. UTIL.	7,426	400	106,141	17,223	15,283	280,195	936
TN	2009	02	FUEL COMB. INDUSTRIAL	15,917	7	39,479	7,352	6,150	74,251	1,939
TN	2009	03	FUEL COMB. OTHER	70,255	31	15,657	7,387	7,043	17,217	13,170
TN	2009	04	CHEMICAL & ALLIED PRODUCT MFG	35,431	1,719	1,389	3,383	2,386	7,062	40,011
TN	2009	05	METALS PROCESSING	46,541	15	1,307	6,686	6,270	6,802	8,889
TN	2009	06	PETROLEUM & RELATED	559	0	343	226	264	436	1,428
TN	2009	07	OTHER INDUSTRIAL PROCESSES	9,764	77	12,473	32,394	13,789	8,424	30,505
TN	2009	08	SOLVENT UTILIZATION	307	1	5,976	2,486	2,161	67	115,148
TN	2009	09	STORAGE & TRANSPORT	27	31	115	983	630	145	21,061
TN	2009	10	WASTE DISPOSAL & RECYCLING	91,375	39	3,973	15,509	14,855	393	19,795
TN	2009	11	HIGHWAY VEHICLES	1,361,408	7,738	147,757	4,238	2,782	831	108,200
TN	2009	12	OFF-HIGHWAY	500,186	45	85,084	6,218	5,873	5,649	38,686
TN	2009	14	MISCELLANEOUS	11,035	36,566	229	191,894	34,195	59	2,519
	2009 Total			2,150,230	46,669	419,926	295,979	111,680	401,532	402,287
TN	2018	01	FUEL COMB. ELEC. UTIL.	7,456	394	34,434	12,513	10,583	103,927	929
TN	2018	02	FUEL COMB. INDUSTRIAL	17,411	8	41,611	8,030	6,782	76,017	2,121
TN	2018	03	FUEL COMB. OTHER	67,959	35	17,092	7,309	6,938	18,652	11,107
TN	2018	04	CHEMICAL & ALLIED PRODUCT MFG	45,446	2,053	1,709	4,320	3,039	9,095	51,613
TN	2018	05	METALS PROCESSING	54,391	17	1,663	8,865	8,346	8,093	11,353
TN	2018	06	PETROLEUM & RELATED	667	0	397	265	312	509	1,639
TN	2018	07	OTHER INDUSTRIAL PROCESSES	11,102	105	14,320	38,040	16,403	10,028	37,790
TN	2018	08	SOLVENT UTILIZATION	378	1	7,669	3,231	2,806	81	144,613
TN	2018	09	STORAGE & TRANSPORT	33	41	139	1,272	803	174	19,686
TN	2018	10	WASTE DISPOSAL & RECYCLING	94,286	50	4,308	16,460	15,719	468	22,547
TN	2018	11	HIGHWAY VEHICLES	1,150,516	8,962	65,242	3,199	1,643	944	64,665
TN	2018	12	OFF-HIGHWAY	540,143	53	69,093	5,019	4,724	5,205	28,667
TN	2018	14	MISCELLANEOUS	10,835	37,788	227	208,363	36,726	59	2,932
	2018 Total			2,000,624	49,507	257,905	316,884	114,825	233,252	399,662

State Tier 1 Emission Totals

State	Year	TIER1	TIER 1 NAME	CO	NH3	NOX	PM10	PM2.5	SO2	VOC
VA	2002	01	FUEL COMB. ELEC. UTIL.	6,892	127	86,886	3,943	2,606	241,204	754
VA	2002	02	FUEL COMB. INDUSTRIAL	64,398	100	75,831	18,467	8,453	42,670	5,332
VA	2002	03	FUEL COMB. OTHER	98,788	13	15,648	11,569	11,236	3,909	11,119
VA	2002	04	CHEMICAL & ALLIED PRODUCT MFG	321	2,158	8,062	447	392	2,126	1,530
VA	2002	05	METALS PROCESSING	3,580	0	937	1,511	1,334	5,251	513
VA	2002	06	PETROLEUM & RELATED	23,384	0	182	255	153	170	501
VA	2002	07	OTHER INDUSTRIAL PROCESSES	12,002	726	9,279	33,161	9,661	17,702	13,086
VA	2002	08	SOLVENT UTILIZATION	0	4	0	225	210	2	107,977
VA	2002	09	STORAGE & TRANSPORT	16	7	11	731	505	0	29,835
VA	2002	10	WASTE DISPOSAL & RECYCLING	16,566	109	1,866	13,839	11,964	1,581	4,065
VA	2002	11	HIGHWAY VEHICLES	2,170,508	7,837	219,602	4,537	3,090	7,218	144,684
VA	2002	12	OFF-HIGHWAY	595,311	44	58,524	7,928	7,486	8,796	55,922
VA	2002	14	MISCELLANEOUS	19,773	46,367	993	188,655	35,889	99	1,025
	2002 Total			3,011,538	57,491	477,822	285,267	92,979	330,730	376,343
VA	2009	01	FUEL COMB. ELEC. UTIL.	11,117	439	68,855	13,019	11,352	150,039	577
VA	2009	02	FUEL COMB. INDUSTRIAL	66,307	112	68,921	17,900	8,395	44,573	5,380
VA	2009	03	FUEL COMB. OTHER	72,984	14	17,692	11,166	10,815	4,586	6,703
VA	2009	04	CHEMICAL & ALLIED PRODUCT MFG	310	2,082	7,790	483	420	2,159	1,448
VA	2009	05	METALS PROCESSING	3,622	0	869	1,502	1,321	4,826	414
VA	2009	06	PETROLEUM & RELATED	25,955	0	212	286	172	201	561
VA	2009	07	OTHER INDUSTRIAL PROCESSES	12,898	733	9,636	33,825	9,931	19,172	13,539
VA	2009	08	SOLVENT UTILIZATION	0	5	0	251	234	3	107,823
VA	2009	09	STORAGE & TRANSPORT	20	7	14	751	513	0	24,916
VA	2009	10	WASTE DISPOSAL & RECYCLING	20,142	119	2,181	14,515	12,206	1,808	4,799
VA	2009	11	HIGHWAY VEHICLES	1,495,771	9,066	133,170	3,760	2,254	900	89,678
VA	2009	12	OFF-HIGHWAY	661,295	48	50,120	6,763	6,388	2,248	39,538
VA	2009	14	MISCELLANEOUS	19,611	49,317	989	203,661	38,194	99	995
	2009 Total			2,390,030	61,943	360,450	307,882	102,195	230,612	296,371
VA	2018	01	FUEL COMB. ELEC. UTIL.	15,862	782	47,155	12,906	10,889	127,501	759
VA	2018	02	FUEL COMB. INDUSTRIAL	72,349	129	72,866	18,637	8,958	48,007	5,762
VA	2018	03	FUEL COMB. OTHER	61,004	15	19,380	10,769	10,394	4,816	4,928
VA	2018	04	CHEMICAL & ALLIED PRODUCT MFG	366	2,462	9,211	587	511	2,484	1,744
VA	2018	05	METALS PROCESSING	4,309	0	1,070	1,794	1,580	5,963	498
VA	2018	06	PETROLEUM & RELATED	28,375	0	245	328	198	231	628
VA	2018	07	OTHER INDUSTRIAL PROCESSES	14,505	878	11,079	37,410	11,226	21,635	15,815
VA	2018	08	SOLVENT UTILIZATION	0	6	0	317	297	3	124,505
VA	2018	09	STORAGE & TRANSPORT	25	8	18	894	610	0	23,932
VA	2018	10	WASTE DISPOSAL & RECYCLING	24,370	141	2,613	15,390	12,522	2,177	5,833
VA	2018	11	HIGHWAY VEHICLES	1,310,698	10,757	61,881	3,343	1,641	1,059	60,454
VA	2018	12	OFF-HIGHWAY	734,294	57	36,970	5,564	5,241	1,217	32,756
VA	2018	14	MISCELLANEOUS	19,459	53,164	985	223,231	41,135	99	967
	2018 Total			2,285,617	68,399	263,472	331,170	105,202	215,193	278,581

State Tier 1 Emission Totals

State	Year	TIER1	TIER 1 NAME	CO	NH3	NOX	PM10	PM2.5	SO2	VOC
WV	2002	01	FUEL COMB. ELEC. UTIL.	10,341	12	230,977	4,573	2,210	516,084	1,180
WV	2002	02	FUEL COMB. INDUSTRIAL	8,685	97	33,825	1,561	1,332	37,111	1,097
WV	2002	03	FUEL COMB. OTHER	29,480	13	15,220	3,813	3,683	3,990	9,275
WV	2002	04	CHEMICAL & ALLIED PRODUCT MFG	50,835	80	1,627	950	831	9,052	5,755
WV	2002	05	METALS PROCESSING	28,837	143	1,641	7,275	6,685	5,619	1,393
WV	2002	06	PETROLEUM & RELATED	1	0	1,086	475	475	7,550	2,163
WV	2002	07	OTHER INDUSTRIAL PROCESSES	2,003	56	5,347	17,363	4,872	2,316	1,803
WV	2002	08	SOLVENT UTILIZATION	15	0	18	49	44	0	35,989
WV	2002	09	STORAGE & TRANSPORT	15	0	3	1,952	947	0	13,479
WV	2002	10	WASTE DISPOSAL & RECYCLING	39,383	8	1,487	7,169	6,748	100	7,156
WV	2002	11	HIGHWAY VEHICLES	560,717	1,933	59,612	1,395	1,003	2,489	40,066
WV	2002	12	OFF-HIGHWAY	119,089	10	34,442	2,072	1,941	2,305	14,805
WV	2002	14	MISCELLANEOUS	2,828	10,725	61	95,496	16,785	16	157
	2002 Total			852,228	13,079	385,346	144,143	47,556	586,631	134,320
WV	2009	01	FUEL COMB. ELEC. UTIL.	12,371	673	174,608	31,783	25,254	246,854	1,401
WV	2009	02	FUEL COMB. INDUSTRIAL	9,179	101	28,092	1,384	1,203	35,304	987
WV	2009	03	FUEL COMB. OTHER	27,941	15	15,864	3,698	3,563	4,293	7,613
WV	2009	04	CHEMICAL & ALLIED PRODUCT MFG	58,271	82	1,804	986	863	10,166	5,426
WV	2009	05	METALS PROCESSING	30,939	142	1,666	7,110	6,489	5,953	1,376
WV	2009	06	PETROLEUM & RELATED	1	0	1,218	533	533	8,471	2,168
WV	2009	07	OTHER INDUSTRIAL PROCESSES	2,288	59	4,995	17,500	5,076	2,570	2,064
WV	2009	08	SOLVENT UTILIZATION	17	0	20	52	47	0	34,996
WV	2009	09	STORAGE & TRANSPORT	17	0	3	846	545	0	11,532
WV	2009	10	WASTE DISPOSAL & RECYCLING	39,119	8	1,470	7,066	6,649	97	6,957
WV	2009	11	HIGHWAY VEHICLES	385,994	2,183	36,049	1,096	703	227	23,907
WV	2009	12	OFF-HIGHWAY	138,999	11	31,148	1,819	1,699	392	14,249
WV	2009	14	MISCELLANEOUS	2,836	11,405	61	94,433	16,241	16	159
	2009 Total			707,972	14,682	296,999	168,307	68,866	314,342	112,833
WV	2018	01	FUEL COMB. ELEC. UTIL.	13,042	719	42,269	24,257	17,551	111,941	1,461
WV	2018	02	FUEL COMB. INDUSTRIAL	9,938	114	29,599	1,455	1,261	36,885	1,062
WV	2018	03	FUEL COMB. OTHER	26,891	18	18,097	3,577	3,439	4,461	7,041
WV	2018	04	CHEMICAL & ALLIED PRODUCT MFG	70,252	99	2,183	1,188	1,041	12,280	6,560
WV	2018	05	METALS PROCESSING	36,850	183	2,153	9,062	8,314	7,182	1,790
WV	2018	06	PETROLEUM & RELATED	1	0	1,378	603	603	9,581	2,325
WV	2018	07	OTHER INDUSTRIAL PROCESSES	2,756	68	5,949	19,353	5,844	3,101	2,561
WV	2018	08	SOLVENT UTILIZATION	20	0	24	60	55	0	41,450
WV	2018	09	STORAGE & TRANSPORT	19	0	4	1,041	682	0	10,701
WV	2018	10	WASTE DISPOSAL & RECYCLING	39,225	10	1,479	7,151	6,708	98	7,331
WV	2018	11	HIGHWAY VEHICLES	319,030	2,484	16,274	844	428	255	15,463
WV	2018	12	OFF-HIGHWAY	152,932	13	26,279	1,381	1,284	56	9,500
WV	2018	14	MISCELLANEOUS	2,830	12,326	61	100,179	17,422	16	158
	2018 Total			673,787	16,035	145,748	170,151	64,632	185,853	107,402
VISTAS	**2002 Total**			**30,836,927**	**686,030**	**5,429,133**	**4,008,366**	**1,285,356**	**4,791,599**	**5,096,205**
VISTAS	**2009 Total**			**25,576,458**	**748,128**	**4,118,204**	**4,318,140**	**1,388,778**	**3,210,593**	**4,137,307**
VISTAS	**2018 Total**			**24,106,779**	**819,705**	**2,667,922**	**4,663,948**	**1,436,690**	**2,441,073**	**3,902,513**

Appendix D: VISTAS Tier 1 Emission Totals

Year	TIER1	TIER 1 NAME	CO	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
2002	01	FUEL COMB. ELEC. UTIL.	143,446	393	1,528,735	115,948	81,468	3,743,710	12,505
2002	02	FUEL COMB. INDUSTRIAL	401,531	1,554	513,824	112,771	83,263	457,515	33,280
2002	03	FUEL COMB. OTHER	786,654	2,801	123,049	102,079	70,500	114,434	416,799
2002	04	CHEMICAL & ALLIED PRODUCT MFG	131,983	7,093	20,366	11,035	7,976	77,450	112,761
2002	05	METALS PROCESSING	224,959	601	11,907	30,504	27,128	49,376	17,637
2002	06	PETROLEUM & RELATED INDUSTRIES	44,572	355	7,178	2,714	1,795	53,393	33,366
2002	07	OTHER INDUSTRIAL PROCESSES	158,490	7,533	120,669	262,110	92,864	97,623	199,300
2002	08	SOLVENT UTILIZATION	1,044	332	5,675	4,347	3,848	92	1,300,735
2002	09	STORAGE & TRANSPORT	610	85	1,069	10,268	5,711	230	322,983
2002	10	WASTE DISPOSAL & RECYCLING	1,017,145	805	42,589	138,543	132,951	6,398	131,779
2002	11	HIGHWAY VEHICLES	20,199,593	74,325	2,193,387	50,584	35,929	88,684	1,778,345
2002	12	OFF-HIGHWAY	5,561,919	429	815,915	71,903	67,936	91,168	609,367
2002	14	MISCELLANEOUS	2,164,979	589,725	44,770	3,095,561	673,984	11,525	127,347
2002 Total			**30,836,927**	**686,030**	**5,429,133**	**4,008,366**	**1,285,356**	**4,791,599**	**5,096,205**
2009	01	FUEL COMB. ELEC. UTIL.	168,910	8,797	1,126,479	214,213	172,561	2,300,703	13,078
2009	02	FUEL COMB. INDUSTRIAL	420,044	1,752	475,797	104,947	77,632	451,318	33,569
2009	03	FUEL COMB. OTHER	636,976	3,158	133,644	90,837	66,810	93,441	254,891
2009	04	CHEMICAL & ALLIED PRODUCT MFG	140,778	7,611	21,651	11,935	8,633	84,677	129,338
2009	05	METALS PROCESSING	244,795	732	12,101	29,378	26,029	55,115	19,761
2009	06	PETROLEUM & RELATED INDUSTRIES	47,692	372	7,809	3,069	2,034	54,169	24,938
2009	07	OTHER INDUSTRIAL PROCESSES	167,229	7,531	118,457	282,677	98,768	100,673	205,534
2009	08	SOLVENT UTILIZATION	1,180	356	6,625	4,791	4,216	99	1,317,828
2009	09	STORAGE & TRANSPORT	717	98	1,176	8,203	4,713	255	276,149
2009	10	WASTE DISPOSAL & RECYCLING	1,057,774	928	45,215	144,736	138,498	7,325	133,456
2009	11	HIGHWAY VEHICLES	14,353,436	87,703	1,408,206	42,370	26,848	8,817	1,146,174
2009	12	OFF-HIGHWAY	6,171,856	474	716,257	62,060	58,577	42,476	454,034
2009	14	MISCELLANEOUS	2,165,071	628,615	44,788	3,318,923	703,456	11,526	128,557
2009 Total			**25,576,458**	**748,128**	**4,118,204**	**4,318,140**	**1,388,778**	**3,210,593**	**4,137,307**
2018	01	FUEL COMB. ELEC. UTIL.	226,089	13,049	509,373	192,921	150,054	1,419,033	15,064
2018	02	FUEL COMB. INDUSTRIAL	457,828	1,985	512,278	116,856	87,553	480,983	36,918
2018	03	FUEL COMB. OTHER	566,637	3,429	146,507	86,073	65,023	130,971	188,386
2018	04	CHEMICAL & ALLIED PRODUCT MFG	173,709	9,023	26,072	14,745	10,671	100,881	166,610
2018	05	METALS PROCESSING	289,668	961	15,085	36,567	32,534	67,608	25,116
2018	06	PETROLEUM & RELATED INDUSTRIES	51,093	396	8,733	3,534	2,336	59,383	26,879
2018	07	OTHER INDUSTRIAL PROCESSES	191,241	8,763	138,189	330,251	116,061	115,846	241,103
2018	08	SOLVENT UTILIZATION	1,423	397	8,415	5,781	5,052	113	1,584,784
2018	09	STORAGE & TRANSPORT	875	120	1,367	9,833	5,631	307	260,418
2018	10	WASTE DISPOSAL & RECYCLING	1,109,042	1,142	48,896	153,303	146,150	8,680	145,545
2018	11	HIGHWAY VEHICLES	12,052,347	101,223	639,931	33,884	17,080	10,027	713,143
2018	12	OFF-HIGHWAY	6,821,290	555	568,258	51,127	48,075	35,713	368,343
2018	14	MISCELLANEOUS	2,165,538	678,662	44,820	3,629,072	750,469	11,526	130,205
2018 Total			**24,106,779**	**819,705**	**2,667,922**	**4,663,948**	**1,436,690**	**2,441,073**	**3,902,513**

Appendix C

Development of the Draft VISTAS Emissions Inventory for Regional Haze Modeling, Area Source Methodology

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DRAFT REPORT

DEVELOPMENT OF THE DRAFT 2002 VISTAS EMISSION INVENTORY FOR REGIONAL HAZE MODELING

AREA SOURCE METHODOLOGY

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OVERVIEW

Under contract with VISTAS, MACTEC was tasked to develop the 2002 base year inventory for both point and area source sectors. This document details the methods used to develop the area source component of the inventory.

Work to develop the area source inventory was performed using a stepwise process. The steps in this process were:

1. Receive area source data from State and local agencies within the VISTAS region.
2. Evaluate the data received by the State and local agencies to determine whether or not the data were usable and if so which pollutants and categories were covered by the submitted data. This included a quality assurance step performed to ensure that the submitted data contained all necessary information needed to develop 2002 emission estimates.
3. Prepare growth factors for projecting emissions from State/local supplied data.
4. Run the Carnegie Mellon University (CMU) ammonia model to produce ammonia emissions for large area source categories (livestock, fertilizers, etc.).
5. Obtain State specific animal populations to use to grow CMU model estimates to 2002.
6. Obtain data on wildfires, prescribed burns, agricultural burning and waste/land clearing burning activities from State and Federal fire officials. Data on acres burned, fuel loadings and emission factors were sought from these officials.
7. Quality assured the data submitted by fire officials for completeness and for location information.
8. Develop fire emission estimates.
9. Updated the National Emission Inventory Input Files (NIF) for the VISTAS States to include the updated emission data.

Once these steps were completed, the preliminary version of the inventory was provided to the State/local agencies for review.

Version 1 of the inventory was then submitted to the States for review and comment. Several changes were made to Version 1 of the inventory based on these reviews as well as the re-runs of the CMU model in order to update from version 3.0 to 3.1 and to update prescribed fires data for AL, FL, GA, MS, and SC, and to add wildfire data for FL that was inadvertently left out of version 1. Finally Version 2 of the VISTAS base year inventory was converted from NIF 2 to NIF 3.

Submittal of State/Local/Tribal Agency Emissions Data

VISTAS solicited emissions data from all State, local and Tribal air quality entities within the VISTAS region. The request specified that if these entities had 2002 emissions data to provide that, otherwise data from 1999, 2000 or 2001 were acceptable and that if possible the submittal format should be NIF version 2. The request also indicated that the default data that would be used should State, local or Tribal agencies not submit data would be the 1999 National Emission Inventory (NEI) version 2.

Data were submitted by almost all of the States in the VISTAS region as well as several local agencies. No Tribes submitted data directly. Data received for the initial version of the VISTAS area source emission inventory is summarized in Table 1.

The general procedure we used for updating data in the database is provided below. Most States only provided VOC, CO and NOx emissions however some states provided additional pollutants.

We generated all Version 1 data files in NIF version 2.0 format. Version 2 files were generated in NIF version 3.0 format. The information that follows describes the general procedure we used to process each individual file in the NIF format.

The emission process file (EP file type) was processed to add records for processes not found in the NEI version 2 (but submitted by the State in their submittal). Then corresponding records in each data set were matched and the State supplied data fields were updated. All new and changed records had the NAICS field marked with "SS" which stands for State Supplied. Generally, we preferred to use "blank" fields to mark State supplied records, however the Access version of the NIF version 2.0 (and version 3.0) format does not provide a blank field for the EP table. We found no entries in the NAICS field for any of the VISTAS states in the 1999 NEI version 2 file, thus we used this field for this table to mark changed or updated records.

For the control table (CE table), we appended new records that did not exist in the current NEI version 2 to ensure that SCCs and pollutants that didn't exist in the NEI had corresponding records in the final file. We then updated matching records with the State supplied data and marked all new and updated records with "SS" in the blank field. Finally we performed a "widow" check to make sure that no widowed records existed after all the updates.

Similar operations were performed for the emissions period table (PE table). Non-matching records were appended to the current NEI version 2 table, then updates were made for matching records to update the data fields to the State supplied values. We then updated the blank field to SS on new and updated records to designate that they were supplied by the State. Finally we deleted orphan records.

Finally for the emissions table (EM table), each State was handled somewhat differently. When States had submitted only VOC, CO, and NOx records, we deleted all VOC, NOx and CO records. We treated the State supplied data as if it was a full and complete inventory for those pollutants. We then appended the State supplied data for VOC, CO and NOx to the emissions table. If a State supplied all pollutants, we completely replaced the EM table. For other States, more involved updates specific to those States were performed. For those States that only submitted VOC, CO, and NOx data, we provided them with a list of missing SCCs found in their submittal and in the 1999 NEI version 2.0

so they could determine if the missing SCCs needed additional pollutants. Specific details on the processing of each of the sets of inventory data provided by State/local agencies are given below.

TABLE 1

SUMMARY OF STATE AND LOCAL AGENCY AREA SOURCE SUBMITTALS

State	Agency	Comments on Original Submittal	Year	Response to Initial QA/QC Checks
AL	AL DEM	Sent 1999 NEI data, with some minor corrections.	1999	Data passed cleanly through EPA's QA/QC software, except for a few minor issues. AL DEM personnel provided corrections and responses to issues in the QA/QC report.
FL	FL DEP	Florida supplied area source emissions for several source categories including (for 1999) commercial fuel use, auto refinishing, dry cleaners, industrial coatings, industrial fuel use, agricultural pesticides, residential fuel use, solvent cleaning, (and for 2000) bakeries, asphalt batching, architectural coatings, consumer and commercial solvents, graphic arts, stage 1 and stage 2 controls, tank breathing loss, traffic markings, and transit losses.	1999 2000	The data were provided in spreadsheets and included activity data and annual and seasonal emissions. The format was not NIF format so it could not be QA/QC'ed using the EPA QA/QC tool.
FL	West Palm Beach	Supplied emission inventory information in a spreadsheet for 2001. The spreadsheet provided annual emissions only from point, area and mobile sources (including nonroad).	2001	The data provided was summarized in broad categories, not by source classification code (SCC). For example one of the categories was Residential Fuel Combustion but contained no information on emissions by type of fuel for the residential fuel combustion category. These data were not processed for use in the inventory

TABLE 1 (cont.)

State	Agency	Comments on Original Submittal	Year	Response to Initial QA/QC Checks
GA	GA DNR	Sent 1999 data for 13 counties in the Atlanta area (VOC, NOx, CO only). Indicated that the 1999 NEI should be used for other counties.	1999	Data passed cleanly through EPA's QA/QC software, with a few minor problems concerning field lengths of numeric values, throughput units and seasonal percentages. These were updated in concurrence with GA DNR personnel.
KY	KY DEP	Kentucky supplied data for 11 counties (Oldham, Bullitt, Boyd, Greenup, Fayette, Scott, Edmonson, Daviess, Hancock, Livingston, and Marshall).	1999 2000	They provided emissions for VOC, CO, and NOx, both annual and summer day emissions. The file format was ASCII NIF format. The data were a mixture of 1999 and 2000 emissions. The data were imported into Access and submitted to the EPA QA/QC tool. One minor problem with duplicate records was fixed by MACTEC with KY DEQ concurrence.
MS	MS DEQ	Mississippi sent an area source file in MS Access NIF format.	1999	The file sent included only records for fireplaces and woodstoves for CO, NOx, PM10-PRI, VOC and SO2.
NC	NC DENR	NC indicated that the current versions of the NEI (1999 version 2) was suitable for their submission without change.	1999	Used 1999 NEI version 2.
SC	SC DHEC	No data submitted	1999	Used 1999 NEI version 2.

TABLE 1 (cont.)

State	Agency	Comments on Original Submittal	Year	Response to Initial QA/QC Checks
TN	TN DEC	Tennessee provided annual NH3 values for area sources for all counties. These values were supplied in an Excel format and were developed by the University of Tennessee. They recommended using the 1999 NEI version 2 for all other area sources. They also recommend that all emissions from livestock be maintained at current levels since levels over the last 20 years have remained essentially constant with the exception of hogs where activity levels have been declining. They also recommended that hog activity levels remain constant.	1999	TN supplied NH3 values used for all matching categories. 1999 NEI version 2 used for all remaining inventory categories.
TN	Memphis-Shelby County	The Memphis and Shelby County Health Department sent area source emission inventory data in MS Access NIF format.	1999	EPA's QA/QC software identified a number of issues with the data submitted. MACTEC worked with Shelby County to resolve many of these issues but not all could be resolved.
VA	VA DEQ	Virginia submitted a MS Access database in NIF format that contained VOC, NOx, and CO emissions with both annual and ozone season emissions included.	1999	Data passed fairly cleanly through EPA's QA/QC software, except for a few out-of-range or other types of messages. One independent city set of records was found to no longer be a legitimate FIPS code, but emissions for that city were added to the corresponding county emissions.
WV	WV DEP	West Virginia initially provided only county fire statistics (both number of fires and acres burned) by county for 2000 and 2001 (both spring and fall). They later provided a NIF format file of records to delete from the 1999 NEI version 2 for WV.	1999	Records provided in NIF format for deletion processed. Records were marked for deletion and removed from NIF version 2.0 for WV

Alabama

Alabama supplied a version of the 1999 NEI that had been updated for a couple of source categories. We processed the data through the QA/QC tool, found some minor problems which were corrected by Alabama DEM personnel and then their data were inserted into the database. Their data included all pollutants.

Florida

Florida's submittal was in an Excel spreadsheet format and included emissions for separate years (1999 and 2000). The data were provided in spreadsheets and included activity data and annual and seasonal emissions. The format was not NIF format so it could not be QA/QC'ed using the EPA QA/QC tool. We then identified all SCCs provided by Florida that were not in the current NEI and determined whether or not those sources could be added to the inventory. In some cases, addition of those sources would have resulted in double counting of emissions so not all of the data could be used.

For 1999, the following data sources were added to the inventory:

2102011000	external fuel combustion, kerosene
2401050000	sheet, strip and coil metal coating – added but data from NEI for 2401045000 was removed to avoid double counting
2415030000	electronics coatings
2415045000	manufacturing coatings
2415065000	auto repair
2420010000	dry cleaning added to replace 2420010055 and 2420010379 to avoid double counting

Data for 2461850000, agricultural pesticides was not added since the NEI already included 2461800000 all pesticides and no good method existed to ensure that double counting did not occur.

For the 2000 data, the following sources were added:

2401002000	architectural surface coating, solvent based added and 2401001000 architectural solvents all solvent types was removed to avoid double counting
2401003000	architectural surface coating water based solvents added and 2401001000 all solvent types was removed to avoid double counting
2460000000	consumer/commercial solvents all processes all solvent types was added and six separate SCCs in the NEI were removed to avoid double counting
2461022000	asphalt paving emulsified
2501060053	gasoline service stations stage 1 balanced submerged filling added with a control effectiveness of 95 percent and a rule effectiveness of 80 percent
2501070051	diesel service stations stage 1 submerged filling added with a rule effectiveness of 80 percent for all counties except 061 and 103

2501070053	diesel service stations stage 1 balanced submerged filling added with rule effectiveness of 80 percent except for county 105
2501070201	underground storage tanks breathing and emptying – diesel added

Data for 2501070100 diesel service stations stage 2 records were not added since those emissions were covered in the on-road and non-road inventories. In addition, 2505030090 distillate tank trucks in transit were not added since they would have resulted in double counting.

In addition to these specific updates, all SCCs provided by Florida that were identical matches to NEI sources were updated to include the Florida supplied parameters (activity data, throughput, control efficiency, etc.).

Florida – West Palm Beach County

West Palm Beach County submitted data for very broad sources that were insufficient to be utilized in producing emissions for use in the VISTAS inventory. Double counting would have resulted from the use of the spreadsheet provided by West Palm Beach County so the 1999 NEI was used in producing emission from West Palm Beach.

Georgia

Georgia also only submitted VOC, CO and NOx for 13 counties in the Atlanta area in NIF format. Our examination of the original NIF file using the EPA QA/QC tool found some problems with seasonal throughputs not summing to 100 percent, some issues with the emission factor units in the EM table, and some numeric values that were too long for the fields. The seasonal throughputs were adjusted based on emails with GA DNR personnel. In all cases if an adjustment had to be made to make the final value sum to 100, the winter value was changed to cause the sum to reach 100. This was only necessary when the correction method instituted to update each seasonal value ended up rounding to a number one percent above or below 100.

Data for only the 13 counties submitted for VOC, CO and NOx were updated. All other GA data is reflective of the 1999 NEI version 2.

Kentucky

Kentucky submitted data for 11 counties. The data received from Kentucky was in an ASCII NIF format and had a few problems when run through the EPA QA/QC tool. Duplicate records were found in the CE table for SCC 2275900101 for VOC and widowed records were found in the PE table for SCC 2660000000. Those problems were corrected and the data were resubmitted to the QA/QC program and no further problems were identified. One further modification was made to the EP table. Records identified as commercial aircraft refueling were converted to aircraft refueling in order to keep 1999 NEI records for PM and SO2 after the corresponding VOC, CO and NOx records were deleted.

Memphis - Shelby County Tennessee

Shelby County initially provided a NIF format Access database. When we submitted the file to EPA's QA/QC software it identified a number of issues with the data submitted. Shelby County provided an updated spreadsheet file several months later that corrected some but not all of the errors found in the first version. MACTEC worked with Shelby County to resolve many of these issues but not all could be resolved. The data that were processed included SCCs which matched the 1999 NEI version 2 and new SCCs not included in the 1999 NEI version 2. For those SCCs that matched, the relevant information and emissions were updated. The information detailed below describes how the SCCs that weren't in the 1999 NEI version 2 were handled.

2104008000 residential wood combustion total all wood stoves. These data were inserted into the inventory database and SCCs that would have resulted in double counting were removed. However, the original SCCs for this category for pollutants not submitted were maintained in the database.

2401050000 solvent utilization surface coating miscellaneous finished metal parts all solvents. These emissions were added to the database.

2401065000 solvent surface coating electronic parts all solvents. Emission were added to the database

2415000000 solvent degreasing all processes/all industries all solvents. These emissions were added to the data base and emissions from 18 separate SCCs found in the 1999 NEI were deleted to avoid double counting.

2420000000 solvent usage dry cleaning all processes all solvents. These emissions were added and three SCCs were removed from the 1999 NEI to avoid double counting

2461000000 solvents miscellaneous non-industrial commercial all processes all solvents was added and 2461800000 pesticides was removed from the 1999 NEI to avoid double counting

2465000000 solvents miscellaneous non-industrial consumer all products/processes all solvents was added and four SCCs from the 1999 NEI were removed to avoid double counting.

2501060000 storage and transport petroleum products gasoline service stations, total all gasoline/processes was added and SCCs from the 1999 NEI were removed to avoid double counting.

2505030000 storage and transport petroleum products trucks total all products was added and 2505030120 was deleted to avoid double counting

2610000000 waste disposal open burning all categories total was added and 2610000500, land clearing of debris was replaced to avoid double counting

2620000000 waste disposal landfills all total was added and 2620030000 landfills municipal total was removed from the 1999 NEI to avoid double counting

2630000000 waste disposal, waste water treatment, all total was added and 2630020000 publicly owned treatment works were removed with the exception of NH3 emissions

There were several records for PM that could not be added for Shelby County because the pollutant codes were unclear as to whether they were PM10 or PM2.5 or whether they were primary or filterable emissions. MACTEC requested verification from Shelby County several times but no information was received to reconcile these records prior to the deadline for delivering the draft emission inventory.

Mississippi

Mississippi submitted NIF format records but the file sent included only records for fireplaces and woodstoves for CO, NOx, PM10-PRI, VOC and SO2. We deleted the records for the corresponding categories in the NEI and replaced them with the records from Mississippi. We added records for PM2.5-PRI which were set equal to the PM10-PRI values.

Virginia

As indicated in Table 1, Virginia provided a NIF format file for CO, VOC, and NOx. In examining the file submitted we found that there were non-road mobile source records in the file. We deleted all records for SCCs that started with 22750 and 228. After that we processed each file type in the NIF format.

For the EP file, only seasonal throughputs, days per week, and weeks per year that were supplied by the State were updated. All other NEI field values were maintained.

In the CE file, Virginia had included the text "Must Code Each County" and "Individually for CE and Device type" in the blank and Control System Description fields. These appeared to be file instructions and had no bearing on the final inventory file so they were deleted.

West Virginia

West Virginia only supplied records that should be deleted from the 1999 NEI version 2. MACTEC deleted those records so that the 1999 NEI version 2 for West Virginia only included records that West Virginia had reviewed for EPA.

GROWTH OF EMISSIONS TO 2002

With the exception of NH3 categories that were calculated using the CMU Ammonia model and for forest wildfires and prescribed burning, all other emissions were grown from the base year submitted to 2002. The growth factors were developed using the Economic Growth Analysis System (EGAS) version 4.0.

Three different sets of EGAS based growth factors were used to project the emissions to 2002. The first set was taken directly from EGAS. They represent growth factors for a particular State, County, and SCC. Values were determined for 1996, 1999, 2000, 2001, and 2002. EGAS growth factors are based on a 1996 base year so in order to determine a growth factor for projecting from 1999 to 2002 you must take the ratio of the values for 2002/1999 in order to obtain the growth factor. We calculated all of the growth factors on the fly for two reasons. First we could simply calculate the growth factors from the raw EGAS growth factors while calculating the projected emissions rather than calculating actual values from the values generated from EGAS and then using those values. Second, some States provided 2000 emissions, thus similarly, the 2002/2000 ratio would provide the growth factor value. We used the year portion of the start date field to determine which ratio (2002/1999 or 2002/2000) should be used for the emission factor. Once the emissions were calculated, then the blank field was marked with either a G9 or a G0 to signify that the record was grown from 1999 or 2000 NEI data respectively. For State supplied data, the SS value in the blank field was modified to be either S9 or S0 to represent that the emissions were grown from1999 or 2000 State-supplied data respectively.

In some cases, the State/County/SCC level growth factors weren't available for a particular State/County/SCC combination. In that case we developed a State-wide growth factor for each SCC. We then used those factors to perform the emission growth using the same ratio method. The State level growth factors were generated at the State/SCC level by taking the average of all county level growth factors for that State. In some cases, we still didn’t have a growth factor for that State/SCC combination. After attempting to perform the growth with the State/County/SCC and the State/SCC growth factor files, we then used a VISTAS region file at the SCC level. That file was developed from the State/County/SCC level file by averaging the growth factor by SCC for all States in the VISTAS region. Again records were grown on the fly using the ratios of the growth factors and all records were marked as grown where applicable. If after these three attempts were made to grow the emissions no growth factor was available, the 1999 value was maintained (i.e., growth factor = 1).

We solicited additional information from the State/Local/Tribal agencies on control programs and changes in rule penetration and rule effectiveness for 2002 but no information was provided by these agencies for 2002. Thus no additional controls were assumed in growing emissions from 1999 (or 2000) to 2002.

There was one exception to the above approach and that was for Stage 2 refueling emissions. Emissions for Stage 2 refueling were developed by the VISTAS on-road/non-road emissions contractor and provided to MACTEC for inclusion in the emission inventory. This was done to ensure that the emissions for Stage 2 refueling were calculated consistently. As a consequence, any State submitted Stage 2 refueling emission estimates were removed from the inventory. Stage 1 estimates were left in.

NH3 EMISSIONS ESTIMATES

Ammonia is a pollutant of particular interest to VISTAS in this inventory. We obtained a draft version of the Carnegie Mellon University (CMU) Ammonia Tool (version 3.0). That emission estimation software was used to develop emission estimates for Version 1 of the VISTAS inventory. Categories other than livestock were developed from the

CMU model and used directly in the emission inventory. As such those estimates may actually be representative of emission years other than 2002, but for the purposes of this inventory, they are treated as if they are 2002 emission estimates. The categories developed directly from the CMU model included:

Fertilizer Application	Anhydrous Ammonia
Fertilizer Application	Aqua Ammonia
Fertilizer Application	Nitrogen Solutions
Fertilizer Application	Urea
Fertilizer Application	Ammonium Nitrate
Fertilizer Application	Ammonium Sulfate
Fertilizer Application	Ammonium Thiosulfate
Fertilizer Application	N-P-K
Fertilizer Application	Calcium Ammonium Nitrate
Fertilizer Application	Potassium Nitrate
Fertilizer Application	Diammonium Phosphate
Fertilizer Application	Monoammonium Phosphate
Fertilizer Application	Liquid Ammonium Polyphosphate
Fertilizer Application	Miscellaneous Fertilizers
Goats Waste Emissions	Angora Goats
Goats Waste Emissions	Milk Goats
Cats	Total
Dogs	Total
Bears	Black Bears
Bears	Grizzly Bears
Elk	Total
Deer	Total
Human Perspiration	Total

In addition to these categories that were developed directly from the model using default inputs, we also developed projected emission estimates for the following categories:

Cattle and Calves Waste Emissions	Milk Cows
Cattle and Calves Waste Emissions	Beef Cows
Cattle and Calves Waste Emissions	Heifers and Heifer Calves
Cattle and Calves Waste Emissions	Steers, Steer Calves, Bulls, and Bull Calves
Hogs and Pigs Composite	Total
Poultry Waste Emissions	Pullet Chicks and Pullets less than 13 weeks old
Poultry Waste Emissions	Pullets 13 weeks old and older but less than 20 weeks old
Poultry Waste Emissions	Layers
Poultry Waste Emissions	Broilers
Poultry Waste Emissions	Ducks
Poultry Waste Emissions	Geese
Poultry Waste Emissions	Turkeys

Horses and Ponies Composite	Total
Sheep and Lambs Composite	Total

The default activity data used to develop emission estimates for these categories were taken from the 1997 Census of Agriculture. We investigated the potential availability of the 2002 Census of Agriculture (the Census of Agriculture, which is updated every five years, serves as the data source for activity data for both the CMU tool and the NEI), however data from the 2002 Census of Agriculture will not be available until February 2004. We did find that many States had State (and in a couple of cases) county level data for 2002 on their individual State agriculture department websites. As a consequence we decided to use State animal populations to project the emissions from 1997 to 2002. We decided to use State level data (rather than county level when available) for all animal types in order to keep the methodology consistent from State-to-State. Using this approach we were able to develop growth factors for each livestock category listed above with the exception of West Virginia. No State data for 2002 was found on their website, nor was it provided following email requests from the State department of agriculture personnel contact listed on their website. We kept growth factors for all livestock categories for West Virginia as one, so their values for these categories are the same as produced by the CMU model (using 1997 data).

In some cases, States had data for all of the subcategories (beef cows, milk cows, heifers and calves, etc.). In other cases, they only had total values (e.g., cattle). If the specific data were available for the category, then we calculated specific growth factors. If not then the more general category (cattle or pig or chicken) growth factor was used for all subcategories for that State. The values used to grow the livestock categories in each State for ammonia are provided in Appendix A.

There was one exception to this approach. Tennessee had provided 1999 data by county and livestock type for the entire State. In their data submittal, Tennessee had also recommended that the 1999 data not be projected to 2002 since animal populations had been fairly constant since that time. Thus, we used their data as provided with the exception that we did not include their information for NH3 from fires and we added the CMU model values for categories that they did not include (i.e., cats, dogs, bears, etc.). Figure 1 shows the difference between CMU and 1999 NEI version 2 ammonia emissions for livestock operations. Figure 2 shows the difference between fertilizer ammonia emissions from the CMU model and the 1999 NEI version 2.

In order to keep track of the database records that were developed using the CMU model, the blank fields of the NIF format tables were updated with “CMU” to indicate that the data were derived from the CMU model.

For Version 2 of the VISTAS area source inventory, we developed updated values for NH3 from version 3.1 of the CMU model. Changes resulting from use of version 3.1 of the CMU model only affected dairy cattle emissions. All other procedures used for the inventory development were identical to what is described above.

FIGURE 1.

COMPARISON OF AMMONIA EMISSION ESTIMATES FOR LIVESTOCK CATEGORIES BY STATE BETWEEN THE CMU MODEL (VERSIONS 3.0 AND 3.1) AND 1999 NEI VERSION 2.

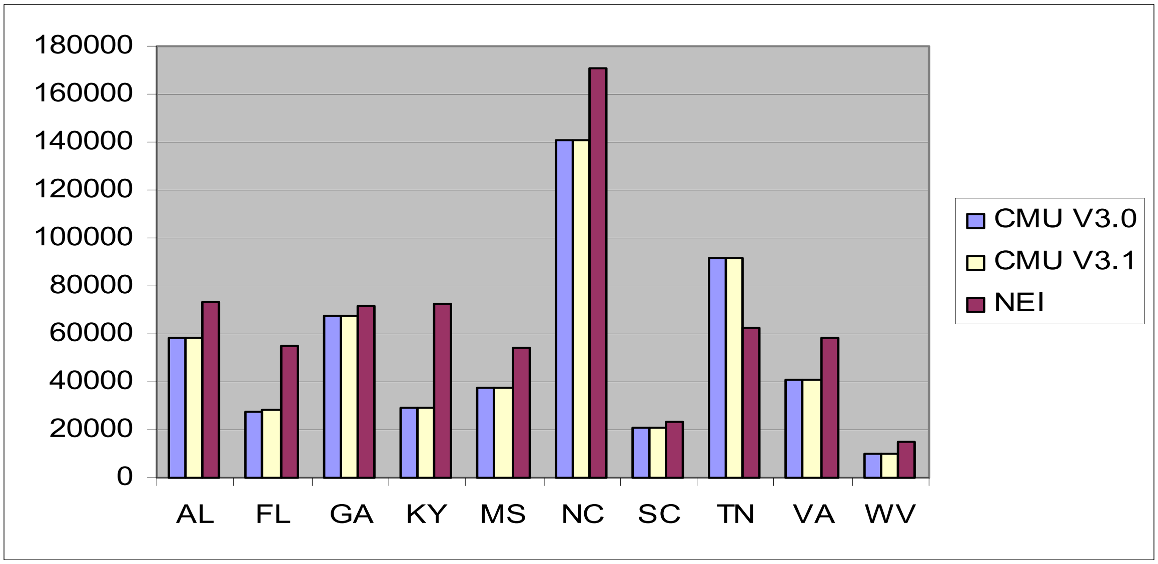
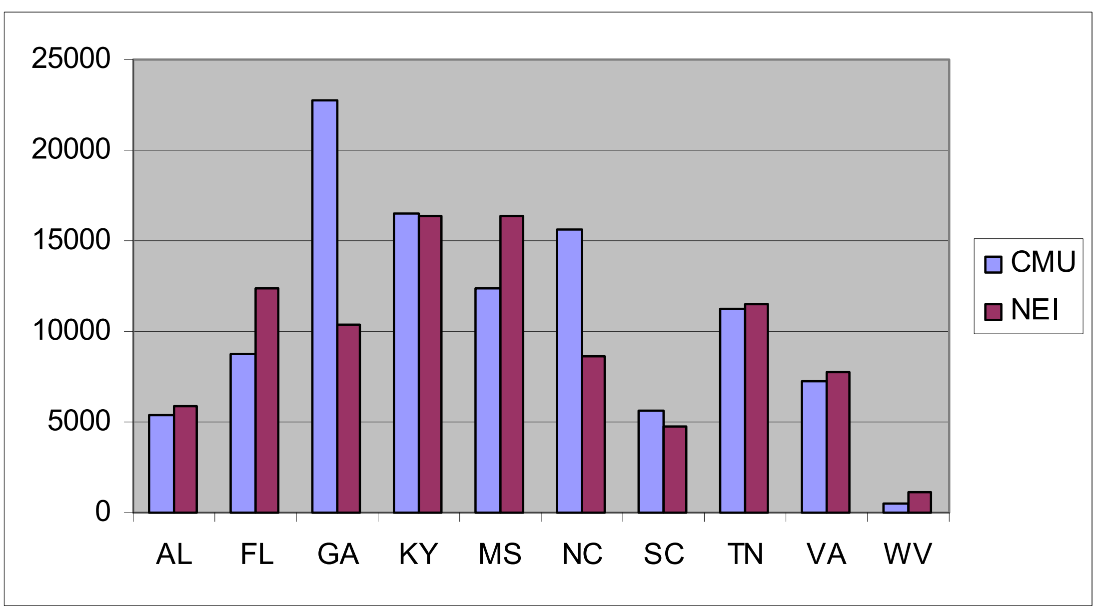


FIGURE 2.

COMPARISON OF AMMONIA EMISSION ESTIMATES FOR FERTILIZER USAGE BY STATE BETWEEN THE CMU MODEL AND 1999 NEI VERSION 2.



FIRE EMISSION ESTIMATES

Data Requested

In early 2003, VISTAS requested that State forestry personnel provide information necessary to calculate fire emissions from wildfires, prescribed burning, agricultural fires and land clearing of debris. Specifically, VISTAS requested the following information:

Wildfires:
- Number of acres burned
- Date of fire – Actual days were preferred with information on the month that the fire occurred in being the minimum information provided
- Type of material burned (pine, oak, etc.)
- Fuel loading (tons/acre)
- Location of fire – Latitude/longitude information was preferred, but if not available, the minimum acceptable information was the county in which the fire was located. For fires that spanned counties, VISTAS requested a breakdown of the acres per county.

Prescribed fires:
- Number of acres burned
- Date of fire – Actual days were preferred with information on the month that the fire occurred in being the minimum information provided
- Type of material burned (short needle conifer, long needle conifer, logging slash debris, hardwood, palmetto, etc.)
- Fuel loading (tons/acre)
- Location of fire - Latitude/longitude information was preferred, but if not available, the minimum acceptable information was the county in which the fire was located. For fires that spanned counties, VISTAS requested a breakdown of the acres per county.

In addition for each of these fire types, VISTAS requested an estimate regarding the percentage of the fire that occurred in the flaming, smoldering and actual fire stages.

Agricultural burning:
- Number of acres burned
- Date of fire – Actual days were preferred with information on the month that the fire occurred in being the minimum information provided Type of material burned (crop type)
- Fuel loading (tons/acre)
- Location of fire - Latitude/longitude information was preferred, but if not available, the minimum acceptable information was the county in which the fire was located. For fires that spanned counties, VISTAS requested a breakdown of the acres per county.

Land clearing of debris:

- Number of acres burned
- Date of fire – Actual days were preferred with information on the month that the fire occurred in being the minimum information provided Type of material burned (grass, wood debris, etc.)
- Fuel loading (tons/acre)
- Location of fire - Latitude/longitude information was preferred, but if not available, the minimum acceptable information was the county in which the fire was located. For fires that spanned counties, VISTAS requested a breakdown of the acres per county.

Data Supplied

Data returned from the State forestry contacts varied by State both in the types of fire information returned (e.g., wildfires, prescribed, agricultural or land clearing) and in the detail provided. Some States provided information on each fire by latitude and longitude while others provided only the county location. In other cases very detailed information was provided on the fire date (including reported date, control date and fire out date, for example) while others only provided the month the fire occurred. For States that only provided the month the fire occurred we set the date to the first of the month. Some States provided fairly detailed information on the fuel type and loading while others provided no data at all on the fuel type (or loading). No States provided estimates on the smoldering or flaming stages of the fire. Finally most States provided information in electronic format; however several only provided hard copy. For those that provided hard copy data, we scanned the data and inserted it into spreadsheets. The spreadsheets were reviewed against the original materials to ensure that the data were translated correctly.

VISTAS also requested information from Federal agencies on fires on Federal lands. The following Federal agencies were requested to submit data:

- Forest Service;
- Fish and Wildlife Service;
- National Park Service;
- Bureau of Land Management; and
- Bureau of Indian Affairs.

Data for wildfires was provided by all Federal agencies. However, prescribed burning data were only provided by the U.S. Forest Service. No other Federal agencies provided prescribed burning data to VISTAS.

Tables 2 and 3 provide an overview of the data supplied by State and Federal agencies for fires for VISTAS.

TABLE 2.

FIRES DATA PROVIDED BY STATE AGENCIES BY FIRE TYPE

State	Agriculture	Prescribed	Silviculture	Land Clearing	Waste Burning	Wildfires
AL	✓	✓		✓		✓
FL	✓	✓	✓	✓		✓
GA	✓		✓	✓		✓
KY						✓
MS		✓				
NC						✓
SC	✓			✓	✓	✓
TN						✓
VA						✓
WV						✓

TABLE 3.

FIRES DATA PROVIDED BY FEDERAL AGENCIES BY FIRE TYPE

Agency	Agriculture	Prescribed	Silviculture	Land Clearing	Waste Burning	Wildfires
USFS		✓				✓
FWS						✓
NPS						✓
BLM						✓
BIA						✓

Data Manipulation/Augmentation

Once all the data had been provided by the State and Federal agencies, MACTEC compiled the data into a master database containing common pieces of information necessary to identify the fire location and date as well as the data necessary to calculate emissions. That database was used to calculate fires on a fire-by-fire basis for all data submitted.

Prior to inserting data into the master database however, separate databases for each State and Federal submittal were developed. The first step in completing these databases was to ensure that sufficient location information was available so that the emissions could eventually be summed at the county level for the annual inventory.

For those data submittals that provided only latitude and longitude, we imported the data into a geographic information system (GIS) program and used the GIS program to add information on the State and county where the fire was located. In many cases this involved converting the data on latitude and longitude. Data on latitude and longitude were submitted in both hours:minutes:seconds format as well as decimal degrees. All data were converted to decimal degrees. For some of these records, the data either 1) fell outside of the State that the submittal was for or 2) fell in the ocean. Fires that fell outside of the State, in the ocean, or in the wrong State were dropped. This resulted in less than three percent of the acreage submitted for any State being deleted. Some State agencies submitted section, township and range data, however converting these data to latitude/longitude was too labor intensive for the current scope of work so we simply used the county information provided to locate these fires.

For data submitted with only State and county information, we placed the fires at the county centroid location. For that work we used a file on the EPA website that listed the location of the county centroid in decimal degrees. All records where the location information was the county centroid were marked in the database.

Once the location information was completed for all data, we then proceeded to augment the fuel loading information in the database. The general approach used for augmenting fuel loading was as follows:

- State-supplied data – if provided, these values were always used
- National Fire Danger Rating System (NFDRS) Model value assigned fuel loading
- Material burned type (a NFDRS value was assigned if the material burned could be easily matched to a NFDRS fuel model)
- State specific defaults calculated where no material burned type was provided
- AP-42 values for fires other than wildfires or prescribed burns

Values for fuel loading were then assigned to each individual fire (either State or Federal) based on this priority scheme. If the State supplied a value for fuel loading (even if the value was for the whole State) that value was used for all fires of that type (e.g., wildfires, prescribed fires, etc.). Similarly, if the Federal agency supplied fuel loading data for the fire, it was always used. Where no State or Federal value was provided but a NFDRS fire model designation was provided, the default value for that fire model designation was used for the fuel loading. If the data included the type of material burned and it could be matched with a similar material described by the vegetation type of a NFDRS fire model category, then the fuel loading for that NFDRS category was used. If the material could not be matched or was not provided, then an average State fuel loading based on a State-wide average of different NFDRS fuel models was used. Finally, for some fire types (e.g., agricultural burning or land clearing of debris), AP-42 fuel loadings were utilized. For those fire types, AP-42 was the primary source of fuel loading information unless information was provided by the State. In a few cases, we also used values from the 1999 NEI based on the NEI documentation.

The default values for the NFDRS fuel models were provided by Bruce Bayle, USFS. NFDRS classifies fuel models using an alphabetic system that describes the general type of material that is consumed in the fire. Table 4 shows the list of NFDRS fuel models and the vegetative types associated with each model.

TABLE 4.

NFDRS FUEL MODEL DESIGNATIONS AND VEGETATION TYPES

NFDRS Fuel Model	Vegetation
A	Annual grass and forbs
B	Mature chaparral
C	Open timber/grass
D	Southern rough
E	Hardwoods (winter)
F	Intermediate brush
G	Closed, short-needle conifer (heavy dead)
H	Closed, short-needle conifer (normal dead)
I	Heavy slash
J	Medium slash
K	Light slash
L	Perennial grass
N	Sawgrass
O	Pocosin
P	Southern plantation
Q	Alaskan black spruce
R	Hardwoods (summer)
S	Alaskan tundra
T	Sagebrush/grass
U	Western, long-needle conifer

The information provided by Bruce Bayle was in the form of fuel loadings, by size class of fuel, for each NFDRS fuel model. Data on the fuel size class were provided for one hour, 10 hour, 100 hour, and 1000 hour fuels. The one hour fuel designation means that the fuel is of a size that will burn in the first hour of the fire. Similar meanings can be assigned to the other size class categories. In addition, information was provided on live woody and live herbaceous materials. Totaling the fuel loading for each size class (along with the live woody and herbaceous material) provided an overall average fuel loading for each NFDRS fuel model type. These values were summed to provide the fuel loadings for each fuel model.

The summation of these values was performed using a weighting scheme provided by Bruce Bayle. For each respective southern fuel model, we used the following percentages to calculate a typical tonnage per acre:

Include 100% of the 1 and 10 hour fuels (1h + 10h).
Include 50% of the 100 hour fuels (100h).
Include 10% of the 1,000 hour fuels (1,000h).
Include 40% of the "live woody" fuels.
Include 10% of the "live herbaceous" fuels.

The above percentages represent an average/typical wildfire and average/typical weather conditions/environmental factors in the southeast.

The values calculated using this weighting scheme were then compared to the default State fuel loadings from Table 4 of the report entitled "Data Needs and Availability for Wildland Fire Emission Inventories - Short-term Improvements to the Wildland Fire Component of the National Emissions Inventory" June 5, 2003, prepared under EPA Contract No. 68-D-02-064, Work Assignment No. I-08 for Tom Pace (known as the Pace Report). A spreadsheet was prepared with the summarized fuel loading values provided by Bruce Bayle along with those from the Pace Report. That spreadsheet was then reviewed by Bruce Bayle, Mark Clere (Fire Planning Specialist, National Forests in Florida, Tallahassee, FL), and Charlie Kerr (Fire Management Officer, Francis Marion & Sumter National Forests, Columbia, SC) to ensure that the data used were optimal for southeastern forests. Suggestions for modifying the values in the spreadsheet were made by the reviewers and implemented as the standard values for use with the different NFDRS fuel models. Appendix B contains a table with the initial values for each NFDRS fuel model calculated using the weighting scheme, the default EPA values from the Pace report and the final values used based on the review of both the initial calculated values and the Pace report defaults.

When the type of material burned wasn’t known, default values had to be calculated. Table 3 of the Pace report provides a State-wide method for calculating fuel loadings based on the fraction of total state acreage in each NFDRS model. These fractions were used with the Bayle revised fuel loading values discussed above to calculate a State default value when the type of material burned could not be determined. For example in KY, 0.001 of State land is classified as NFDRS model C, 0.199 as L, 0.048 as P and 0.752 as R. This yields a State default for wildfires (where the fuel type was not specified) of 1.69. These values were used whenever there was insufficient information to assign an actual value based either on the NFDRS model or the type of vegetation (material) burned.

Once the fuel loading had been assigned to each fire, the remaining information necessary to calculate emissions was emission factors. Each fire was assigned a "fire model" designation for the purposes of assigning an emission factor to the fire. In the cases where the fires had designated NFDRS fire models already, the "fire model" designation was identical to the NFDRS letter designation. There were other designations that were assigned to other fire types (agricultural burning fires, etc.). In some cases the material burned type was used to assign the "fire model" emission factor assignment. Emission factors were assigned for all fire types.

The basis for the emission factors for many of these fires was Table 2 of the Pace report. The emission factors used differ from Table 2 of the Pace report slightly for a few of the "fire models". This is because per note 3 for Table 2 in the Pace report, emission factors for fuel models other than NFDRS types A, B, C, F, and L should be augmented by 17% and 8.5% for wildfires and prescribed fires respectively. We did augment the values by those percentages.

The emission factors for each fuel model are provided in Appendix C.

Once all of the data required to calculate emissions were acquired or assigned, we then put all of the State data into the master database. The master database contains the following data fields:

StateFIPS	State FIPS code
CountyFIPS	County FIPS code
SCC	Source Classification Code
Date	Date of Fire
Acres	Number of Acres burned
Latitude	Latitude in decimal degrees
Longitude	Longitude in decimal degrees
LatLongIsCountyCent	True/False field indicating whether the latitude and longitude value is the county centroid – value is "True" if it is
FireType	Type of fire - prescribed and silviculture burning were both assigned the prescribed burning SCC, waste burning and land clearing of debris burning were both assigned the waste burning SCC
Material	Type of material burned if known
Fuel Loading	Fuel loading value in tons/acre
Default Fuel Loading	True/false field indicating if the fuel loading value is a default value – "True" if it is
Default Material	True/false field indicating if the material field value is a default value – "True" if it is
Fuel Loading Source	Source for the fuel loading value
Emission Factor Code	Code used to look up emission factor values in the emission factor table - NFDRS fuel model if available
Pollutant	Pollutant for emissions

Emissions	Emissions value in tons
Emission Factor	Emission factor in lbs/ton of material burned
Agency	Agency that submitted data
DataSource	Who supplied the data (State or Federal or other)
StateFederal	One character indicator field that indicates if the record is a State (S) or federal (F) data record.

The master database file contains the raw fire-by-fire information used to estimate most (but not all) emissions in versions 1 and 2 of the VISTAS area source inventory. Summing emissions for the individual fires in the master database will not provide the same annual values found in the inventory in all cases. This is because of the replacement scheme used to determine fire emissions for the annual inventory. Because Federal agencies did not all submit prescribed fire acreage, some values for prescribed fire emissions from the 1999 NEI Version 2 were maintained if that county had federal land in it. This was done to avoid double counting of emissions. Following publication of Version 1 of the VISTAS inventory, AL, FL, GA, MS and SC fire contacts indicated that the prescribed fire data submitted included Federal and State lands. For those States, the prescribed fire emission values in the master fire database match the NIF version. For those States that did not include Federal lands in their submittals, MACTEC obtained a GIS file that contained federal land information in it. We used that data to determine which counties contained federal lands. If the county contained federal lands, then the 1999 NEI version 2 prescribed fire emissions were maintained for that county in order to avoid double counting.

Similarly, one State (MS) did not submit wildfire information. For that State, the data in the master fire database file will not match the annual emission inventory values. For MS, the 1999 NEI version 2 values were maintained, again to avoid double counting or underestimating.

Figures 3 through 6 provide an overview of the replacement process used to allocate fire emissions from either the master fire database or maintained from the 1999 NEI version 2.

FIGURE 3.

GENERAL APPROACH TO ESTIMATING EMISSIONS FOR FIRES (APPLIES TO WILDFIRES AND PRESCRIBED FIRES).

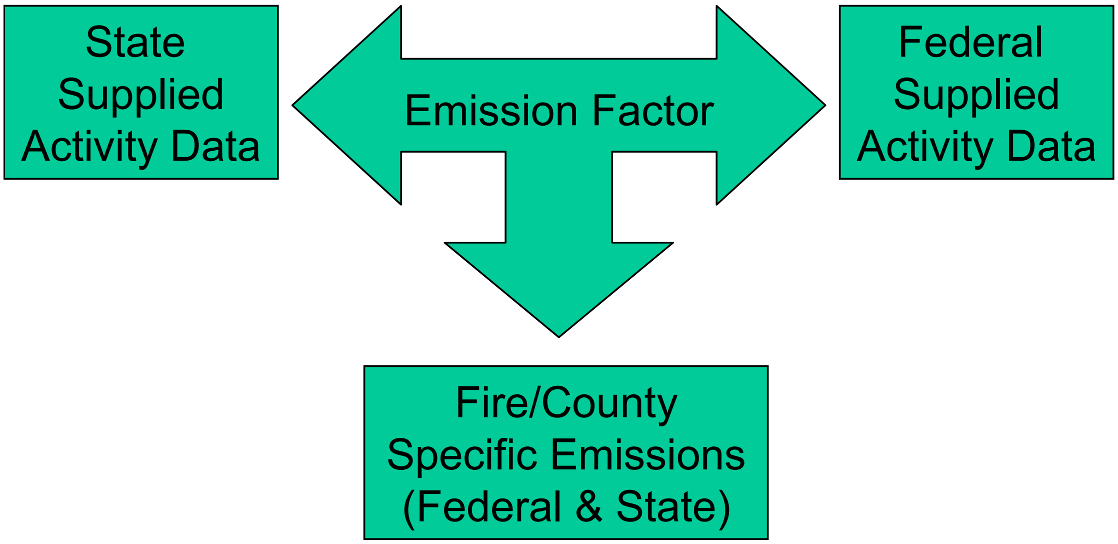


FIGURE 4.

APPROACH USED FOR CALCULATING FIRES IF FEDERAL DATA WERE MISSING.

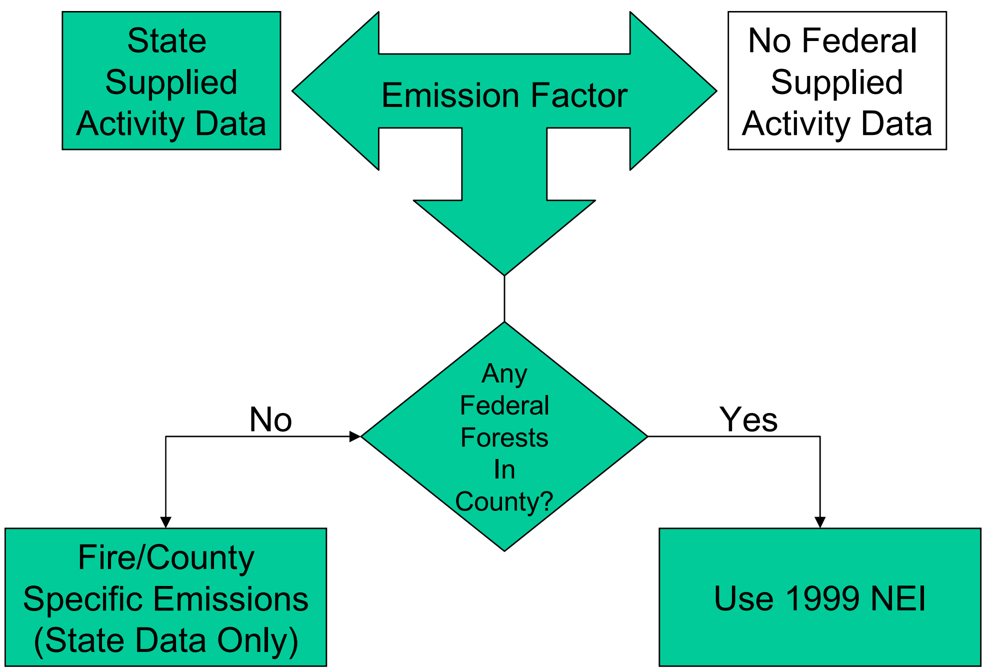


FIGURE 5.

APPROACH USED FOR CALCULATING FIRES IF STATE DATA WERE MISSING.

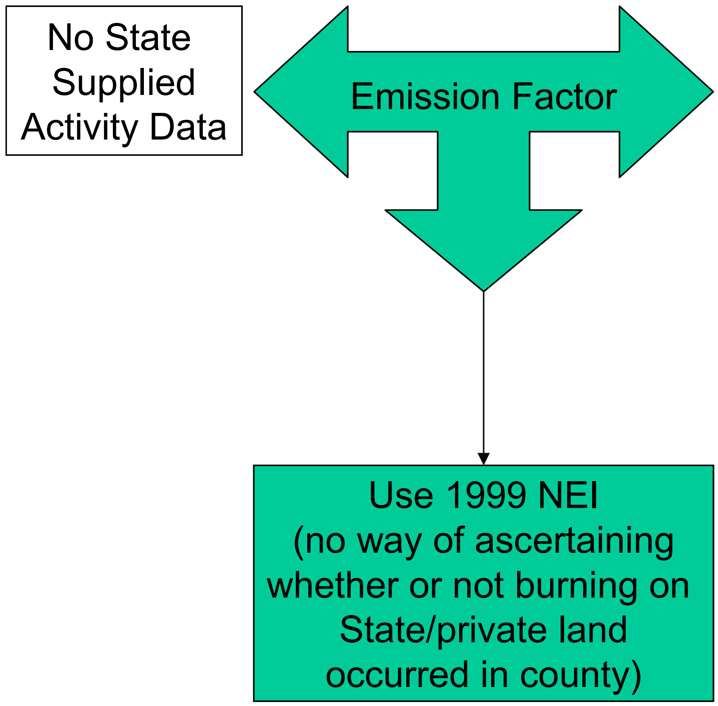
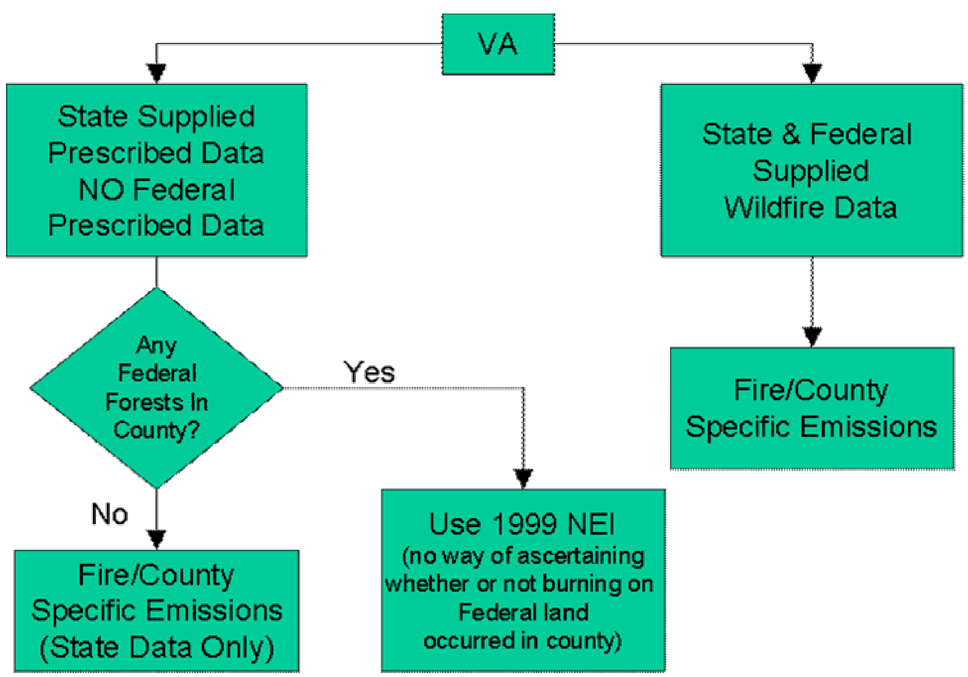


FIGURE 6.

EXAMPLE OF THE APPROACH USED FOR VA COUNTIES BASED ON ACTUAL REPORTED DATA.



RESULTS

Tables 5 through 11 and figures 7 through 13 provide an overview of the emissions for both versions of the draft 2002 VISTAS emission inventory (Version 1 and Version 2) and the 1999 NEI Version 2 that was used as the starting point for the VISTAS inventory, by State and pollutant.

Table 5 shows that the CO emissions for the VISTAS region decreased by approximately 600,000 tons for 2002 compared with 1999 levels for Version 1 of the VISTAS inventory. However, Version 2 shows an increase of over 2 million tons compared to Version 1. This is due to the inclusion of the prescribed burning emissions calculated from the data submitted by AL, FL, GA, MS, and SC rather than using the State supplied/NEI V2 blended approach used for Version 1 of the VISTAS inventory. The majority of the increase is for fires in FL. Similarly, Table 6 shows a decrease of approximately 58,000 tons of NOx from 1999 to 2002 Version 1 but only a 21,000 ton decrease relative to 2002 Version 2. Table 7 indicates that SO2 emissions have increased over the 1999-2002 period by 20,000 tons for Version 1 and 37,000 tons for Version 2. VOC emissions (Table 8) are showing a slight increase (3,000 tons) from 1999 to 2002 Version 1, but a substantially larger increase (65,000 tons) for Version 2. PM emissions increase by 200,000 and 41,000 tons for PM-10 and PM-2.5 respectively (Tables 9 and 10) for Version 1 but increases for Version 2 are 425,000 and 230,000 tons (respectively) for Version 2. Finally, NH3 emissions decreased slightly (9,000 tons) from 1999 to 2002 Version 1 but show a slight increase for Version 2 (produced by the use of the updated CMU Version 3.1 model).

TABLE 5.

AREA SOURCE CO EMISSIONS (ALL VALUES IN TONS)

	1999 NEI V2	VISTAS 2002 Draft Version 1	VISTAS 2002 Draft Version 2
AL	1,075,786	873,217	1,043,657
FL	721,708	953,784	3,332,231
GA	531,628	671,607	755,489
KY	252,902	120,848	120,847
MS	191,706	156,747	171,436
NC	769,251	420,198	420,198
SC	419,406	336,945	346,668
TN	200,639	171,912	171,912
VA	287,071	180,077	180,076
WV	112,027	93,496	93,496
Total	**4,562,124**	**3,978,831**	**6,636,010**

FIGURE 7.

CO EMISSIONS BY STATE FOR 2002 AND 1999 NEI VERSION 2.

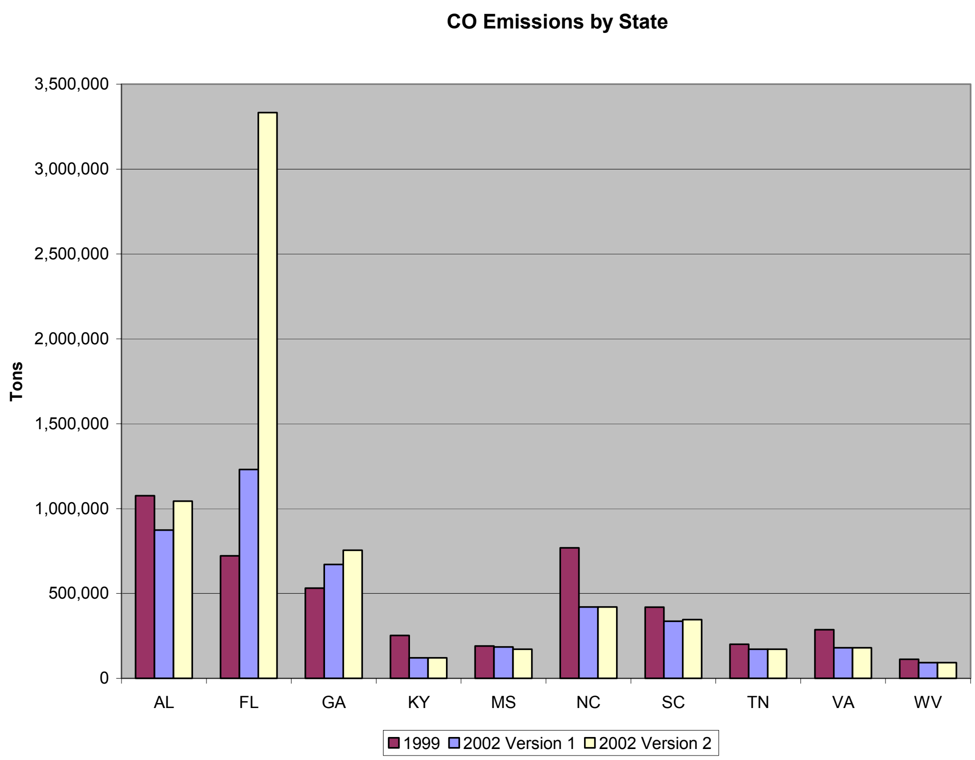


TABLE 6.

AREA SOURCE NOX EMISSIONS (ALL VALUES IN TONS)

	1999 NEI V2	VISTAS 2002 Draft Version 1	VISTAS 2002 Draft Version 2
AL	50,694	42,603	44,484
FL	55,882	53,411	96,723
GA	41,505	40,664	42,529
KY	74,603	59,843	59,843
MS	8,034	7,853	7,636
NC	33,443	24,880	24,879
SC	22,534	20,197	20,423
TN	46,843	28,479	28,479
VA	44,778	42,106	42,106
WV	22,726	23,167	23,167
Total	**401,041**	**343,203**	**390,269**

FIGURE 8.

NOX EMISSIONS BY STATE FOR 2002 AND 1999 NEI VERSION 2.

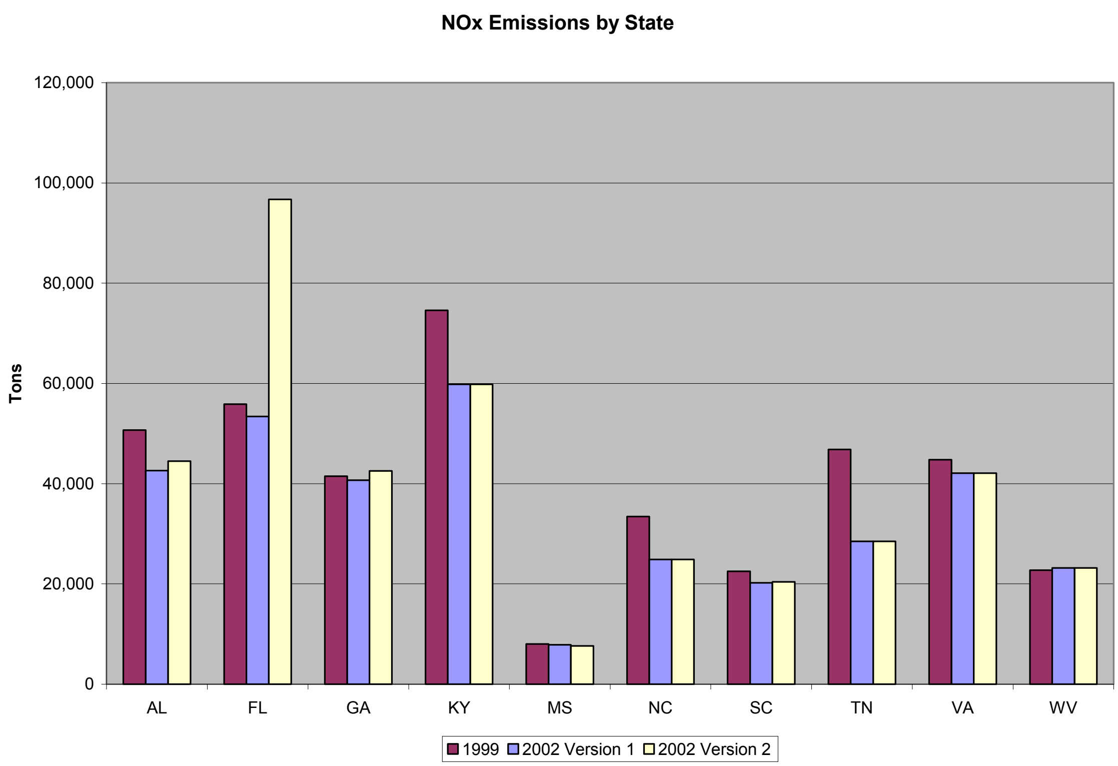


TABLE 7.

AREA SOURCE SO2 EMISSIONS (ALL VALUES IN TONS)

	1999 NEI V2	VISTAS 2002 Draft Version 1	VISTAS 2002 Draft Version 2
AL	43,394	49,653	52,110
FL	37,736	44,469	58,728
GA	4,583	7,120	7,737
KY	54,909	56,003	56,003
MS	840	848	901
NC	31,009	31,500	31,500
SC	12,705	13,037	13,128
TN	40,186	41,230	41,230
VA	8,206	8,783	8,782
WV	11,087	11,517	11,517
Total	**244,654**	**264,161**	**281,636**

FIGURE 9.

SO2 EMISSIONS BY STATE FOR 2002 AND 1999 NEI VERSION 2.

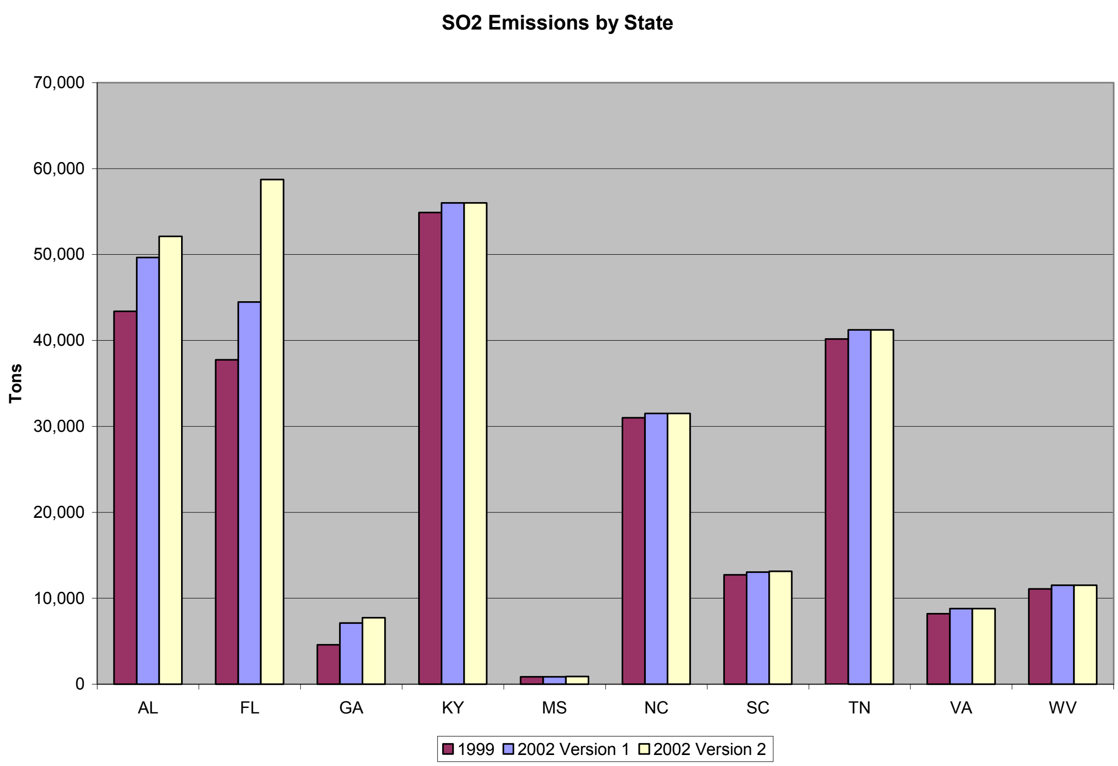


TABLE 8.

AREA SOURCE VOC EMISSIONS (ALL VALUES IN TONS)

	1999 NEI V2	VISTAS 2002 Draft Version 1	VISTAS 2002 Draft Version 2
AL	327,400	251,368	237,264
FL	376,173	529,506	602,458
GA	213,204	238,690	242,622
KY	144,764	118,453	118,453
MS	128,694	149,610	148,969
NC	311,716	279,897	279,896
SC	193,951	192,833	193,285
TN	215,671	213,886	213,885
VA	204,245	143,908	143,908
WV	93,644	93,937	93,938
Total	**2,209,462**	**2,212,088**	**2,274,618**

FIGURE 10.

VOC EMISSIONS BY STATE FOR 2002 AND 1999 NEI VERSION 2.

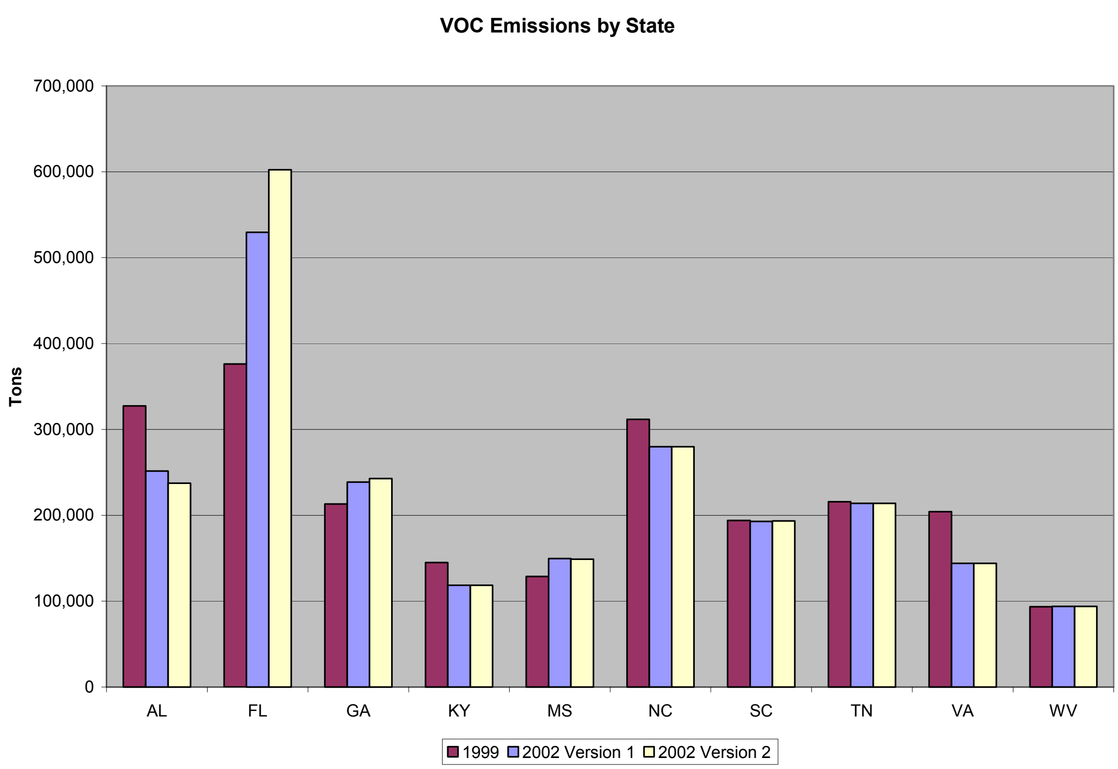


TABLE 9.

AREA SOURCE PM10-PRI EMISSIONS (ALL VALUES IN TONS)

	1999 NEI V2	VISTAS 2002 Draft Version 1	VISTAS 2002 Draft Version 2
AL	499,591	511,026	528,690
FL	562,376	648,848	850,288
GA	723,576	775,212	782,352
KY	271,436	269,497	269,497
MS	361,991	378,091	375,747
NC	338,368	343,761	343,761
SC	271,671	278,217	278,881
TN	277,322	281,620	281,620
VA	282,905	297,891	297,891
WV	120,622	125,656	125,656
Total	**3,709,857**	**3,909,820**	**4,134,383**

FIGURE 11.

PM10-PRI EMISSIONS BY STATE FOR 2002 AND 1999 NEI VERSION 2.

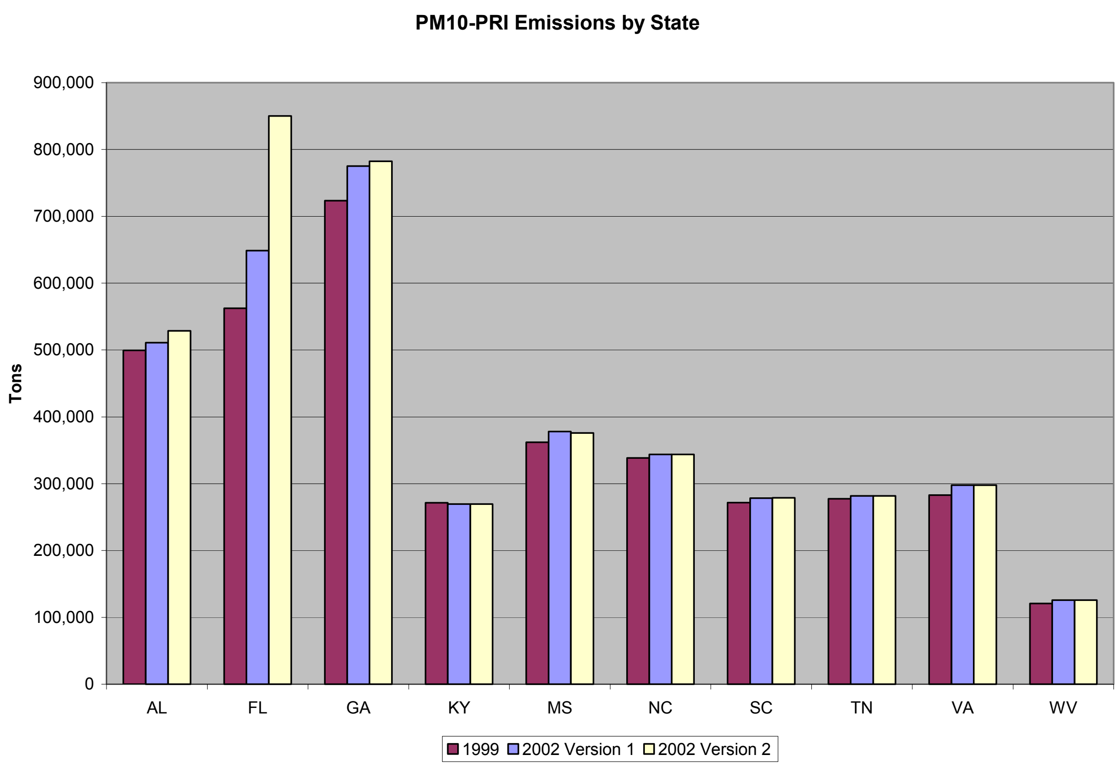


TABLE 10.

AREA SOURCE PM2.5-PRI EMISSIONS (ALL VALUES IN TONS)

	1999 NEI V2	VISTAS 2002 Draft Version 1	VISTAS 2002 Draft Version 2
AL	168,103	157,235	171,171
FL	169,910	222,539	393,600
GA	184,224	197,549	203,532
KY	79,396	70,432	70,431
MS	84,982	87,057	84,901
NC	115,722	112,691	112,690
SC	70,553	65,296	65,827
TN	79,053	76,762	76,762
VA	86,499	90,157	90,156
WV	35,023	34,764	34,764
Total	**1,073,466**	**1,114,482**	**1,303,835**

FIGURE 12.

PM2.5-PRI EMISSIONS BY STATE FOR 2002 AND 1999 NEI VERSION 2.

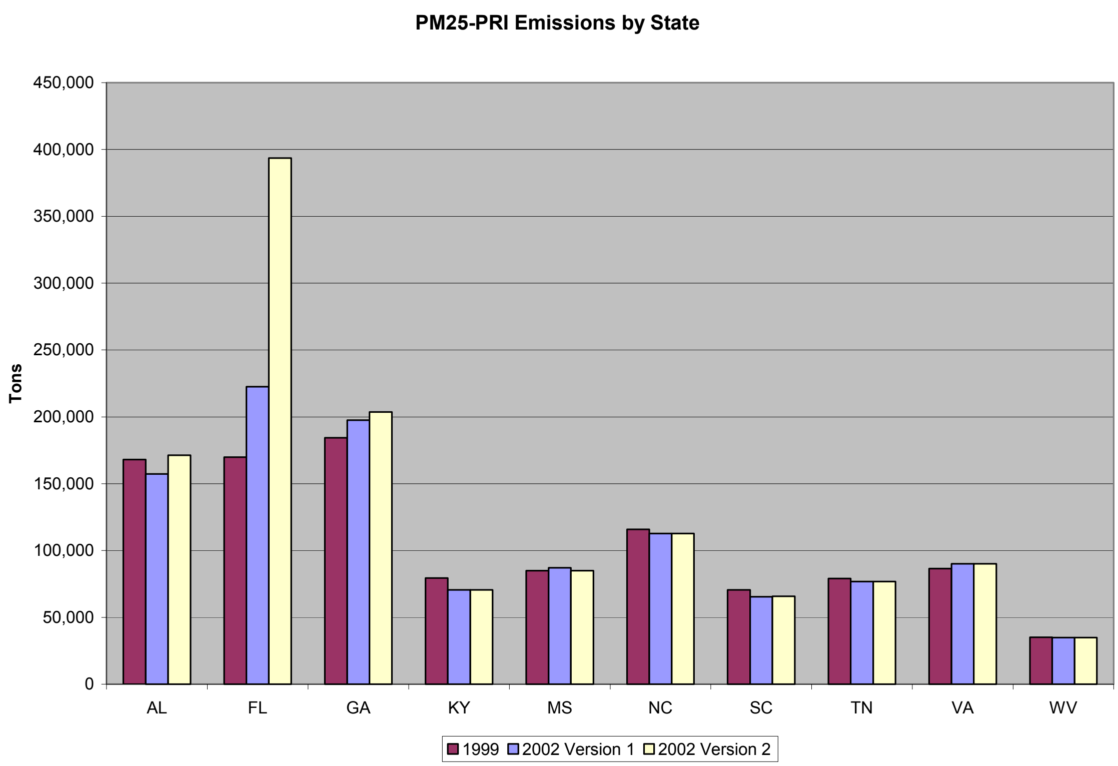


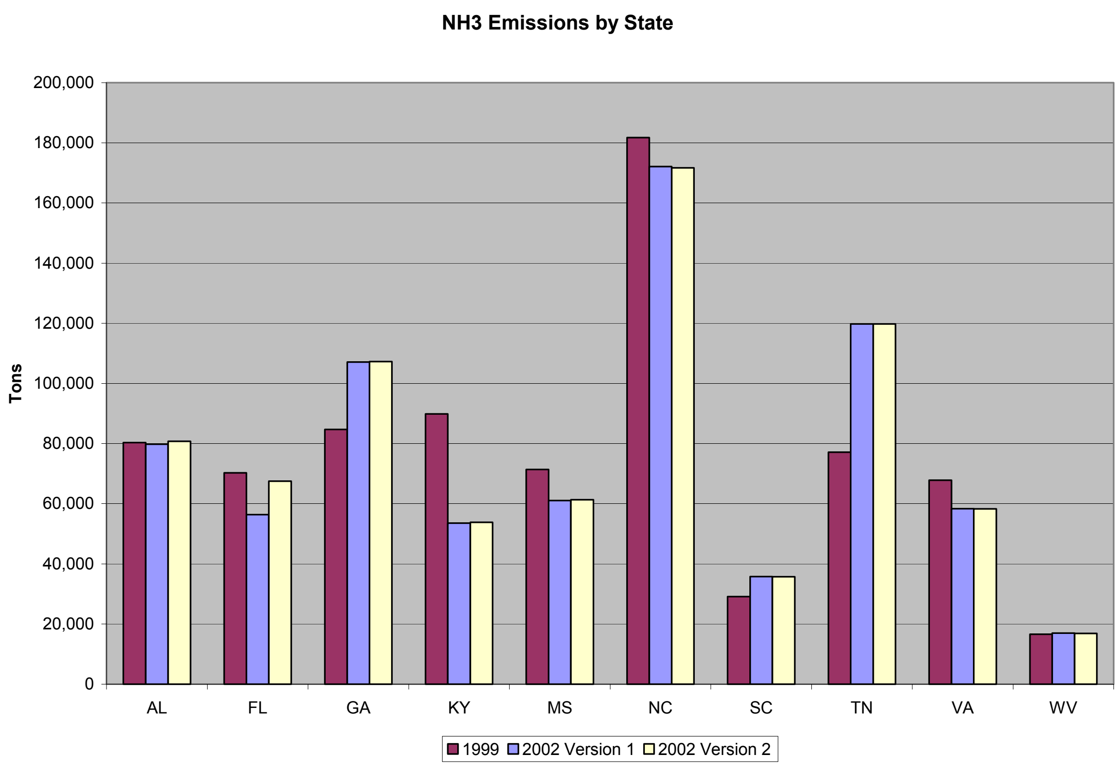
TABLE 11.

AREA SOURCE NH3 EMISSIONS (ALL VALUES IN TONS)

	1999 NEI V2	VISTAS 2002 Draft Version 1	VISTAS 2002 Draft Version 2
AL	80,343	79,807	80,736
FL	70,313	56,412	67,493
GA	84,683	107,089	107,271
KY	89,851	53,553	53,810
MS	71,346	61,023	61,279
NC	181,801	172,085	171,734
SC	29,124	35,782	35,700
TN	77,141	119,790	119,790
VA	67,814	58,343	58,241
WV	16,602	16,979	16,864
Total	**769,020**	**760,864**	**772,917**

FIGURE 13.

NH3 EMISSIONS BY STATE FOR 2002 AND 1999 NEI VERSION 2.



Appendix A

NH3 Growth Factors for Livestock Operations

TABLE A-1. LIVESTOCK NH3 GROWTH FACTORS AND ANIMAL POPULATIONS

State	FIPST	SCC	Category	2002 Population (1000s)	1997 Population (1000s)	Growth Factor
AL	01	2805020003	All Cattle/calves	1370	1,531	0.89484
AL	01	2805020003	Cows and Heifers that have Calved			0.89484
AL	01	2805020002	Beef Cows	750	832	0.90144
AL	01	2805020001	Milk Cows			0.89484
AL	01	2805020003	Heifers 500 lbs or over			0.89484
AL	01	2805020002	For beef cow replacement			0.89484
AL	01	2805020001	For milk cow replacement			0.89484
AL	01	2805020003	Other heifers			0.89484
AL	01	2805020004	Steers 500 lbs+			0.89484
AL	01	2805020004	Bulls 500 lbs +			0.89484
AL	01	2805020004	Calves < 500 lbs			0.89484
AL	01	2805020003	Cattle and calves on feed			0.89484
AL	01	2805025000	All Hogs and Pigs			1.00000
AL	01	2805025000	Breeding stock hogs and pigs			1.00000
AL	01	2805025000	Market Hogs/Pigs			1.00000
AL	01	2805030003	All Chickens	15256	18605	0.81999
AL	01	2805030003	Hens and Pullets - laying age	9645	13433	0.71801
AL	01	2805030002	Pullets 13-19 weeks		2729	0.71801
AL	01	2805030001	Pullets < 13 weeks		2443	0.71801
AL	01	2805030004	Other Chickens	1051303	871123	1.20684
AL	01	2805040000	Sheep			1.00000
AL	01	2805040000	Breeding Ewes			1.00000
AL	01	2805040000	Lamb Crop			1.00000
FL	12	2805020003	All Cattle/calves	1780	1,970	0.90355
FL	12	2805020003	Cows and Heifers that have Calved			0.90355
FL	12	2805020002	Beef Cows	958	1,072	0.89366
FL	12	2805020001	Milk Cows	152	158	0.96203
FL	12	2805020003	Heifers 500 lbs or over			0.90355
FL	12	2805020002	For beef cow replacement			0.90355
FL	12	2805020001	For milk cow replacement			0.90355
FL	12	2805020003	Other heifers			0.90355
FL	12	2805020004	Steers 500 lbs+			0.90355
FL	12	2805020004	Bulls 500 lbs +			0.90355
FL	12	2805020004	Calves < 500 lbs			0.90355
FL	12	2805020003	Cattle and calves on feed			0.90355
FL	12	2805025000	All Hogs and Pigs	35	65	0.53846
FL	12	2805025000	Breeding stock hogs and pigs			0.53846
FL	12	2805025000	Market Hogs/Pigs			0.53846
FL	12	2805030003	All Chickens	125331	142265	0.88097
FL	12	2805030003	Hens and Pullets - laying age	10631	9865	1.07765
FL	12	2805030002	Pullets 13-19 weeks			1.07765
FL	12	2805030001	Pullets < 13 weeks			1.07765
FL	12	2805030004	Other Chickens	114700	132400	0.86631
FL	12	2805040000	Sheep			1.00000
FL	12	2805040000	Breeding Ewes			1.00000
FL	12	2805040000	Lamb Crop			1.00000

State	FIPST	SCC	Category	2002 Population (1000s)	1997 Population (1000s)	Growth Factor
GA	13	2805020003	All Cattle/calves	1240	1,390	0.89209
GA	13	2805020003	Cows and Heifers that have Calved			0.89209
GA	13	2805020002	Beef Cows			0.89209
GA	13	2805020001	Milk Cows			0.89209
GA	13	2805020003	Heifers 500 lbs or over			0.89209
GA	13	2805020002	For beef cow replacement			0.89209
GA	13	2805020001	For milk cow replacement			0.89209
GA	13	2805020003	Other heifers			0.89209
GA	13	2805020004	Steers 500 lbs+			0.89209
GA	13	2805020004	Bulls 500 lbs +			0.89209
GA	13	2805020004	Calves < 500 lbs			0.89209
GA	13	2805020003	Cattle and calves on feed			0.89209
GA	13	2805025000	All Hogs and Pigs	345	514	0.67121
GA	13	2805025000	Breeding stock hogs and pigs			0.67121
GA	13	2805025000	Market Hogs/Pigs			0.67121
GA	13	2805030003	All Chickens	29553	30318	0.97477
GA	13	2805030003	Hens and Pullets - laying age	20900	19869	1.05189
GA	13	2805030002	Pullets 13-19 weeks			1.05189
GA	13	2805030001	Pullets < 13 weeks			1.05189
GA	13	2805030004	Other Chickens	1290500	1017521	1.26828
GA	13	2805040000	Sheep			1.00000
GA	13	2805040000	Breeding Ewes			1.00000
GA	13	2805040000	Lamb Crop			1.00000
KY	21	2805020003	All Cattle/calves	2430	2,600	0.93462
KY	21	2805020003	Cows and Heifers that have Calved	1240	1,330	0.93233
KY	21	2805020002	Beef Cows	1120	1,180	0.94915
KY	21	2805020001	Milk Cows	120	150	0.80000
KY	21	2805020003	Heifers 500 lbs or over	350	367	0.95368
KY	21	2805020002	For beef cow replacement	175	195	0.89744
KY	21	2805020001	For milk cow replacement	45	57	0.78947
KY	21	2805020003	Other heifers	130	115	1.13043
KY	21	2805020004	Steers 500 lbs+	220	205	1.07317
KY	21	2805020004	Bulls 500 lbs +	75	78	0.96154
KY	21	2805020004	Calves < 500 lbs	540	620	0.87097
KY	21	2805020003	Cattle and calves on feed	10	20	0.50000
KY	21	2805025000	All Hogs and Pigs	370	570	0.64912
KY	21	2805025000	Breeding stock hogs and pigs	40	70	0.57143
KY	21	2805025000	Market Hogs/Pigs	330	500	0.66000
KY	21	2805030003	All Chickens	6195	4939	1.25430
KY	21	2805030003	Hens and Pullets - laying age	4350	3501	1.24250
KY	21	2805030002	Pullets 13-19 weeks	845	678	1.24631
KY	21	2805030001	Pullets < 13 weeks	805	760	1.05921
KY	21	2805030004	Other Chickens	195	16378	0.01191
KY	21	2805040000	Sheep	22	22	1.00000
KY	21	2805040000	Breeding Ewes	14	15	0.93333
KY	21	2805040000	Lamb Crop	16	18	0.88889
MS	28	2805020003	All Cattle/calves	1100	1,260	0.87302
MS	28	2805020003	Cows and Heifers that have Calved			0.87302

State	FIPST	SCC	Category	2002 Population (1000s)	1997 Population (1000s)	Growth Factor
MS	28	2805020002	Beef Cows	576	632	0.91139
MS	28	2805020001	Milk Cows	34	48	0.70833
MS	28	2805020003	Heifers 500 lbs or over			0.87302
MS	28	2805020002	For beef cow replacement			0.87302
MS	28	2805020001	For milk cow replacement			0.87302
MS	28	2805020003	Other heifers			0.87302
MS	28	2805020004	Steers 500 lbs+			0.87302
MS	28	2805020004	Bulls 500 lbs +			0.87302
MS	28	2805020004	Calves < 500 lbs			0.87302
MS	28	2805020003	Cattle and calves on feed			0.87302
MS	28	2805025000	All Hogs and Pigs	275	220	1.25000
MS	28	2805025000	Breeding stock hogs and pigs			1.25000
MS	28	2805025000	Market Hogs/Pigs			1.25000
MS	28	2805030003	All Chickens	10814	11073	0.97661
MS	28	2805030003	Hens and Pullets - laying age			0.97661
MS	28	2805030002	Pullets 13-19 weeks			0.97661
MS	28	2805030001	Pullets < 13 weeks			0.97661
MS	28	2805030004	Other Chickens			0.97661
MS	28	2805040000	Sheep			1.00000
MS	28	2805040000	Breeding Ewes			1.00000
MS	28	2805040000	Lamb Crop			1.00000
NC	37	2805020003	All Cattle/calves	920	941	0.97768
NC	37	2805020003	Cows and Heifers that have Calved			0.97768
NC	37	2805020002	Beef Cows	417	435	0.95862
NC	37	2805020001	Milk Cows	63	78	0.80769
NC	37	2805020003	Heifers 500 lbs or over			0.97768
NC	37	2805020002	For beef cow replacement			0.97768
NC	37	2805020001	For milk cow replacement			0.97768
NC	37	2805020003	Other heifers			0.97768
NC	37	2805020004	Steers 500 lbs+			0.97768
NC	37	2805020004	Bulls 500 lbs +			0.97768
NC	37	2805020004	Calves < 500 lbs			0.97768
NC	37	2805020003	Cattle and calves on feed			0.97768
NC	37	2805025000	All Hogs and Pigs	9800	9624	1.01829
NC	37	2805025000	Breeding stock hogs and pigs			1.01829
NC	37	2805025000	Market Hogs/Pigs			1.01829
NC	37	2805030003	All Chickens	17042	16162	1.05445
NC	37	2805030003	Hens and Pullets - laying age			1.05445
NC	37	2805030002	Pullets 13-19 weeks			1.05445
NC	37	2805030001	Pullets < 13 weeks			1.05445
NC	37	2805030004	Other Chickens	735200	591248	1.24347
NC	37	2805040000	Sheep			1.00000
NC	37	2805040000	Breeding Ewes			1.00000
NC	37	2805040000	Lamb Crop			1.00000
SC	45	2805020003	All Cattle/calves	435	454	0.95815
SC	45	2805020003	Cows and Heifers that have Calved			0.95815
SC	45	2805020002	Beef Cows	210	229	0.91703
SC	45	2805020001	Milk Cows	20	25	0.80000

State	FIPST	SCC	Category	2002 Population (1000s)	1997 Population (1000s)	Growth Factor
SC	45	2805020003	Heifers 500 lbs or over			0.95815
SC	45	2805020002	For beef cow replacement			0.95815
SC	45	2805020001	For milk cow replacement			0.95815
SC	45	2805020003	Other heifers			0.95815
SC	45	2805020004	Steers 500 lbs+			0.95815
SC	45	2805020004	Bulls 500 lbs +			0.95815
SC	45	2805020004	Calves < 500 lbs			0.95815
SC	45	2805020003	Cattle and calves on feed			0.95815
SC	45	2805025000	All Hogs and Pigs	300	305	0.98361
SC	45	2805025000	Breeding stock hogs and pigs			0.98361
SC	45	2805025000	Market Hogs/Pigs			0.98361
SC	45	2805030003	All Chickens	5372	5711	0.94064
SC	45	2805030003	Hens and Pullets - laying age			0.94064
SC	45	2805030002	Pullets 13-19 weeks			0.94064
SC	45	2805030001	Pullets < 13 weeks			0.94064
SC	45	2805030004	Other Chickens	192900	158679	1.21566
SC	45	2805040000	Sheep			1.00000
SC	45	2805040000	Breeding Ewes			1.00000
SC	45	2805040000	Lamb Crop			1.00000
TN	47	2805020003	All Cattle/calves	2270	2,145	1.05828
TN	47	2805020003	Cows and Heifers that have Calved	1190	1,151	1.03388
TN	47	2805020002	Beef Cows	1106	1,039	1.06449
TN	47	2805020001	Milk Cows	84	112	0.75000
TN	47	2805020003	Heifers 500 lbs or over			1.05828
TN	47	2805020002	For beef cow replacement			1.05828
TN	47	2805020001	For milk cow replacement			1.05828
TN	47	2805020003	Other heifers			1.05828
TN	47	2805020004	Steers 500 lbs+			1.05828
TN	47	2805020004	Bulls 500 lbs +			1.05828
TN	47	2805020004	Calves < 500 lbs			1.05828
TN	47	2805020003	Cattle and calves on feed			1.05828
TN	47	2805025000	All Hogs and Pigs			1.00000
TN	47	2805025000	Breeding stock hogs and pigs			1.00000
TN	47	2805025000	Market Hogs/Pigs			1.00000
TN	47	2805030003	All Chickens	2200	2478	0.88781
TN	47	2805030003	Hens and Pullets - laying age	1256	1654	0.75937
TN	47	2805030002	Pullets 13-19 weeks	317	567	0.55908
TN	47	2805030001	Pullets < 13 weeks	453	257	1.76265
TN	47	2805030004	Other Chickens	186400	120830	1.54266
TN	47	2805040000	Sheep			1.00000
TN	47	2805040000	Breeding Ewes			1.00000
TN	47	2805040000	Lamb Crop			1.00000
VA	51	2805020003	All Cattle/calves	1,650	1,780	0.92697
VA	51	2805020003	Cows and Heifers that have Calved	810	850	0.95294
VA	51	2805020002	Beef Cows	690	725	0.95172
VA	51	2805020001	Milk Cows	120	125	0.96000
VA	51	2805020003	Heifers 500 lbs or over	250	270	0.92593
VA	51	2805020002	For beef cow replacement	120	130	0.92308

State	FIPST	SCC	Category	2002 Population (1000s)	1997 Population (1000s)	Growth Factor
VA	51	2805020001	For milk cow replacement	60	65	0.92308
VA	51	2805020003	Other heifers	70	75	0.93333
VA	51	2805020004	Steers 500 lbs+	175	195	0.89744
VA	51	2805020004	Bulls 500 lbs +	40	45	0.88889
VA	51	2805020004	Calves < 500 lbs	375	420	0.89286
VA	51	2805020003	Cattle and calves on feed	27	30	0.90000
VA	51	2805025000	All Hogs and Pigs	410	400	1.02500
VA	51	2805025000	Breeding stock hogs and pigs			1.02500
VA	51	2805025000	Market Hogs/Pigs			1.02500
VA	51	2805030003	All Chickens	4554	4660	0.97725
VA	51	2805030003	Hens and Pullets - laying age			0.97725
VA	51	2805030002	Pullets 13-19 weeks			0.97725
VA	51	2805030001	Pullets < 13 weeks			0.97725
VA	51	2805030004	Other Chickens	271500	259400	1.04665
VA	51	2805040000	Sheep			1.00000
VA	51	2805040000	Breeding Ewes			1.00000
VA	51	2805040000	Lamb Crop			1.00000
WV	54	2805020003	All Cattle/calves			1.00000
WV	54	2805020003	Cows and Heifers that have Calved			1.00000
WV	54	2805020002	Beef Cows			1.00000
WV	54	2805020001	Milk Cows			1.00000
WV	54	2805020003	Heifers 500 lbs or over			1.00000
WV	54	2805020002	For beef cow replacement			1.00000
WV	54	2805020001	For milk cow replacement			1.00000
WV	54	2805020003	Other heifers			1.00000
WV	54	2805020004	Steers 500 lbs+			1.00000
WV	54	2805020004	Bulls 500 lbs +			1.00000
WV	54	2805020004	Calves < 500 lbs			1.00000
WV	54	2805020003	Cattle and calves on feed			1.00000
WV	54	2805025000	All Hogs and Pigs			1.00000
WV	54	2805025000	Breeding stock hogs and pigs			1.00000
WV	54	2805025000	Market Hogs/Pigs			1.00000
WV	54	2805030003	All Chickens			1.00000
WV	54	2805030003	Hens and Pullets - laying age			1.00000
WV	54	2805030002	Pullets 13-19 weeks			1.00000
WV	54	2805030001	Pullets < 13 weeks			1.00000
WV	54	2805030004	Other Chickens			1.00000
WV	54	2805040000	Sheep			1.00000
WV	54	2805040000	Breeding Ewes			1.00000
WV	54	2805040000	Lamb Crop			1.00000

* WV had no data available on 2002 populations so all growth factors = 1.0000

Appendix B –

Fire Fuel Loading Values

TABLE B-1. FUEL LOADING VALUES USED TO PRODUCE FIRE EMISSION VALUES FOR NFDRS CLASSIFIED FIRES

NFDRS Fuel Model	Vegetation	1h	10h	100h	1000h	live woody	live herb.	Average fuel loading	EPA wildfire fuel loading	EPA prescribed fuel loading	Bayle revised*
A	Annual grass and forbs	0.2					0.3	0.23	0.5	0.5	0.5
B	Mature chaparral	3.5	4	0.5		11.5		12.35	19.5	19.5	12.35
C	Open timber/grass	0.4	1			0.5	0.8	1.68	4.7	4.7	2
D	Southern rough	2	1			3	0.75	4.275	15.6	10.6	4.275
E	Hardwoods (winter)	1.5	0.5	0.25		0.5	0.5	2.375			2.375
F	Intermediate brush	2.5	2	1.5		9		8.85	3.8	3.8	8.85
G	Closed, short-needle conifer (heavy dead)	2.5	2	5	12	0.5	0.5	8.45	73.5	25.6	8.45
H	Closed, short-needle conifer (normal dead)	1.5	1	2	2	0.5	0.5	3.95	27.5	15	3.95
I	Heavy slash	12	12	10	12			30.2	55.1	49.1	30.2
J	Medium slash	7	7	6	5.5			17.55	34	31.2	12
K	Light slash	2.5	2.5	2	2.5			6.25	14.4	13.1	6.25
L	Perennial grass	0.25					0.5	0.3	0.8	0.8	0.3
N	Sawgrass	1.5	1.5			2		3.8	5	5	3.8
O	Pocosin	2	3	3	2	7		9.5	46.1	45.1	9.5
P	Southern plantation	1	1	0.5		0.5	0.5	2.5	16.4	10.2	2.5
Q	Alaskan black spruce	2	2.5	2	1	4	0.5	7.25	57.6	48.8	7.25
R	Hardwoods (summer)	0.5	0.5	0.5		0.5	0.5	1.5	3.1	3.1	2
S	Alaskan tundra	0.5	0.5	0.5	0.5	0.5	0.5	1.55			1.55
T	Sagebrush/grass	1	0.5			2.5	0.5	2.55	4.5	4.5	2.55
U	Western, long-needle conifer	1.5	1.5	1		0.5	0.5	3.75	19.1	10.3	3.75

* Bayle revised values were the values used to produce the emission inventory.

Appendix C

Emission Factors Used for Fire Emission Calculations

TABLE C-1. FIRE EMISSION FACTORS (LB/TON OF FUEL CONSUMED)

Fuel Model[1]	Vegetation	Pollutant	Wildfires[2]	Prescribed - piled fuel	Prescribed - nonpiled	Source
A	Annual grass and forbs	CH4	13.6	7.7	13.6	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	CO	289	74.3	289	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	EC	1.5	0.6	1.5	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	NH3	1.3	0.5	1.3	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	NOX	6.2	6.2	6.2	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	OC	11.6	4.3	11.6	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	PM10	28.1	8	28.1	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	PM25	24.1	8	24.1	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	SO2	1.7	1.7	1.7	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	TSP	34.1	12	34.1	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	VOC	13.6	6.3	13.6	Table 2 Data Needs and Availability - Pace Report
AGGRAIN	Agriculture-Grain	CH4	5.43	5.43	5.43	AP-42 Table 2.5-5 Avg of Oat/Barley/Wheat
AGGRAIN	Agriculture-Grain	CO	140.66	140.66	140.66	AP-42 Table 2.5-5 Avg of Oat/Barley/Wheat
AGGRAIN	Agriculture-Grain	PM10	29.33	29.33	29.33	AP-42 Table 2.5-5 Avg of Oat/Barley/Wheat
AGGRAIN	Agriculture-Grain	PM25	29.33	29.33	29.33	AP-42 Table 2.5-5 Avg of Oat/Barley/Wheat
AGGRAIN	Agriculture-Grain	VOC	18	18	18	AP-42 Table 2.5-5 Avg of Oat/Barley/Wheat
AGHAY	Agriculture-Hay (pasture/range)	CH4	5	5	5	AP-42 Table 2.5-5 Hay
AGHAY	Agriculture-Hay (pasture/range)	CO	139	139	139	AP-42 Table 2.5-5 Hay
AGHAY	Agriculture-Hay (pasture/range)	PM10	32	32	32	AP-42 Table 2.5-5 Hay
AGHAY	Agriculture-Hay (pasture/range)	PM25	32	32	32	AP-42 Table 2.5-5 Hay
AGHAY	Agriculture-Hay (pasture/range)	VOC	17	17	17	AP-42 Table 2.5-5 Hay
AGSC	Agriculture-Hay (pasture/range)	CH4	2.5	2.5	2.5	AP-42 Table 2.5-5 Hay
AGSC	Agriculture-Sugar Cane	CO	70.5	70.5	70.5	AP-42 Table 2.5-5 Sugar Cane
AGSC	Agriculture-Sugar Cane	PM10	7.2	7.2	7.2	AP-42 Table 2.5-5 Sugar Cane
AGSC	Agriculture-Sugar Cane	PM25	7.2	7.2	7.2	AP-42 Table 2.5-5 Sugar Cane
AGSC	Agriculture-Sugar Cane	VOC	8	8	8	AP-42 Table 2.5-5 Sugar Cane
AGUNSP	Agriculture-Unspecified	CH4	5.4	5.4	5.4	AP-42 Table 2.5-5 Unspecified
AGUNSP	Agriculture-Unspecified	CO	117	117	117	AP-42 Table 2.5-5 Unspecified
AGUNSP	Agriculture-Unspecified	PM10	21	21	21	AP-42 Table 2.5-5 Unspecified
AGUNSP	Agriculture-Unspecified	PM25	21	21	21	AP-42 Table 2.5-5 Unspecified
AGUNSP	Agriculture-Unspecified	VOC	18	18	18	AP-42 Table 2.5-5 Unspecified
B	Mature chaparral	CH4	13.6	7.7	13.6	Table 2 Data Needs and Availability - Pace Report

Fuel Model[1]	Vegetation	Pollutant	Wildfires[2]	Prescribed - piled fuel	Prescribed - nonpiled	Source
B	Mature chaparral	CO	289	74.3	289	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	EC	1.5	0.6	1.5	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	NH3	1.3	0.5	1.3	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	NOX	6.2	6.2	6.2	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	OC	11.6	4.3	11.6	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	PM10	28.1	8	28.1	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	PM25	24.1	8	24.1	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	SO2	1.7	1.7	1.7	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	TSP	34.1	12	34.1	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	VOC	13.6	6.3	13.6	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	CH4	13.6	7.7	13.6	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	CO	289	74.3	289	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	EC	1.5	0.6	1.5	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	NH3	1.3	0.5	1.3	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	NOX	6.2	6.2	6.2	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	OC	11.6	4.3	11.6	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	PM10	28.1	8	28.1	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	PM25	24.1	8	24.1	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	SO2	1.7	1.7	1.7	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	TSP	34.1	12	34.1	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	VOC	13.6	6.3	13.6	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report

Fuel Model[1]	Vegetation	Pollutant	Wildfires[2]	Prescribed - piled fuel	Prescribed - nonpiled	Source
E	Hardwoods (winter)	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	CH4	13.6	7.7	13.6	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	CO	289	74.3	289	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	EC	1.5	0.6	1.5	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	NH3	1.3	0.5	1.3	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	NOX	6.2	6.2	6.2	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	OC	11.6	4.3	11.6	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	PM10	28.1	8	28.1	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	PM25	24.1	8	24.1	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	SO2	1.7	1.7	1.7	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	TSP	34.1	12	34.1	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	VOC	13.6	6.3	13.6	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report

Fuel Model[1]	Vegetation	Pollutant	Wildfires[2]	Prescribed - piled fuel	Prescribed - nonpiled	Source
H	Closed, short-needle conifer (normal dead)	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
K	Light slash	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report

Fuel Model[1]	Vegetation	Pollutant	Wildfires[2]	Prescribed - piled fuel	Prescribed - nonpiled	Source
K	Light slash	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
K	Light slash	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
K	Light slash	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
K	Light slash	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
K	Light slash	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
K	Light slash	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
K	Light slash	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
K	Light slash	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
K	Light slash	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
K	Light slash	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	CH4	13.6	7.7	13.6	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	CO	289	74.3	289	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	EC	1.5	0.6	1.5	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	NH3	1.3	0.5	1.3	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	NOX	6.2	6.2	6.2	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	OC	11.6	4.3	11.6	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	PM10	28.1	8	28.1	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	PM25	24.1	8	24.1	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	SO2	1.7	1.7	1.7	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	TSP	34.1	12	34.1	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	VOC	13.6	6.3	13.6	Table 2 Data Needs and Availability - Pace Report
LC	Land Clearing - All types	CO	169	169	169	Table 2 Data Needs and Availability - Pace Report
LC	Land Clearing - All types	NOX	5	5	5	Table 2 Data Needs and Availability - Pace Report
LC	Land Clearing - All types	PM10	17	17	17	Table 2 Data Needs and Availability - Pace Report
LC	Land Clearing - All types	PM25	17	17	17	Table 2 Data Needs and Availability - Pace Report
LC	Land Clearing - All types	VOC	11.6	11.6	11.6	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report

Fuel Model[1]	Vegetation	Pollutant	Wildfires[2]	Prescribed - piled fuel	Prescribed - nonpiled	Source
N	Sawgrass	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
PREMISC	Prescribed - Miscellaneous types	CH4	14.230545	14.23054545	14.230545	Average of all used fuel models
PREMISC	Prescribed - Miscellaneous types	CO	302.39909	302.3990909	302.39909	Average of all used fuel models
PREMISC	Prescribed - Miscellaneous types	EC	1.5695455	1.569545455	1.5695455	Average of all used fuel models
PREMISC	Prescribed - Miscellaneous types	NH3	1.3602727	1.360272727	1.3602727	Average of all used fuel models
PREMISC	Prescribed - Miscellaneous types	NOX	6.4874545	6.487454545	6.4874545	Average of all used fuel models
PREMISC	Prescribed - Miscellaneous types	OC	12.137818	12.13781818	12.137818	Average of all used fuel models
PREMISC	Prescribed - Miscellaneous types	PM10	29.402818	29.40281818	29.402818	Average of all used fuel models

Fuel Model[1]	Vegetation	Pollutant	Wildfires[2]	Prescribed - piled fuel	Prescribed - nonpiled	Source
PREMISC	Prescribed - Miscellaneous types	PM25	25.217364	25.21736364	25.217364	Average of all used fuel models
PREMISC	Prescribed - Miscellaneous types	SO2	1.7788182	1.778818182	1.7788182	Average of all used fuel models
PREMISC	Prescribed - Miscellaneous types	TSP	35.681	35.681	35.681	Average of all used fuel models
PREMISC	Prescribed - Miscellaneous types	VOC	14.230545	14.23054545	14.230545	Average of all used fuel models
Q	Alaskan black spruce	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report

Fuel Model[1]	Vegetation	Pollutant	Wildfires[2]	Prescribed - piled fuel	Prescribed - nonpiled	Source
S	Alaskan tundra	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
WASTE	Waste Burning (all categories)	CH4	13	13	13	NEI values
WASTE	Waste Burning (all categories)	CO	85	85	85	NEI values
WASTE	Waste Burning (all categories)	NOX	6	6	6	NEI values
WASTE	Waste Burning (all categories)	PM10	38	38	38	NEI values
WASTE	Waste Burning (all categories)	PM25	34.8	34.8	34.8	NEI values
WASTE	Waste Burning (all categories)	VOC	30	30	30	NEI values
PREHARD	Prescribed - Hardwoods	CH4	15.912	8.3545	14.756	Hardwood fuel model values

Fuel Model[1]	Vegetation	Pollutant	Wildfires[2]	Prescribed - piled fuel	Prescribed - nonpiled	Source
PREHARD	Prescribed - Hardwoods	CO	338.13	80.6155	313.565	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	EC	1.755	0.651	1.6275	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	NH3	1.521	0.5425	1.4105	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	NOX	7.254	6.727	6.727	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	OC	13.572	4.6655	12.586	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	PM10	32.877	8.68	30.4885	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	PM25	28.197	8.68	26.1485	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	SO2	1.989	1.8445	1.8445	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	TSP	39.897	13.02	36.9985	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	VOC	15.912	6.8355	14.756	Hardwood fuel model values
SILVI	Silviculture-All types	CH4	14.230545	14.23054545	14.230545	Average of all used fuel models
SILVI	Silviculture-All types	CO	302.39909	302.3990909	302.39909	Average of all used fuel models
SILVI	Silviculture-All types	EC	1.5695455	1.569545455	1.5695455	Average of all used fuel models
SILVI	Silviculture-All types	NH3	1.3602727	1.360272727	1.3602727	Average of all used fuel models
SILVI	Silviculture-All types	NOX	6.4874545	6.487454545	6.4874545	Average of all used fuel models
SILVI	Silviculture-All types	OC	12.137818	12.13781818	12.137818	Average of all used fuel models
SILVI	Silviculture-All types	PM10	29.402818	29.40281818	29.402818	Average of all used fuel models
SILVI	Silviculture-All types	PM25	25.217364	25.21736364	25.217364	Average of all used fuel models
SILVI	Silviculture-All types	SO2	1.7788182	1.778818182	1.7788182	Average of all used fuel models
SILVI	Silviculture-All types	TSP	35.681	35.681	35.681	Average of all used fuel models
SILVI	Silviculture-All types	VOC	14.230545	14.23054545	14.230545	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	CH4	14.861091	14.86109091	14.861091	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	CO	315.79818	315.7981818	315.79818	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	EC	1.6390909	1.639090909	1.6390909	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	NH3	1.4205455	1.420545455	1.4205455	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	NOX	6.7749091	6.774909091	6.7749091	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	OC	12.675636	12.67563636	12.675636	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	PM10	30.705636	30.70563636	30.705636	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	PM25	26.334727	26.33472727	26.334727	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	SO2	1.8576364	1.857636364	1.8576364	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	TSP	37.262	37.262	37.262	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	VOC	14.861091	14.86109091	14.861091	Average of all used fuel models
WILDLEAF	Wildfire-Leaf and needle mix	CH4	15.912	15.912	15.912	Average of fuel models E & H

Fuel Model[1]	Vegetation	Pollutant	Wildfires[2]	Prescribed - piled fuel	Prescribed - nonpiled	Source
WILDLEAF	Wildfire-Leaf and needle mix	CO	338.13	338.13	338.13	Average of fuel models E & H
WILDLEAF	Wildfire-Leaf and needle mix	EC	1.755	1.755	1.755	Average of fuel models E & H
WILDLEAF	Wildfire-Leaf and needle mix	NH3	1.521	1.521	1.521	Average of fuel models E & H
WILDLEAF	Wildfire-Leaf and needle mix	NOX	7.254	7.254	7.254	Average of fuel models E & H
WILDLEAF	Wildfire-Leaf and needle mix	OC	13.572	13.572	13.572	Average of fuel models E & H
WILDLEAF	Wildfire-Leaf and needle mix	PM10	32.877	32.877	32.877	Average of fuel models E & H
WILDLEAF	Wildfire-Leaf and needle mix	PM25	28.197	28.197	28.197	Average of fuel models E & H
WILDLEAF	Wildfire-Leaf and needle mix	SO2	1.989	1.989	1.989	Average of fuel models E & H
WILDLEAF	Wildfire-Leaf and needle mix	TSP	39.897	39.897	39.897	Average of fuel models E & H
WILDLEAF	Wildfire-Leaf and needle mix	VOC	15.912	15.912	15.912	Average of fuel models E & H
DE	Southern Rough/Hardwood (winter)	CH4	15.912	8.3545	14.756	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	CO	338.13	80.6155	313.565	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	EC	1.755	0.651	1.6275	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	NH3	1.521	0.5425	1.4105	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	NOX	7.254	6.727	6.727	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	OC	13.572	4.6655	12.586	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	PM10	32.877	8.68	30.4885	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	PM25	28.197	8.68	26.1485	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	SO2	1.989	1.8445	1.8445	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	TSP	39.897	13.02	36.9985	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	VOC	15.912	6.8355	14.756	Same as Emission Factors for D and E

[1] Single Character Fuel Models correspond to the same value NFDRS models

[2] Emission factors listed in the wildfire and prescribed emission factor columns for other fire types are all identical. They do not truly represent wildfire or prescribed emission factors but rather the emission factors for that type of fire.

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Appendix C

Future Year Electricity Generating Sector Emission Inventory Development Using the Integrated Planning Model (IPM®) in Support of Fine Particulate Mass and Visibility Modeling in the VISTAS and Midwest RPO Regions

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Draft Report

Future Year Electricity Generating Sector Emission Inventory Development Using the Integrated Planning Model (IPM®) in Support of Fine Particulate Mass and Visibility Modeling in the VISTAS and Midwest RPO Regions

Prepared for

Visibility Improvement State and Tribal Association of the Southeast (VISTAS)
And
Midwest Regional Planning Organization (MRPO)

Prepared by

ICF Resources, L.L.C.
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Fairfax, VA 22031

January 2005

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A. Overview

In order to model regional haze, visibility and other air quality issues, Visibility Improvement State and Tribal Association of the Southeast (VISTAS) and Midwest Regional Planning Organization (MRPO), awarded a contract to ICF Resources, L.L.C. (ICF) in August 2004, seeking ICF's services to generate future year emission inventory for the electric generating sector of the contiguous United States using the Integrated Planning Model (IPM®).

IPM is a dynamic linear optimization model that can be used to examine air pollution control policies for various pollutants throughout the contiguous U.S. for the entire electric power system. The dynamic nature of IPM enables the projection of the behavior of the power system over a specified future period. The optimization logic determines the least-cost means of meeting electric generation and capacity requirements while complying with specified constraints including air pollution regulations, transmission bottlenecks, and plant-specific operational constraints. The versatility of IPM allows users to specify which constraints to exercise and populate IPM with their own datasets.

This report summarizes the analysis that ICF has performed in generating the future year electricity generating sector emission inventory by using IPM (hereafter, the analysis is referred to as the VISTAS analysis). The model assumptions and data used in this analysis are presented in Section B and the Appendix. The results are presented in Section C and the analysis limitations are presented in Section D.

Since the modeling is based on the EPA's prior analyses for which detailed public documentation is available, we have summarized only the incremental changes that were proposed by VISTAS and MRPO as part of this analysis. For detailed documentation on EPA's prior modeling using IPM, please visit www.epa.gov/airmarkets/epa-ipm.

B. Modeling Assumptions

The VISTAS analysis is based on the USEPA Modeling Applications Using IPM (V.2.1.6). As per the analytical needs of VISTAS and MRPO, the following changes were made to the underlying assumptions in the US EPA Base Case (V2.1.6) in this analysis:

i) The underlying database in the VISTAS analysis is US EPA's National Electric Energy Data System (NEEDS[1]) NODA Database, with changes based upon the comments and technical directions from VISTAS and MRPO's stakeholders. The changes focused on

[1] The NEEDS database contains the existing and planned/committed unit data in EPA modeling applications of IPM. NEEDS includes basic geographic, operating, air emissions, and other data on these generating units. For data sources underlying NEEDS and description of fields as well as the documentation on EPA Modeling Applications Using IPM (V.2.1.6), please visit website http://www.epa.gov/airmarkets/epa-ipm/index.html

existing installations of NO_x, SO_2 and particulate matter (PM) controls, NO_x emission rates, SO_2 emission limits, capacity of existing units, heat rate and unit identifications of selected units in the VISTAS and MRPO regions. These changes are summarized in detail in Appendix 1.

ii) The analysis covers the period between 2007 and 2030. To make the model size and run time tractable, IPM is run for a number of selected years within the study horizon known as run years. Each run year represents several calendar years in the study horizon, and all calendar years within the study horizon are mapped to their representative run years. Although results are only reported for the run years, IPM takes into account all years in the study horizon while developing the projections. Table 1 summarizes the mapping between the run years and the calendar years. Model results are available for all run years; the last run year (2026) results are, however, not recommended to be used because of end-year effects.

Table 1: IPM Run Years

Run Year	Calendar Years
2007	2007-2007
2009	2008-2009
2010	2010-2012
2015	2013-2017
2018	2018-2018
2020	2019-2022
2026	2023-2030

iii) The Duke Power and Progress Energy SO_2 and NO_x control technology investment strategies for complying with North Carolina's Clean Smokestacks Rule were explicitly hardwired in the analysis.

iv) The CAIR rule implemented as part of this analysis is broadly consistent with the Environmental Protection Agency 40 CFR Parts 51, et al. Supplemental Proposal for the Rule to Reduce Interstate Transport of Fine Particulate Matter and Ozone (Clean Air Interstate Rule), proposed on June 10, 2004. Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, West Virginia, Wisconsin are the states affected by the CAIR SO_2 and the CAIR annual NO_x policies starting 2010. Connecticut is affected by an ozone season NO_x policy. The CAIR plants affected by the annual NO_x policy are capped at 1.6 million tons starting 2010 and 1.33 million tons starting 2015. The power plants affected by the CAIR SO_2 policy have to surrender 2 Title IV SO_2 allowances for every ton of SO_2 emitted starting 2010 and 3 Title IV SO_2 allowances for every ton of SO_2 emitted starting 2015.

C. Analysis Results

ICF ran IPM under two future scenarios – Base Case and CAIR Case. The Base Case represents the current operation of the power system under currently known laws and regulations, including those that come into force in the study horizon. The CAIR Case is the Base Case with the proposed CAIR rule superimposed. The run results were parsed at the unit level for the 2009 and 2018 run years. Appendix 2 summarizes the SO_2 and NO_x emission results on a state level. The following paragraphs discuss the results from the two runs.

1. Emissions

Table 2 presents the emissions from the Base Case and the CAIR Case in the VISTAS analysis.

Table 2: SO_2 and NO_x Emissions from the Electric Power Sector (Million Tons)

		Base Case		CAIR Case	
		2009	**2018**	**2009**	**2018**
CAIR Affected Region	**SO_2**	9.1	8.2	5.3	4.1
	NO_x*	2.9	3.0	2.8	1.4
VISTAS States	**SO_2**	3.44	2.96	2.28	1.42
	NO_x	1.09	1.09	1.07	0.44
Midwest RPO States	**SO_2**	3.05	2.61	1.51	1.33
	NO_x	0.83	0.88	0.83	0.34

*Note: Excludes Connecticut

In the CAIR region, compared with the Base Case, SO_2 emissions would be reduced by 3.8 million tons in 2009 and by 4.1 million tons in 2018. The NO_x emissions would be cut by 1.6 million tons annually in 2018, compared with the Base Case.

Total projected state-level emissions for SO_2 and NO_x for both the Base Case and the CAIR Case are included in Tables A11 and A12 in the Appendix.

2. Projected Costs

For the proposed CAIR region, the analysis projects the annualized incremental cost for the US to be $2.1 billion in 2009 and $3.6 billion in 2018. This represents a 3.3% increase in production cost in 2009 and a 4.6% increase in 2018 over the base case. The production cost as projected by IPM includes the capital costs of new investment decisions, fuel costs and the operation and maintenance costs of power plants. The marginal costs of emission reductions (allowance prices) in the CAIR case are shown in Table 3.

Table 3: Marginal Costs of Emission Reductions in CAIR Case (1999 $)

		2009	2018
Marginal Cost ($/ton)	SO_2	700	1,100
	NO_x	1,500	1,700

3. Projected Control Technology Retrofits

In the VISTAS analysis, the proposed CAIR policy requires the installation of an additional 67 GW of SO_2 scrubbers and an additional 35 GW of selective catalytic reduction (SCR) on existing coal capacity by 2018 (see Table 4). The pool of existing SCR's that are used during the ozone season in the NO_x SIP call region in the Base Case are allowed to operate year-round in the CAIR Case.

Table 4: Pollution Control Installations by Technology in 2018 (GW)

Technology	Base Case (Cumulative)	CAIR Case (Cumulative)
Scrubber	19	86
SCR	33	67

4. Projected Generation Mix

Table 5 shows the generation mix under the proposed CAIR policy. Coal-fired generation and natural gas-fired generation are projected to remain relatively unchanged due to the phased-in nature of the proposed CAIR.

Relative to the Base Case, in 2009, 2.7 GW of coal-fired capacity is projected to be uneconomic to maintain (approximately 1%) and 90 MW of coal-fired capacity is projected to repower to natural gas in the CAIR Case.

Table 5: National Generation Mix (BkWh's)

Generating Fuel Use	2009		2018	
	Base Case	CAIR Case	Base Case	CAIR Case
Coal	2,115	2,072	2,219	2,154
Oil/Natural Gas	821	862	1,301	1,364
Other	1,197	1,197	1,196	1,194

5. Projected Coal Production for the Electric Power Sector

Coal production for electricity generation is expected to increase with or without the proposed CAIR (Table 6). The reductions in emissions from the power sector will be met through the installation of pollution controls for SO_2 and NO_x.

Table 6: Coal Production in the Electric Power Sector (Million Tons)

Supply Area	2009		2018	
	Base Case	CAIR Case	Base Case	CAIR Case

Appalachia	327	296	297	306
Interior	182	184	189	212
West	528	545	611	550
National	1,038	1,025	1,096	1,067

6. Projected Retail Electricity Prices

National average retail electricity prices in the CAIR Case are projected to increase 2.4 percent in 2009 and 1.6 percent in 2018. Table 7 and Table 8 summarize the national and regional level retail electricity prices. These estimates were developed using the USEPA's Retail Electricity Price Model.

Table 7: National Average Retail Electricity Prices (1999 Mills/kWh)

	Base Case	CAIR Case	Percent Change
2009	59.4	60.9	2.4%
2018	63.2	64.3	1.6%

Source: Retail Electricity Price Model.

Retail electricity prices by NERC region are in Table 8

Table 8: Retail Electricity Prices by NERC Region (1999 Mills/kWh)

Power Region	Primary States Included	Base Case		CAIR Case	
		2009	2018	2009	2018
ECAR	OH,MI,IN,KY,WV,PA	51.3	56.7	53.8	58.7
ERCOT	TX	53.0	65.0	54.8	65.3
MAAC	PA,NJ,MD,DC,DE	56.9	69.3	59.5	71.6
MAIN	IL,MO,WI	51.9	60.3	53.6	61.7
MAPP	MN,IA,SD,ND,NE	54.6	49.4	54.7	49.8
NY	NY	80.0	88.1	81.8	89.6
NE	VT,NH,ME,MA,CT,RI	73.8	82.8	75.4	83.5
FRCC	FL	70.8	68.8	71.7	69.6
STV	VA,NC,SC,GA,AL,MS,TN,AR,LA	56.4	54.1	57.4	55.3
SPP	KS,OK,MO	52.8	57.4	53.7	58.0
PNW	WA,OR,ID	50.1	48.0	50.6	48.0
RM	MT,WY,CO,UT,NM,AZ,NV,ID	61.5	65.1	62.1	65.2
CALI	CA	96.8	98.2	97.6	98.3

Source: Retail Electricity Price Model.

7. Projected Fuel Price Impacts

The impacts of the CAIR on mine mouth coal prices and natural gas prices at the Henry Hub are summarized in Table 9.

Table 9: Average Coal Mine Mouth and Henry Hub Natural Gas Prices (1999$/MMBtu)

	2009	2018	2009	2018
Coal	0.62	0.55	0.60	0.55
Natural Gas	2.77	2.97	2.9	2.99

D. Limitations of Analysis

VISTAS modeling using IPM is based on various economic and engineering input assumptions that are inherently uncertain, such as assumptions for future fuel prices, electricity demand growth and the cost and performance of control technologies. As configured, IPM does not take into account demand response (i.e., consumer reaction to changes in electricity prices).

E. Appendix

1. Changes made to the NEEDS NODA Database for the VISTAS Analysis

NEEDS NODA is the most recent version of the NEEDS database that EPA has made public. It contains existing and planned/committed generation unit data in the contiguous United States. In Appendix 1, the changes suggested by VISTAS and MRPO stakeholders are presented side by side against the values in the original NEEDS NODA for comparison. For description of the items changed, please visit website http://www.epa.gov/airmarkets/epa-ipm/index.html.

Table A1 Changes made to NO_x Post Combustion Control Installations on Existing Units

Plant Name	Unique ID	Post Combustion NO_x Control (NEEDS NODA)	Post Combustion NO_x Control (VISTAS)	Data Source*
ASHEVILLE	2706_B_1	SNCR	None	Southern Company
BARRY	3_B_1	SNCR	None	Southern Company
BARRY	3_B_2	SNCR	None	Southern Company
BARRY	3_B_3	SNCR	None	Southern Company
BARRY	3_B_4	SNCR	None	Southern Company
Barry	3_G_A1	None	SCR	Southern Company
Barry	3_G_A2ST	None	SCR	Southern Company
MT STORM	3954_B_3	None	SCR	NC-WV-SC
PLEASANTS	6004_B_1	None	SCR	NC-WV-SC
PLEASANTS	6004_B_2	None	SCR	NC-WV-SC
Victor J Daniel Jr	6073_G_3	None	SCR	Southern Company
Victor J Daniel Jr	6073_G_3CT	None	SCR	Southern Company
Victor J Daniel Jr	6073_G_4CT	None	SCR	Southern Company

* Data Source shows the names of sheets in NEEDS-NODA-VISTAS-Aug18Rev.xls, provided by Gregory Stella, VISTAS Technical Advisor for Emissions Inventories.

Table A2 Changes made to NO_x Emission Rates (lbs/MMBtu)

Plant Name	Unique ID	Mode1 Rate (VISTAS)	Mode2 Rate (VISTAS)	Mode3 Rate (VISTAS)	Mode4 Rate (VISTAS)	Data Source*
GREENE COUNTY	10_B_1	0.718	0.718	0.468	0.468	Southern Company
GREENE COUNTY	10_B_2	0.416	0.416	0.380	0.380	Southern Company
Greene County	10_G_GT10	0.090	0.090	0.090	0.090	Southern Company
Greene County	10_G_GT2	0.090	0.090	0.090	0.090	Southern Company
Greene County	10_G_GT3	0.090	0.090	0.090	0.090	Southern Company
Greene County	10_G_GT4	0.090	0.090	0.090	0.090	Southern Company
Greene County	10_G_GT5	0.090	0.090	0.090	0.090	Southern Company
Greene County	10_G_GT6	0.090	0.090	0.090	0.090	Southern Company
Greene County	10_G_GT7	0.090	0.090	0.090	0.090	Southern Company
Greene County	10_G_GT8	0.090	0.090	0.090	0.090	Southern Company
Greene County	10_G_GT9	0.090	0.090	0.090	0.090	Southern Company
CROSS	130_B_1	0.100	0.100	0.100	0.100	SC
CROSS	130_B_2	0.100	0.100	0.100	0.100	SC
EATON	2046_B_1	0.280	0.280	0.280	0.280	Southern Company
EATON	2046_B_2	0.280	0.280	0.280	0.280	Southern Company
EATON	2046_B_3	0.280	0.280	0.280	0.280	Southern Company
Chevron Oil	2047_G_1	0.320	0.320	0.320	0.320	Southern Company
Chevron Oil	2047_G_2	0.320	0.320	0.320	0.320	Southern Company
Chevron Oil	2047_G_3	0.320	0.320	0.320	0.320	Southern Company
Chevron Oil	2047_G_4	0.320	0.320	0.320	0.320	Southern Company
Chevron Oil	2047_G_5	0.064	0.064	0.064	0.064	Southern Company
SWEATT	2048_B_1	0.280	0.280	0.280	0.280	Southern Company
SWEATT	2048_B_2	0.280	0.280	0.280	0.280	Southern Company
Sweatt	2048_G_A	0.320	0.320	0.320	0.320	Southern Company
JACK WATSON	2049_B_1	0.280	0.280	0.280	0.280	Southern Company
JACK WATSON	2049_B_2	0.280	0.280	0.280	0.280	Southern Company
JACK WATSON	2049_B_3	0.280	0.280	0.280	0.280	Southern Company
JACK WATSON	2049_B_4	0.470	0.470	0.415	0.415	Southern Company
JACK WATSON	2049_B_5	0.590	0.590	0.415	0.415	Southern Company
Jack Watson	2049_G_A	0.880	0.880	0.880	0.880	Southern Company
E C GASTON	26_B_1	0.473	0.473	0.473	0.473	Southern Company
E C GASTON	26_B_2	0.473	0.473	0.473	0.473	Southern Company
E C GASTON	26_B_3	0.457	0.457	0.457	0.457	Southern Company
E C GASTON	26_B_4	0.457	0.457	0.457	0.457	Southern Company
E C GASTON	26_B_5	0.429	0.060	0.429	0.060	Southern Company
E C Gaston	26_G_GT4	0.880	0.880	0.880	0.880	Southern Company
ASHEVILLE	2706_B_1	0.491	0.319	0.491	0.319	-
CLIFFSIDE	2721_B_5	0.294	0.070	0.294	0.070	NC-WV-SC
BARRY	3_B_1	0.500	0.500	0.500	0.500	Southern Company
BARRY	3_B_2	0.500	0.500	0.500	0.500	Southern Company
BARRY	3_B_3	0.300	0.300	0.300	0.300	Southern Company
BARRY	3_B_4	0.290	0.290	0.290	0.290	Southern Company
BARRY	3_B_5	0.380	0.380	0.380	0.380	Southern Company
Barry	3_G_A1	0.013	0.013	0.013	0.013	Southern Company
Barry	3_G_A1CT	0.013	0.013	0.013	0.013	Southern Company
Barry	3_G_A1ST	0.013	0.013	0.013	0.013	Southern Company
Barry	3_G_A2C1	0.013	0.013	0.013	0.013	Southern Company
Barry	3_G_A2C2	0.013	0.013	0.013	0.013	Southern Company
Barry	3_G_A2ST	0.013	0.013	0.013	0.013	Southern Company
W S LEE	3264_B_1	0.393	0.393	0.250	0.250	NC-WV-SC
W S LEE	3264_B_2	0.415	0.415	0.250	0.250	NC-WV-SC
W S Lee	3264_G_4	0.320	0.320	0.320	0.320	SC
W S Lee	3264_G_5	0.320	0.320	0.320	0.320	SC
W S Lee	3264_G_6	0.320	0.320	0.320	0.320	SC
MCMEEKIN	3287_B_M	0.350	0.350	0.350	0.350	SC

Plant Name	Unique ID	Mode1 Rate (VISTAS)	Mode2 Rate (VISTAS)	Mode3 Rate (VISTAS)	Mode4 Rate (VISTAS)	Data Source*
	CM1					
MCMEEKIN	3287_B_MCM2	0.350	0.350	0.350	0.350	SC
MT STORM	3954_B_3	0.604	0.060	0.604	0.060	NC-WV-SC
JAMES H MILLER JR	6002_B_1	0.275	0.060	0.275	0.060	Southern Company
JAMES H MILLER JR	6002_B_2	0.247	0.060	0.247	0.060	Southern Company
JAMES H MILLER JR	6002_B_3	0.306	0.070	0.306	0.070	Southern Company
JAMES H MILLER JR	6002_B_4	0.275	0.070	0.275	0.070	Southern Company
PLEASANTS	6004_B_1	0.302	0.060	0.302	0.060	NC-WV-SC
PLEASANTS	6004_B_2	0.335	0.060	0.335	0.060	NC-WV-SC
WANSLEY	6052_B_1	0.405	0.070	0.405	0.070	Southern Company
WANSLEY	6052_B_2	0.390	0.070	0.390	0.070	Southern Company
Wansley	6052_G_5A	0.880	0.880	0.880	0.880	Southern Company
VICTOR J DANIEL JR.	6073_B_1	0.310	0.310	0.310	0.310	Southern Company
VICTOR J DANIEL JR.	6073_B_2	0.350	0.350	0.350	0.350	Southern Company
Victor J Daniel Jr	6073_G_3	0.013	0.013	0.013	0.013	Southern Company
Victor J Daniel Jr	6073_G_3CT	0.013	0.013	0.013	0.013	Southern Company
Victor J Daniel Jr	6073_G_3ST	0.013	0.013	0.013	0.013	Southern Company
Victor J Daniel Jr	6073_G_4	0.013	0.013	0.013	0.013	Southern Company
Victor J Daniel Jr	6073_G_4CT	0.013	0.013	0.013	0.013	Southern Company
Victor J Daniel Jr	6073_G_4ST	0.013	0.013	0.013	0.013	Southern Company
MCINTOSH	6124_B_1	0.613	0.613	0.410	0.410	Southern Company
McIntosh	6124_G_CT1	0.090	0.090	0.090	0.090	Southern Company
McIntosh	6124_G_CT2	0.090	0.090	0.090	0.090	Southern Company
McIntosh	6124_G_CT3	0.090	0.090	0.090	0.090	Southern Company
McIntosh	6124_G_CT4	0.090	0.090	0.090	0.090	Southern Company
McIntosh	6124_G_CT5	0.090	0.090	0.090	0.090	Southern Company
McIntosh	6124_G_CT6	0.090	0.090	0.090	0.090	Southern Company
McIntosh	6124_G_CT7	0.090	0.090	0.090	0.090	Southern Company
McIntosh	6124_G_CT8	0.090	0.090	0.090	0.090	Southern Company
WINYAH	6249_B_1	0.100	0.100	0.100	0.100	SC
WINYAH	6249_B_2	0.120	0.120	0.120	0.120	SC
WINYAH	6249_B_3	0.120	0.120	0.120	0.120	SC
WINYAH	6249_B_4	0.120	0.120	0.120	0.120	SC
SCHERER	6257_B_1	0.450	0.450	0.150	0.150	Southern Company
SCHERER	6257_B_2	0.450	0.450	0.150	0.150	Southern Company
SCHERER	6257_B_3	0.300	0.300	0.150	0.150	Southern Company
SCHERER	6257_B_4	0.300	0.300	0.150	0.150	Southern Company
Wilson	6258_G_5A	0.880	0.880	0.880	0.880	Southern Company
Wilson	6258_G_5B	0.880	0.880	0.880	0.880	Southern Company
Wilson	6258_G_5C	0.880	0.880	0.880	0.880	Southern Company

Plant Name	Unique ID	Mode1 Rate (VISTAS)	Mode2 Rate (VISTAS)	Mode3 Rate (VISTAS)	Mode4 Rate (VISTAS)	Data Source*
Wilson	6258_G_5D	0.880	0.880	0.880	0.880	Southern Company
Wilson	6258_G_5E	0.880	0.880	0.880	0.880	Southern Company
Wilson	6258_G_5F	0.880	0.880	0.880	0.880	Southern Company
Wilson	6258_G_IC1	0.880	0.880	0.880	0.880	Southern Company
CRIST	641_B_2	0.280	0.280	0.280	0.280	Southern Company
CRIST	641_B_3	0.280	0.280	0.280	0.280	Southern Company
CRIST	641_B_4	0.400	0.400	0.240	0.240	Southern Company
CRIST	641_B_5	0.400	0.400	0.240	0.240	Southern Company
CRIST	641_B_7	0.482	0.060	0.482	0.060	Southern Company
SCHOLZ	642_B_1	0.540	0.540	0.320	0.320	Southern Company
SCHOLZ	642_B_2	0.570	0.570	0.320	0.320	Southern Company
SMITH	643_B_1	0.490	0.490	0.240	0.240	Southern Company
SMITH	643_B_2	0.410	0.410	0.410	0.410	Southern Company
Lansing Smith	643_G_CT1	0.880	0.880	0.880	0.880	Southern Company
GADSDEN	7_B_1	0.544	0.544	0.544	0.544	Southern Company
GADSDEN	7_B_2	0.544	0.544	0.544	0.544	Southern Company
Atkinson	700_G_5A	0.320	0.320	0.320	0.320	Southern Company
Atkinson	700_G_5B	0.320	0.320	0.320	0.320	Southern Company
BOWEN	703_B_1BLR	0.405	0.070	0.405	0.070	Southern Company
BOWEN	703_B_2BLR	0.405	0.070	0.405	0.070	Southern Company
BOWEN	703_B_3BLR	0.409	0.070	0.409	0.070	Southern Company
BOWEN	703_B_4BLR	0.419	0.070	0.419	0.070	Southern Company
Bowen	703_G_6	0.880	0.880	0.880	0.880	Southern Company
HAMMOND	708_B_1	0.800	0.800	0.410	0.410	Southern Company
HAMMOND	708_B_2	0.800	0.800	0.410	0.410	Southern Company
HAMMOND	708_B_3	0.800	0.800	0.410	0.410	Southern Company
HAMMOND	708_B_4	0.404	0.070	0.404	0.070	Southern Company
HARLLEE BRANCH	709_B_1	0.800	0.800	0.519	0.519	Southern Company
HARLLEE BRANCH	709_B_2	0.800	0.800	0.374	0.374	Southern Company
HARLLEE BRANCH	709_B_3	0.800	0.800	0.381	0.381	Southern Company
HARLLEE BRANCH	709_B_4	0.800	0.800	0.381	0.381	Southern Company
JACK MCDONOUGH	710_B_MB1	0.450	0.450	0.230	0.230	Southern Company
JACK MCDONOUGH	710_B_MB2	0.450	0.450	0.230	0.230	Southern Company
Jack McDonough	710_G_3A	0.320	0.320	0.320	0.320	Southern Company
Jack McDonough	710_G_3B	0.320	0.320	0.320	0.320	Southern Company
MCMANUS	715_B_1	0.310	0.310	0.310	0.310	Southern Company
MCMANUS	715_B_2	0.310	0.310	0.310	0.310	Southern Company
McManus	715_G_3A	0.880	0.880	0.880	0.880	Southern Company
McManus	715_G_3B	0.880	0.880	0.880	0.880	Southern Company
McManus	715_G_3C	0.880	0.880	0.880	0.880	Southern Company
McManus	715_G_4A	0.880	0.880	0.880	0.880	Southern Company
McManus	715_G_4B	0.880	0.880	0.880	0.880	Southern Company
McManus	715_G_4C	0.880	0.880	0.880	0.880	Southern Company
McManus	715_G_4D	0.880	0.880	0.880	0.880	Southern Company
McManus	715_G_4E	0.880	0.880	0.880	0.880	Southern Company
McManus	715_G_4F	0.880	0.880	0.880	0.880	Southern Company
McManus	715_G_IC1	3.200	3.200	3.200	3.200	Southern Company

Plant Name	Unique ID	Mode1 Rate (VISTAS)	Mode2 Rate (VISTAS)	Mode3 Rate (VISTAS)	Mode4 Rate (VISTAS)	Data Source*
MITCHELL	727_B_3	0.625	0.625	0.625	0.625	Southern Company
Mitchell	727_G_4A	0.880	0.880	0.880	0.880	Southern Company
Mitchell	727_G_4B	0.880	0.880	0.880	0.880	Southern Company
Mitchell	727_G_4C	0.880	0.880	0.880	0.880	Southern Company

* Data Source shows the names of sheets in NEEDS-NODA-VISTAS-Aug18Rev.xls, provided by Gregory Stella, VISTAS Technical Advisor for Emissions Inventories. “SC” reflects the spreadsheet CopyofSCIPMdata.xls.

Table A3 Changes made to SO_2 Scrubber Installations on Existing Units

Plant Name	Unique ID	Wet/DryScrubber (NEEDS NODA)	Wet/DryScrubber (VISTAS)	Data Source*
NORTH BRANCH POWER STATION	7537_B_1A	Dry Scrubber	-	NC-WV-SC
NORTH BRANCH POWER STATION	7537_B_1B	Dry Scrubber	-	NC-WV-SC
Morgantown Energy Facility	10743_G_GEN1	Dry Scrubber	-	NC-WV-SC

* Data Source shows the name of sheets in NEEDS-NODA-VISTAS-Aug18Rev.xls, provided by Gregory Stella, VISTAS Technical Advisor for Emissions Inventories.

Table A4 Changes made to SO_2 Emission Rate Limits (lbs/MMBtu)

Plant Name	Unique ID	SO_2 Rate (NEEDS NODA)	SO_2 Rate (VISTAS)	Data Source*
GREENE COUNTY	10_B_1	4.000	1.197	Southern Company
GREENE COUNTY	10_B_2	4.000	1.197	Southern Company
EATON	2046_B_1	4.800	0.001	Southern Company
EATON	2046_B_2	4.800	0.001	Southern Company
EATON	2046_B_3	4.800	0.001	Southern Company
SWEATT	2048_B_1	4.800	0.001	Southern Company
SWEATT	2048_B_2	4.800	0.001	Southern Company
JACK WATSON	2049_B_1	4.800	0.001	Southern Company
JACK WATSON	2049_B_2	4.800	0.001	Southern Company
JACK WATSON	2049_B_3	4.800	0.001	Southern Company
JACK WATSON	2049_B_4	4.800	0.885	Southern Company
JACK WATSON	2049_B_5	4.800	0.885	Southern Company
E C GASTON	26_B_1	3.800	1.667	Southern Company
E C GASTON	26_B_2	3.800	1.667	Southern Company
E C GASTON	26_B_3	3.800	1.667	Southern Company
E C GASTON	26_B_4	3.800	1.667	Southern Company
E C GASTON	26_B_5	3.800	1.667	Southern Company
BUCK	2720_B_5	2.300	1.630	NC-WV-SC
BUCK	2720_B_6	2.300	1.630	NC-WV-SC
BUCK	2720_B_7	2.300	1.630	NC-WV-SC
BUCK	2720_B_8	2.300	1.630	NC-WV-SC
BUCK	2720_B_9	2.300	1.630	NC-WV-SC
CLIFFSIDE	2721_B_1	2.300	2.200	NC-WV-SC
CLIFFSIDE	2721_B_2	2.300	2.200	NC-WV-SC
CLIFFSIDE	2721_B_3	2.300	2.200	NC-WV-SC

Plant Name	Unique ID	SO_2 Rate (NEEDS NODA)	SO_2 Rate (VISTAS)	Data Source*
CLIFFSIDE	2721_B_4	2.300	2.200	NC-WV-SC
CLIFFSIDE	2721_B_5	2.300	2.200	NC-WV-SC
DAN RIVER	2723_B_1	2.300	1.810	NC-WV-SC
DAN RIVER	2723_B_2	2.300	1.810	NC-WV-SC
DAN RIVER	2723_B_3	2.300	1.810	NC-WV-SC
BARRY	3_B_1	1.800	1.197	Southern Company
BARRY	3_B_2	1.800	1.197	Southern Company
BARRY	3_B_3	1.800	1.197	Southern Company
BARRY	3_B_4	1.800	1.197	Southern Company
BARRY	3_B_5	1.800	1.197	Southern Company
JAMES H MILLER JR	6002_B_1	1.800	0.795	Southern Company
JAMES H MILLER JR	6002_B_2	1.800	0.795	Southern Company
JAMES H MILLER JR	6002_B_3	1.800	0.795	Southern Company
JAMES H MILLER JR	6002_B_4	1.800	0.795	Southern Company
VICTOR J DANIEL JR.	6073_B_1	4.800	0.885	Southern Company
VICTOR J DANIEL JR.	6073_B_2	4.800	0.885	Southern Company
SCHERER	6257_B_1	1.200	0.796	Southern Company
SCHERER	6257_B_2	1.200	0.796	Southern Company
SCHERER	6257_B_3	1.200	0.796	Southern Company
SCHERER	6257_B_4	1.200	0.796	Southern Company
CRIST	641_B_2	0.740	0.001	Southern Company
CRIST	641_B_3	0.740	0.001	Southern Company
CRIST	641_B_4	5.900	1.197	Southern Company
CRIST	641_B_5	5.900	1.197	Southern Company
CRIST	641_B_6	5.900	1.197	Southern Company
CRIST	641_B_7	5.900	1.197	Southern Company
SCHOLZ	642_B_1	6.170	1.200	Southern Company
SCHOLZ	642_B_2	6.170	1.200	Southern Company
SMITH	643_B_1	6.170	1.197	Southern Company
SMITH	643_B_2	6.170	1.197	Southern Company
GADSDEN	7_B_1	4.000	2.500	Southern Company
GADSDEN	7_B_2	4.000	2.500	Southern Company
BOWEN	703_B_1BLR	4.580	1.667	Southern Company
HAMMOND	708_B_1	4.580	1.667	Southern Company
HAMMOND	708_B_2	4.580	1.667	Southern Company
HAMMOND	708_B_3	4.580	1.667	Southern Company
HAMMOND	708_B_4	4.580	1.667	Southern Company
HARLLEE BRANCH	709_B_1	4.580	1.667	Southern Company
HARLLEE BRANCH	709_B_2	4.580	1.667	Southern Company
HARLLEE BRANCH	709_B_3	4.580	1.667	Southern Company
HARLLEE BRANCH	709_B_4	4.580	1.667	Southern Company
JACK MCDONOUGH	710_B_MB1	4.580	1.667	Southern Company
JACK MCDONOUGH	710_B_MB2	4.580	1.667	Southern Company
MCMANUS	715_B_1	3.159	2.620	Southern Company
MCMANUS	715_B_2	3.159	2.620	Southern Company
MITCHELL	727_B_3	4.580	2.500	Southern Company

Plant Name	Unique ID	SO_2 Rate (NEEDS NODA)	SO_2 Rate (VISTAS)	Data Source*
YATES	728_B_Y2BR	4.580	1.667	Southern Company
YATES	728_B_Y3BR	4.580	1.667	Southern Company
YATES	728_B_Y4BR	4.580	1.667	Southern Company
YATES	728_B_Y5BR	4.580	1.667	Southern Company
KRAFT	733_B_1	4.580	1.270	Southern Company
KRAFT	733_B_2	4.580	1.270	Southern Company
KRAFT	733_B_3	4.580	1.270	Southern Company
KRAFT	733_B_4	0.800	0.001	Southern Company
RIVERSIDE	734_B_11	2.632	0.001	Southern Company
RIVERSIDE	734_B_12	3.159	0.001	Southern Company
RIVERSIDE	734_B_4	2.632	0.001	Southern Company
RIVERSIDE	734_B_5	2.632	0.001	Southern Company
RIVERSIDE	734_B_6	2.632	0.001	Southern Company
GORGAS	8_B_10	4.000	1.667	Southern Company
GORGAS	8_B_6	4.000	2.500	Southern Company
GORGAS	8_B_7	4.000	2.500	Southern Company
GORGAS	8_B_8	4.000	1.667	Southern Company
GORGAS	8_B_9	4.000	1.667	Southern Company

* Data Source shows the names of sheets in NEEDS-NODA-VISTAS-Aug18Rev.xls, provided by Gregory Stella, VISTAS Technical Advisor for Emissions Inventories.

Table A5 Changes made to Particulate Matter (PM) Control Installations on Existing Units

Plant Name	Unique ID	PM Control (NEEDS NODA)	PM Control (VISTAS)	Data Sources *
G G ALLEN	2718_B_3	Hot-side ESP	Cold-side ESP	NC-WV-SC
G G ALLEN	2718_B_5	Hot-side ESP	Cold-side ESP	NC-WV-SC
WESTON	4078_B_3	Hot-side ESP + Fabric Filter	Fabric Filter	Wisconsin

* Data Sources shows the name of sheets in NEEDS-NODA-VISTAS-Aug18Rev.xls, provided by Gregory Stella, VISTAS Technical Advisor for Emissions Inventories.

Table A6 Changes made to Summer Net Dependable Capacity (MW)

Plant Name	Unique ID	Capacity (NEEDS NODA)	Capacity (VISTAS)	Data Source*
VACA_SC_Combined Cycle	077_C_077	1317	807	SC
CRIST	641_B_1	24	0	Southern Company
Lansing Smith	A274_G_A274	500	530	Southern Company
Atkinson	700_G_5A	32	15.3	Southern Company
Atkinson	700_G_5B	32	15.3	Southern Company
Dahlberg	7709_G_10	75	80	Southern Company
Dahlberg	7709_G_9	75	80	Southern Company
FRANKLIN	A7840_G_A331	570	630	Southern Company
Mill Creek	A294_G_A294	320	326.8	NC-WV-SC
Mill Creek	A295_G_A295	240	245.1	NC-WV-SC
Mill Creek	A296_G_A296	80	81.7	NC-WV-SC
SCE&G Hardeeville	3286_C_2		170	SC
SCE&G Hardeeville	3286_C_3		170	SC
SCE&G Hardeeville	3286_C_4		170	SC

Plant Name	Unique ID	Capacity (NEEDS NODA)	Capacity (VISTAS)	Data Source*
Cross 3	130_C_3		660	SC

* Data Source shows the name of sheets in NEEDS-NODA-VISTAS-Aug18Rev.xls, provided by Gregory Stella, VISTAS Technical Advisor for Emissions Inventories. "SC" reflects the spreadsheet CopyofSCIPMdata.xls.

Table A7 Changes made to Heat Rate (Btu/kWh)

Plant Name	Unique ID	ORIS Code	BGCI	Unit ID	Heat Rate (NEEDS NODA)	Heat Rate (VISTAS)	Data Sourc
ALLEN S KING	1915_B_1	1915	B	1	8879	9229	Minnesota

* Data Source shows the name of sheets in NEEDS-NODA-VISTAS-Aug18Rev.xls, provided by Gregory Stella, VISTAS Technical Advisor for Emissions Inventories.

Table A8 Changes made to Unit ID

Plant Name	Unique ID	ORIS Code	BGCI	Unit ID (NEEDS NODA)	Unit ID (VISTAS)	Data Sourc
Talbot County Energy	A397_G_A397	7916	G	397	1	Oglethorpe
Talbot County Energy	A398_G_A398	7916	G	398	2	Oglethorpe
Talbot County Energy	A399_G_A399	7916	G	399	3-4	Oglethorpe
Talbot County Energy	A400_G_A400	7916	G	400	5-6	Oglethorpe
Mill Creek	A294_G_A294	7981	G	294	1-4	NC-WV-SC
Mill Creek	A295_G_A295	7981	G	295	5-7	NC-WV-SC
Mill Creek	A296_G_A296	7981	G	296	8	NC-WV-SC

* Data Source shows the name of sheets in NEEDS-NODA-VISTAS-Aug18Rev.xls, provided by Gregory Stella, VISTAS Technical Advisor for Emissions Inventories.

Table A9 Duke and Progress Energy SO_2 Control Plan for North Carolina Clean Smokestacks Rule

Unit	Technology	Operation Date	Company
Asheville 1	Scrubber	2005	Progress Energy
Asheville 2	Scrubber	2006	Progress Energy
Cape Fear 5	Scrubber	2012	Progress Energy
Cape Fear 6	Scrubber	2011	Progress Energy
Mayo 1	Scrubber	2008	Progress Energy
Roxboro 1	Scrubber	2009	Progress Energy
Roxboro 2	Scrubber	2007	Progress Energy
Roxboro 3	Scrubber	2007	Progress Energy
Roxboro 4	Scrubber	2007	Progress Energy
Sutton 3	Scrubber	2012	Progress Energy
Allen 1	Scrubber	2011	Duke Power
Allen 2	Scrubber	2011	Duke Power
Allen 3	Scrubber	2011	Duke Power
Allen 4	Scrubber	2012	Duke Power
Allen 5	Scrubber	2012	Duke Power
Belews Creek 1	Scrubber	2008	Duke Power
Belews Creek 2	Scrubber	2008	Duke Power
Cliffside 5	Scrubber	2009	Duke Power

Unit	Technology	Operation Date	Company
Marshall 1	Scrubber	2007	Duke Power
Marshall 2	Scrubber	2007	Duke Power
Marshall 3	Scrubber	2006	Duke Power
Marshall 4	Scrubber	2006	Duke Power

Source: Gregory Stella, VISTAS Technical Advisor for Emissions Inventories.

Table A10 Duke and Progress Energy NO_x Control Plan for North Carolina Clean Smokestacks Rule

Unit	Technology	Operation Date	Company
Asheville 1	SCR	2009	Progress Energy
Lee 2	ROFA	2007	Progress Energy
Lee 3	SCR	2010	Progress Energy
Sutton 2	ROFA	2006	Progress Energy
Allen 1	SNCR	2003	Duke Power
Allen 2	SNCR	2007	Duke Power
Allen 3	SNCR	2005	Duke Power
Allen 4	SNCR	2006	Duke Power
Allen 5	SNCR	2008	Duke Power
Belews Creek 1	SCR	2003	Duke Power
Belews Creek 2	SCR	2004	Duke Power
Buck 3	SNCR	2009	Duke Power
Buck 4	SNCR	2008	Duke Power
Buck 5	SNCR	2006	Duke Power
Buck 6	SNCR	2007	Duke Power
Cliffside 1	SNCR	2009	Duke Power
Cliffside 2	SNCR	2009	Duke Power
Cliffside 3	SNCR	2008	Duke Power
Cliffside 4	SNCR	2008	Duke Power
Cliffside 5	SCR	2002	Duke Power
Dan River 1	SNCR	2009	Duke Power
Dan River 2	SNCR	2009	Duke Power
Dan River 3	SNCR	2007	Duke Power
Marshall 1	SNCR	2007	Duke Power
Marshall 2	SNCR	2006	Duke Power
Marshall 3	SNCR	2005	Duke Power
Marshall 4	SNCR	2008	Duke Power
Riverbend 4	SNCR	2007	Duke Power
Riverbend 5	SNCR	2008	Duke Power
Riverbend 6	SNCR	2008	Duke Power
Riverbend 7	SNCR	2007	Duke Power

Source: Gregory Stella, VISTAS Technical Advisor for Emissions Inventories.

2. Projected State by State SO_2 and NO_x Emissions Data for the Base Case and the CAIR Case

Tables A11 and A12 present the Base Case and the CAIR Case SO_2 and NO_x emissions by state in 2009 and 2018 run years.

Table A11 Projected State by State SO_2 Emissions for the Base Case and the CAIR Case (MTons)

SO_2 Emission	Base Case 2009	Base Case 2018	CAIR Case 2009	CAIR Case 2018
CAIR Affected States				
Alabama	465.59	375.32	314.85	226.52
Arkansas	82.44	82.44	82.44	82.44
District Of Columbia	0.00	0.00	0.00	0.00
Delaware	38.05	44.34	21.92	16.93
Florida	219.39	215.49	200.15	126.60
Georgia	582.08	554.01	394.43	221.61
Iowa	153.23	180.17	158.37	169.68
Illinois	345.91	419.34	235.80	263.12
Indiana	726.25	528.47	341.19	321.60
Kansas	81.65	85.82	80.39	73.44
Kentucky	483.24	429.42	342.67	225.77
Louisiana	99.21	99.21	62.06	33.73
Massachusetts	11.76	17.08	13.63	16.21
Maryland	309.97	330.78	66.86	24.41
Michigan	380.34	404.63	374.05	395.86
Minnesota	91.66	92.63	80.93	82.89
Missouri	264.37	277.82	259.01	269.33
Mississippi	85.63	85.63	85.63	51.96
North Carolina	182.49	133.82	132.19	78.34
New Jersey	54.72	33.57	34.26	19.99
New York	148.93	142.64	94.75	47.41
Ohio	1444.21	1108.36	404.28	211.25
Pennsylvania	885.72	865.51	205.83	131.53
South Carolina	163.64	179.03	143.57	152.55
Tennessee	436.46	323.66	279.93	103.60
Texas	406.00	419.87	395.66	354.44
Virginia	220.95	181.60	140.92	116.25
Wisconsin	156.32	153.46	150.20	140.66
West Virginia	598.56	482.96	246.85	111.94
Total	9118.75	8247.07	5342.83	4070.06
Non CAIR States				
Arizona	60.66	50.92	60.66	50.92
California	6.52	6.52	6.52	6.52
Colorado	91.73	91.75	91.07	91.77
Connecticut	6.47	6.47	6.20	6.47
Idaho	0.05	0.05	0.05	0.05
Maine	5.44	5.44	5.11	5.44
Montana	20.27	23.19	20.33	23.33

SO_2 Emission	Base Case		CAIR Case	
	2009	2018	2009	2018
North Dakota	133.57	133.48	125.72	133.74
Nebraska	71.00	71.54	71.44	71.62
New Hampshire	7.46	7.60	1.62	7.99
New Mexico	52.92	52.92	52.92	52.92
Nevada	18.22	23.57	19.13	25.42
Oklahoma	117.63	117.63	117.63	117.63
Oregon	10.18	10.18	10.18	10.18
Rhode Island	0.00	0.00	0.00	0.00
South Dakota	12.09	12.09	12.09	12.09
Utah	53.08	35.90	53.01	35.90
Vermont	0.04	0.04	0.04	0.04
Washington	11.78	11.82	10.91	11.82
Wyoming	74.87	51.91	71.20	51.91
Total	753.99	713.01	735.82	715.75
National Total	9872.74	8960.09	6078.66	4785.81

Table A12 Projected State by State NO_x Emissions for the Base Case and the CAIR Case (MTons)

NO_x Emission	Base Case		CAIR Case	
	2009	2018	2009	2018
CAIR Affected States				
Alabama	131.99	135.01	132.33	39.94
Arkansas	43.65	44.64	43.74	32.22
District Of Columbia	0.00	0.08	0.02	0.09
Delaware	8.88	10.72	5.85	6.88
Florida	148.62	159.10	147.90	59.54
Georgia	131.90	128.94	119.43	65.56
Iowa	70.57	84.23	70.00	40.52
Illinois	129.60	157.20	141.63	69.27
Indiana	237.33	244.96	238.64	87.16
Kansas	82.93	89.51	82.99	32.24
Kentucky	178.97	182.23	177.31	64.71
Louisiana	50.47	51.71	50.71	30.93
Massachusetts	15.44	20.43	16.45	14.60
Maryland	57.99	60.28	58.08	14.34
Michigan	116.40	119.75	116.19	70.52
Minnesota	69.81	78.79	71.14	38.82
Missouri	117.52	116.68	118.70	77.94
Mississippi	38.65	40.18	38.76	10.79
North Carolina	66.73	64.67	67.19	60.05
New Jersey	15.69	19.36	15.35	12.37
New York	49.75	49.53	44.44	40.18
Ohio	272.11	282.58	257.64	82.15
Pennsylvania	198.20	199.51	183.96	75.28
South Carolina	50.50	55.23	50.21	36.39
Tennessee	107.01	112.45	104.56	32.45

NO_x Emission	Base Case		CAIR Case	
	2009	2018	2009	2018
Texas	184.51	194.07	184.07	172.72
Virginia	65.21	56.98	63.07	40.31
Wisconsin	79.60	80.40	75.40	37.81
West Virginia	173.98	170.52	174.57	42.23
Total	2894.04	3009.75	2850.32	1388.03
Non CAIR States				
Arizona	78.55	80.81	78.55	80.79
California	34.59	31.62	33.40	31.44
Colorado	68.25	70.33	68.19	70.43
Connecticut	6.19	7.31	6.90	8.56
Idaho	1.50	1.10	1.50	1.13
Maine	1.84	1.86	1.79	1.93
Montana	38.32	38.43	38.38	38.43
North Dakota	71.63	71.64	68.00	71.73
Nebraska	49.01	49.45	49.27	49.60
New Hampshire	2.07	2.83	1.73	3.05
New Mexico	73.50	73.87	73.50	73.90
Nevada	29.88	37.66	31.01	39.95
Oklahoma	77.58	80.27	77.70	82.99
Oregon	13.44	13.87	13.44	13.86
Rhode Island	0.52	0.61	0.50	0.64
South Dakota	14.54	14.55	14.54	14.56
Utah	60.74	60.26	60.73	60.26
Vermont	0.01	0.02	0.01	0.04
Washington	28.67	26.73	28.67	26.72
Wyoming	81.17	81.17	81.17	81.17
Total	732.01	744.42	728.98	751.20
National Total	3626.05	3754.17	3579.30	2139.23

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Appendix C

LADCO IPM Model Parsed File Post-Processing Methodology and File Preparation (January 2005) Technical Memorandum

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LADCO IPM MODEL PARSED FILE POST-PROCESSING METHODOLOGY AND FILE PREPARATION (JANUARY 2005)

TECHNICAL MEMORANDUM

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February 8, 2005

I. INTRODUCTION

This technical memorandum describes the procedure for preparing air quality modeling input-formatted emission files based on Integrated Planning Model (IPM) output. These files will be used for Midwest Regional Planning Organization (MRPO) and Visibility Improvement-State and Tribal Association of the South (VISTAS) modeling for visibility, ozone, and fine particles.

A. POST-PROCESSING METHODOLOGY

The essence of the IPM model post-processing methodology is to take an initial IPM model output file and transform it into air quality model input files. ICF via VISTAS/MRPO provides an initial spreadsheet file containing unit-level records of both (1) “existing” units and (2) committed or new generic aggregates. All records have unit and fuel type data; existing, retrofit (for SO_2 and NO_x), and separate NO_x control information; annual SO_2 and NO_x emissions and heat input; summer season (May-September) NO_x and heat input; July day NO_x and heat input; coal heat input by coal type; nameplate capacity (MW), and State FIPS code. Existing units also have county FIPS code, a unique plant identifier (ORISPL) and unit ID (also called boiler ID) (BLRID); generic units do not have these data.

This section includes a description of the post-processing methodology.

The IPM data are processed using EPA-approved data files and methodology. The processing includes estimating various types of emissions and adding in control efficiencies, stack parameters, latitude-longitude coordinates, and State identifiers (plant ID, point ID, stack ID, process ID). Additionally, the generic units are sited in a county and given appropriate IDs. This processing is described in more detail below.

1. Generics

The data are prepared by transforming the generic aggregates into units similar to the existing units in terms of the available data. The generic aggregates are split into smaller generic units based on their unit types and capacity, are provided a dummy ORIS unique plant and boiler ID, and are given a county FIPS code based on an algorithm that sites each generic by assigning a sister plant that is in a county based on its attainment/nonattainment status. Within a state, plants (in county then ORIS plant code order) in attainment counties are used first as sister sites to generic units, followed by plants in PM nonattainment counties, followed by plants in 8-hour ozone nonattainment counties. Note that no LADCO or VISTAS States provided us with blackout counties that would not be considered when siting generics, so this process is identical to the one used for EPA IPM post-processing.

2. Adding Data for All Units

SCCs were assigned for all units; unit/fuel/firing/bottom type data were used for existing units’ assignments, while only unit and fuel type were used for generic units’ assignments.

Latitude-longitude coordinates were assigned, first using the EPA-provided data files, secondly using the September 17, 2004 Pechan in-house latitude-longitude file, and lastly using county centroids. These data were only used when the data were not provided in the 2002 NIF files.

Stack parameters were attached, first using the EPA-provided data files, secondly using a March 9, 2004 Pechan in-house stack parameter file based on previous EIA-767 data, and lastly using an EPA June 2003 SCC-based default stack parameter file. These data were only used when the data were not provided in the 2002 NIF files.

Plant ID (within State and county), point ID, process ID, and stack ID were then attached, first using the EPA-provided data files, or secondly using Pechan-generated defaults: the point ID is assigned the value of the given boiler ID preceded by '#', unless the boiler ID has a length of six [the length for the point ID], in which case the left-most character is replaced with '#'); and the default Pechan process ID is '01'. Default stack IDs within a plant are assigned for each unique stack height-diameter combination; the default Pechan stack ID is of the form '4N'. The process ID and stack ID default data were only used when the data were not provided.

3. Estimating Emissions

Additional data were required for estimating VOC, CO, filterable primary PM_{10} and $PM_{2.5}$, PM condensable, and NH_3 emissions for all units. Thus, ash and sulfur contents were assigned by first using 2002 EIA-767 values for existing units or SCC-based defaults; filterable PM_{10} and $PM_{2.5}$ efficiencies were obtained from the 2002 EGU NEI that were based on 2002 EIA-767 control data and the PM Calculator program (a default of 99.2% is used for coal units if necessary); fuel use was back calculated from the given heat input and a default SCC-based heat content; and emission factors were obtained from an EPA-approved October 7, 2004 Pechan emission factor file based on AP-42 emission factors. Note that this updated file is not the one used for estimating emissions for previous EPA post-processed IPM files.

Emissions for 28 temporal-pollutant combinations were estimated since there are seven pollutants (VOC, CO, primary PM_{10} and $PM_{2.5}$, NH_3, SO_2 and NO_x) and four temporal periods (annual, summer season, winter season, July day). Note that annual SO_2 and annual, summer season, and July day NO_x emission values are provided in the file.

- Annual emissions were first estimated by multiplying the fuel use, emission factor (which might include sulfur and/or ash content factor), removal control efficiency, and a units conversion factor.

- Summer emissions were estimated by multiplying the annual emissions by a ratio of the summer to annual heat input.

- Winter emissions were estimated by subtracting the summer emissions from the annual emissions.

- July day emissions were estimated by multiplying the annual emissions by a ratio of the July day to annual heat input.

The FoxPro program, and associated date files (in Excel) are included in the zip file, LADCOIPMdoc.zip, as is this document.

4. Crosswalk File

The Task 1 crosswalk file was used to obtain FIPS State and county, plant ID (within State and county), and point ID. If the FIPS State and county, plant ID and point ID are in the 2002 NIF tables, then the process ID and stack ID are obtained from the NIF; otherwise, defaults, described above, were used.

B. FILE PREPARATION

This section of the documentation describes the file preparation for these data; that is, how the post-processed IPM data were formatted as MRPO-specified NIF 3.0 tables. The tables were developed separately as two sets of tables for (1) IPM boilers that had a crosswalk match that were in the 2002 NIF files provided by LADCO and VISTAS, and (2) IPM boilers that were not in the 2002 NIF files provided by LADCO and VISTAS. Note that records for a given plant can be included in both sets of tables because a boiler in the IPM scenario may have a match to a point in the 2002 NIF tables, while another boiler at the same plant may not.

NIF tables for each scenario were developed and based on the Task 1 crosswalk. Two special cases relating to the crosswalk match were handled as follows:

1. One-to many match: At a given plant, if one IPM boiler ID is matched to more than one point ID, the boiler data are put on the first point ID records; records from the other point IDs are deleted from the relevant tables.

2. Many-to one match: At a given plant, if more than one IPM boiler ID is matched to one point ID, all the boilers' emissions (tons), throughput (really heat input in MMBtu), and capacity (MW) are summed ("summed boiler") and put on that point ID's records in the relevant tables. The values for stack parameters and latitude-longitude values are those from the first record summed.

The two sets of tables that were developed are described below.

A. "**NIF**" – For IPM units that have a crosswalk match and are in the 2002 NIF tables, the following was done:

In the **SI** table:

Filled in the scenario ORIS plant code as a character variable.

All records without ORIS plant code values were deleted.

If two ORISPL match with one FIPS State+county - plant ID, both records are included in this table.

In the **EU** table:

Filled in the scenario boiler ID.

All records without boiler ID values were deleted.

Filled in maximum nameplate capacity (given in IPM scenario).

In the **EM** table:

Identified which process ID record to use for each emissions release point ID (and stack ID) by using the process ID that has the largest SO_2 + NO_x temporal emissions sum. If no SO_2 + NO_x for any process ID at that point, then used largest primary PM_{10} + primary $PM_{2.5}$ temporal emissions sum; if not that, used VOC + CO + NH_3 temporal emissions sum; if not that, used a default process ID associated with that point ID in EPA IPM runs; or as a last resort, used the Pechan default process ID.

Deleted all EM records if

(1) they are for point IDs without a match in the IPM file;

(2) they are for process IDs not chosen as the one for the given point ID;

(3) they are not for the 7 pollutants (VOC [changed from ROG], CO, NO_x, SO_2, NH_3, primary PM_{10}, or primary $PM_{2.5}$);

(4) they are for durations other than annual (20yy0101 – 20yy1231), summer season (20yy0501 – 20yy0930), winter season (20yy1001 – 20yy0430 [MRPO will change these start and end dates], and typical season day (20yy0721 – 20yy0721), where yy=09 or 18.

Added needed pollutant records (with identifiers) if they are not originally in the EM table.

Filled/added in pollutant code and start and end dates for each record.

Filled/added in emissions for the 7 pollutants for the 4 temporal periods.

Filled/added in emission unit numerator (TON) and emission type (30) for all kept and added records.

Filled/added in (emission) factor numeric values [which we will calculate], emission unit numerator (LB), and emission unit denominator (E6BTU) for annual SO_2, NO_x, primary PM_{10} and primary $PM_{2.5}$ and all pollutants' summer season, winter season and typical day emissions. Left blank if summed boiler data. Note that because of NIF 3.0 table format limitations, there may be some values that are not 0 but appear to be 0 because they have the value 0 when formatted to two decimal places for (emission) factor numeric values. Real 0 values are indicated with a value of -99 to distinguish them from very small values that display as zero in the NIF tables.

Filled/added in (emission) factor numeric values [the latest EPA-approved emission factor which was used to calculate the emissions], emission unit numerator (LB), and emission unit denominator (appropriate SCC unit for the SCC we used [which is not necessarily the SCC displayed in the NIF file]) for annual CO, VOC, and NH_3. Left blank if summed boiler data.

In the **PE** table:

Deleted all FIPS State+county - plant ID - point ID - process ID - start date - end date records that are not in the EM table; added those that are in the EM table.

Filled/added in actual throughput (heat input given in IPM scenario or else derived) and throughput numerator units (E6BTU) for the 4 temporal periods.

In the **CE** table:

Kept records for those EM table identified FIPS State+county - plant ID - point ID - process ID records, whether or not they have control devices in IPM file.

Controls for NO_x, SO_2, and filterable PM (not primary PM_{10} and $PM_{2.5}$) are included to "record" what information about controls was provided in the IPM file. Note that PM controls were not used to estimate PM_{10} and $PM_{2.5}$ emissions, and the PM pollutant code will match with no other NIF table's pollutant value. The fields used to determine the control devices (as best we could) are retrofit controls, existing controls, NO_x controls – in that order. Left blank if summed boiler data.

Filled/added in pollutant code, and primary, secondary, third control, fourth control device type codes. If there was a retrofit control, it was included first. We used the best possible acceptable NIF 3.0 codes for the IPM control devices.

Did not fill in any control efficiency information since none was provided in the IPM file.

In the **EP** table:

Only kept records for those EM table identified FIPS State+county - plant ID - point ID - process IDs.

Did not fill in any values.

Added in default process ID records when necessary.

Added in IPMSCC (character 8) at end of each NIF record to display the single SCC assigned to each IPM boiler. Left blank if summed boiler data.

In the **ER** table:

Only kept records for those EM table identified FIPS State+county - plant ID - stack ID records.

Added in default stack ID records when necessary.

Did not fill in any values.

B. “**NoNIF**” – For IPM units that are not in the NIF (which includes existing units with or without a crosswalk match as well as generic units), we did the following (besides filling in the record type for all tables):

In the **SI** table:

Added all records at the plant level.

Included the scenario ORIS plant code as a character variable, FIPS State+county code, plant ID (=’ORIS’+ORISPL value if not matched in the crosswalk file), facility name, SIC primary (4911 for all), NAICS primary (22 for all), State abbreviation, and country (USA).

In the **EU** table:

Added all records at the plant-point ID level.

Included FIPS State+county code, plant ID (=’ORIS’+ORISPL value if not matched in the crosswalk file), point ID (=’#’ + boiler ID value, unless the boiler ID has a length of six [the length for the point ID], in which case the left-most character is replaced with ‘#’) – if there is no crosswalk match), boiler ID, SIC unit level (4911 for all), NAICS unit level (22 for all), and maximum nameplate capacity.

In the **EM** table:

Added all records at the plant-point-process ID-pollutant level.

Included the pollutant code, stack ID, start and end dates, emissions for the 7 pollutants for the 4 temporal periods, and emission unit numerator (TON) and emission type (30).

Added in (emission) factor numeric values [which we will calculate], emission unit numerator (LB), and emission unit denominator (E6BTU) for annual SO_2, NO_x, primary PM_{10} and primary $PM_{2.5}$ and all pollutants' summer season, winter season and typical day emissions. Left blank if summed boiler data. Note that because of NIF table format limitations, there may be some values that are not 0 but appear to be 0 because they have the value 0 when formatted to two decimal places for (emission) factor numeric values. Real 0 values are indicated with a value of -99 to distinguish them from very small values that display as zero in the NIF tables.

Added in (emission) factor numeric values [the latest EPA-approved emission factor which was used to calculate the emissions], emission unit numerator (LB), and emission unit denominator (appropriate SCC unit for the SCC we used [which is not necessarily the SCC displayed in the NIF file]) for annual CO, VOC, and NH_3. Left blank if summed boiler data.

In the **PE** table:

Added all records at the plant-point-process ID level.

Included start and end dates, actual throughput (heat input given in IPM scenario or else derived) and throughput numerator units (E6BTU) for the 4 temporal periods.

In the **CE** table:

Added records at the plant-point-process ID-pollutant level if they are in the EM file.

Controls for NO_x, SO_2, and filterable PM (not primary PM_{10} and $PM_{2.5}$) are included to "record" what information about controls was provided in the IPM file. The fields used to determine the control devices (as best we could) are retrofit controls, existing controls, NO_X controls – in that order. Left blank if summed boiler data.

Included pollutant code, and primary, secondary, third control, fourth control device type codes. If there was a retrofit control, it was included first. We used the best possible acceptable NIF 3.0 codes for the IPM control devices.

Did not provide any control efficiency information since none was provided in the IPM file.

In the **EP** table:

Added all records at the plant-point-process ID level.

Included stack ID and SCC (which is left blank if summed boiler data).

In the **ER** table:

Added all records at the plant-stack ID level.

Included stack ID, the five stack parameters (height, diameter, temperature, velocity, and flow), the latitude and longitude coordinates (may be county centroid), and the xy coordinate type (LATLON).

File layouts for the tables for the NIF and NoNIF records are included in the zip file, LADCOIPMdoc.zip, as is this document.

The list of supporting data files (besides the original IPM scenario file) used for this post-processing are listed below.

File Name	File Description
allgenerics	Lists all generics sited in the 4 scenarios.
centroid	Lists county centroids used.
controlchoicesall	Lists all control choice combinations in the 4 scenarios (used in condensable PM emission factor assignment).
f767bg02	2002 EIA-767 Boiler-Generator file used to relate into 2002 EGU inventory.
fipsatal	Lists State codes and names used.
inv02704	File with 2002 EIA-767-based data for PM control efficiencies, sulfur and ash content.
ipmtonifcontrols	Lists all the NOx, SO2, and PM NIF control device code assignments corresponding to the control devices in the 4 scenarios.
latlon091704	Lists power plant latitude-longitude coordinates used.
neiblr1	NEI boiler data file received from EPA used to fill in data if needed.
neiplt1	NEI plant data file received from EPA used to fill in data if needed.
neiplt2	NEI plant data file received from EPA used to fill in data if needed.
neiplt3	NEI plant data file received from EPA used to fill in data if needed.
nif2002_CE_completeset	Compilation of the three sets of 2002 NIF CE files received.
nif2002_EM_completeset_pt1	Compilation of the three sets of 2002 NIF EM files received (part 1).
nif2002_EM_completeset_pt2	Compilation of the three sets of 2002 NIF EM files received (part 2).
nif2002_EM_completeset_pt3	Compilation of the three sets of 2002 NIF EM files received (part 3).
nif2002_EP_completeset	Compilation of the three sets of 2002 NIF EP files received.
nif2002_ER_completeset	Compilation of the three sets of 2002 NIF ER files received.
nif2002_EU_completeset	Compilation of the three sets of 2002 NIF EU files received.
nif2002_PE_completeset	Compilation of the three sets of 2002 NIF PE files received.
nif2002_SI_completeset	Compilation of the three sets of 2002 NIF SI files received.
pmcdef	Latest EPA-approved condensable PM emission factor assignment (embedded within code).
sccdeflt	Lists default SCC-level stack parameters and default heat contents.
sccemfac100704	Latest EPA-approved uncontrolled emission factor file for CO, VOC, NH3, filterable PM-10, and filterable PM-2.5.
sccmatch	Lists all SCC combinations assigned in the 4 scenarios.
siteall	List of plants and their county's PM-10 (as of January 2004) and 8-hour ozone (as of April 2004) Nonattainment status used for siting generics.
stkp02or030904	Compilation of default stack parameters taken from the 1999 through the 2002 EGU inventory, with 2001 as the dominant year.
xwalkmrpoupdforprog	MRPO IPM-State ID crosswalk file for MRPO IPM post-processing. This file differs from the "true" crosswalk file (delivered December 9, 2004) in that it eliminates any one boiler-to-multiple points relationship, per LADCO agreement.

Additional file structures used solely for the FoxPro program that actually does the IPM post-processing.	
File Name	**File Description**
mrpoyylxxstat	File structure for mrpoYYLXXstat.xls, a file used to format and convert into a dbf the IPM scenario file delivered to Pechan.
mrpoyylxx	File structure for the adjusted version of mrpoYYlXXstat.dbf.
ladcostructure	File structure for a working .dbf file used throughout the FoxPro program.

Appendix C

Fuel Oil and Kerosene Sales 2002

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DOE/EIA-0535(02)
Distribution Category UC-950

Fuel Oil and Kerosene Sales 2002

November 2003

Energy Information Administration
Office of Oil and Gas
U.S. Department of Energy
Washington DC 20585

Contacts

The *Fuel Oil and Kerosene Sales 2002* report is prepared by the Energy Information Administration (EIA) under the general direction of John Cook (202) 586-5214, Petroleum Division, Office of Oil and Gas.

Detailed, technical questions about tables referencing the form EIA-821 may be directed to:

Daniel Walzer (202) 586-3511

Fuel Oil and Kerosene Data Available Through Electronic Access

Annual petroleum marketing data are available through electronic access that contains statistics from the *Fuel Oil and Kerosene Sales 2002* report. Included are annual sales data on petroleum volumes of kerosene, distillate fuel oils, and residual fuel oils by State. Annual historical data at the national level are provided in summary tables.

For ***Fuel Oil and Kerosene Sales* on the Internet**, access EIA's home page at http://www.eia.doe.gov.

Internet Addresses:

E-Mail: infoctr@eia.doe.gov
World Wide Web Site: http://www.eia.doe.gov

Further information as to content may be obtained from the National Energy Information Center (NEIC), telephone (202) 586-8800.

Table of Contents

Tables

Sales of Fuel Oil and Kerosene in 2002

Adjusted Sales of Fuel Oil and Kerosene in 2002

Introduction

The *Fuel Oil and Kerosene Sales 2002* report provides information, illustrations and State-level statistical data on energy use sales of kerosene; No.1, No. 2, and No. 4 distillate fuel oil; and residual fuel oil. State-level kerosene sales include volumes for residential, commercial, industrial, farm, and all other uses. State level distillate sales include volumes for residential, commercial, industrial, oil company, railroad; vessel bunkering, military, electric power, farm, on-highway, off highway construction, and other uses. State-level residual fuel sales include volumes for commercial, industrial, oil company, vessel bunkering, military, electric power, and other uses. The Petroleum Division, Office of Oil and Gas, Energy Information Administration ensures the accuracy, quality, and confidentiality of the published data in the *Fuel Oil and Kerosene Sales 2002*.

NOTE: The 2001 adjusted numbers have been revised sice they were first published in the *Fuel Oil and Kerosene Sales 2001*. The revisions to the data were made to include new distillate fuel oil and residual fuel oil volumes for "Electric Power" and a new residual product supplied number. See the Adjusted Salres section and "Technical Note 3" in Appendix A for futher explanation.

Except for the kerosene and on-highway diesel information, data presented in Tables 1 through 12 (Sales of Fuel Oil and Kerosene) present results of the EIA-821 survey. Tables 13 through 24 (Adjusted Sales of Fuel Oil and Kerosene) include volumes that are based on the EIA-821 survey but have been adjusted to equal the products supplied volumes published in the *Petroleum Supply Annual* (PSA).

Tables 1 through 12 contain sales estimates resulting from the EIA-821 survey for all categories except kerosene and on-highway diesel. For on-highway diesel the survey was not expected to yield valid statistics because the sampling frame does not include a comprehensive listing of all truck stops. Hence, State-level data obtained from the Federal Highway Administration were used instead.

Kerosene sales data were not expected to be complete because a comprehensive listing of kerosene retailers was not available to serve as a sampling frame. It was thought that a complete frame would be expensive to construct because many kerosene retailers are convenience stores or other small businesses. Because of these concerns, kerosene sales data have been published only after adjusting the sales data so that they add to the U.S. total of kerosene product supplied from the PSA.

In Tables 13 through 24, estimates of distillate fuel oil are adjusted at the Petroleum Administration for Defense (PAD) district level to equal published PSA volume estimates of products supplied. For certain sales categories, data obtained from alternate sources are used instead of the adjusted numbers. See "Technical Note 3" in Appendix A for further explanation.

Kerosene and residual fuel oil in Tables 13 through 24 are adjusted at the national level to equal published PSA products supplied estimates. Thus the kerosene figures in Tables 13 through 24 are identical to those shown in Tables 1 through 12.

The sales data (Tables 1 through 12) differ from the adjusted sales estimates (Tables 13 through 24) with the exception of kerosene and on-highway diesel for many reasons, including:

- Some products are interchangeable (fungible) and may be supplied as one product and sold as another product. For example, kerosene, low-sulfur kerosene-type jet fuel, and low-sulfur No. 1 fuel oil can be used interchangeably.

- Products supplied into a PAD district may be blended prior to final sale. For example, residual fuel and No. 2 distillate may be blended and sold as No. 4 fuel oil or, in colder climates, kerosene may be blended with distillate fuel oil and sold as heating oil.

- Geographic differences can be attributed to the transportation of product by truck or rail from the district of production. Inter-PAD district movements of products by these modes of transportation are not accounted for in Tables 13 through 24.

- Products may be supplied into a PAD district but the final sale may cross PAD district boundaries. For example, a fuel oil dealer in Ohio (PAD District 2) may make retail sales into Pennsylvania (PAD District 1B) and/or West Virginia (PAD District 1C).

- Drawdowns or buildups in stocks will cause volumes supplied to differ from sales volumes.

Sales of Fuel Oil and Kerosene in 2002

The absence of fuel switching opportunities, a somewhat sluggish economy, and a milder winter than normal combined to reduce demand in a number of oil consuming sectors and resulted in the first drop in distillate sales in more than a decade. Total distillate sales fell slightly (0.9 percent) by 569 million gallons from the all-time high set in 2001 to 59.3 billion gallons.

In 2001 sales of residual fuel surged, boosted by significant volumes of fuel switching. In 2002, without the fuel switching, residual fuel oil sales fell sharply (23.9 percent) in a continuation of the long-term trend of declining sales of heavy fuel oil. Sales of kerosene also fell sharply (40.1 percent) from the all-time high of 2001.

The relatively small decrease in distillate sales, combined with sizable drops in sales of residual fuel oil and kerosene, resulted in distillate sales accounting for a considerably larger share of the overall fuel oil market in 2002 compared to 2001. In 2002 distillate sales accounted for 84.3 percent of total sales, compared to 80.3 percent in 2001. In 2002 sales of residual fuel oil accounted for 14.7 percent of total sales, down from 18.2 percent in 2001. Sales of kerosene accounted for the remaining 0.9 percent, compared to 1.5 percent of total sales in 2001.[1]

Distillate Fuel Oil

For the first time in more than a decade, sales of distillate fuel oil fell. Sales totaled 59.3 billion gallons, a drop of 569 million gallons from the all-time high set the preceding year and nearly 260 million gallons below the total volume of distillate sold in 2000. Although the drop in sales is the first in more than a decade, it should be noted within the context of what occurred in 2001, when the distillate sales increase was the smallest of the previous decade (approximately 310 million gallons) and represented only about one-fifth of the average increase of the previous 10 years.[2]

Table HL1. Volume Distribution of Distillate and Residual Fuel Oils, 2001 and 2002

Energy Use	Distillate 2002		Distillate 2001		Residual 2002		Residual 2001	
	Volume (million gallons)	Percent Share	Volume (million gallons)	Percent Share	Volume (million gallons)	Percent Share	Volume (million gallons)	Percent Share
Residential	6,377	10.8	6,643	11.1	—	—	—	—
Commercial	3,293	5.5	3,718	6.2	572	5.6	648	4.8
Industrial	2,384	4.0	2,466	4.1	1,251	12.4	1,747	12.8
Oil Company	771	1.3	748	1.2	109	1.1	132	1.0
Farm	3,418	5.8	3,584	6.0	—	—	—	—
Electric Power	751	1.3	1,344	2.2	3,575	34.5	5,647	41.5
Railroad	3,245	5.5	3,040	5.1	—	—	—	—
Vessel Bunkering	2,079	3.5	2,044	3.4	4,848	46.8	5,409	39.7
On-Highway	34,309	57.8	33,215	55.4	—	—	—	—
Military	357	0.6	401	0.7	4	0.0	20	0.1
Off-Highway	2,358	4.0	2,708	4.5	—	—	—	—
Other	0	0.0	0	0.0	3	0.0	5	0.0
Total	59,343		59,911		10,362		13,609	

Notes: Totals may not equal sum of components due to independent rounding.
Sources: Energy Information Administration, Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report,"2000 and 2001.

[1]Numbers may not sum to 100 percent due to rounding.

[2]The average increase during the period 1991-2001 was 1.47 billion gallons. Distillate sales increased by more than 2.0 billion gallons in both 1999 and 2000.

In 2002 a number of factors had a negative influence on the volume of distillate fuel sold. First, and by far the most significant impact on sales, was the change in the relationship between prices of natural gas and distillate fuel oil. During the winter of 2001 unusually expensive natural gas made fuel switching from gas to oil attractive to any consumers having that option. During the winter of 2002, with more moderate natural gas prices, the opportunity for fuel switching disappeared. Sales of distillate fuel oil to the industrial and commercial sectors, and especially to the electric power sector, fell sharply as a result. Sales of distillate fuel to the industrial sector fell by 3.3 percent and sales to the electric power sector plunged by 44.1 percent.[3]

Second, even as the economy showed signs of improving from the slowdown in 2001, some economic indicators and some sectors of the economy lagged. Despite strong demand for oil products in some sectors, demand was negatively impacted in other areas of the economy.

Although overall Gross Domestic Product (GDP), a prime measure of the state of the economy, increased by 2.4 percent in constant dollars, unemployment also increased from 4.7 to 5.8 percent.[4] In addition, even though total energy consumption in the United States increased by 1.4 percent from 96.32 quads during 2001 to 97.622 quads in 2002, the overall increase only partially offset the drop that occurred in 2001. Total energy consumption in 2002 remained approximately 1.3 quads below the all-time high rate of 98.942 quads in 2000.[5] Further, industrial production and capacity utilization rates fell, and the overall value of new construction also fell slightly. A drop of 23.4 percent in the value of new commercial and industrial construction more than offset the 6.8 percent increase in new residential construction that was spurred by low interest rates.

Third, weather also played a role in lowering distillate demand in 2002. On the surface, since the number of heating degree days in 2001 and 2002 was almost identical, with 2002 having a slightly higher total, it could be inferred that there should be little difference in the demand for sales of distillate between the two years and that a small increase in sales in 2002 could be expected. Yet sales fell sharply in 2002, partly due to differences in the weather. Major differences in the day-to-day peak demand for electricity are much more significant than the raw totals. Many days in the first quarter of 2001 were significantly colder than in 2002, especially in the primary oil-burning areas of the U.S. (New England, Central Atlantic and East North Central). These three areas were 15 to 25 percent colder in the first quarter of 2001 than was the case in 2002.

Further, although weather impacts residential and commercial use of distillate, the weather has the greatest effect on the use of distillate as a peaking fuel by electric generators. Such units are used in the winter when it is very cold and when interruptible contract provisions are triggered, forcing some users of natural gas to switch to alternatives. Consequently, in 2002 the weather and a number of different factors combined to limit sales of distillate to the electric power sector, where sales plunged by nearly 600 million gallons (44.1 percent). These other factors in 2002 included: the absence of incentives or any opportunities for fuel switching; increased natural gas capacity in the electric power sector; increased generation of electricity by hydroelectric plants; and only a small increased in demand for electricity.

Finally, and to a limited extent, considerably warmer than normal summer weather helped limit the drop in demand for distillate as some electric power producers used distillate fuel to run peaking facilities as they strove to meet peak summer cooling needs.[6] For example, in New England and the Lower Atlantic, a number of electric power generators reported using higher volumes of distillate to produce electricity to meet peak summer demand.[7]

The transportation sector fared far better in 2002 than was the case in 2001 when distillate sales dropped due to the aftermath of the September 11 attacks. In fact, sales of distillates for use as bunker fuel, for railroads,

[3]Although sales to the commercial sector dropped (11.4 percent), differing weather conditions, installation of new gas-fired equipment, and conversion of existing facilities played a more significant role in the decline than did the absence of fuel switching.

[4]*Economic Indictors*, September 2003, Washington D.C. U.S. Government Printing Office, p. 12 . (Data are adjusted for inflation using 1996 as the base).

[5]One quad equals one quadrillion (a one followed by fifteen zeros) British thermal units (Btu). Source EIA, *Monthy Energy Review*, October 2003, Table 2.1.

[6]The summer of 2002 was both warmer than the summer of 2001 and considerably warmer than normal. Temperatures during the summer as measured by cooling degree days were warmer than normal in all regions of the country. In three census regions, the number of cooling degree days were slightly above normal, ranging between 3.5 and 6.9 percent above normal; two regions were moderately warmer than normal by as much as 15.8 percent warmer; and in four regions the number of cooling degree days was significantly higher than normal, by as much as 35 percent.

[7] Smaller peaking units, especially older units are often combustion turbines (in some cases converted jet turbine engines that run on No 2 fuel oil).

and for on-highway diesel all increased and the combined sales to the transportation sector accounted for 66.8 percent of total distillate sales compared to about 63.9 percent in 2001. Sales of on-highway diesel increased by more than one billion gallons or 3.3 percent; although the magnitude of that increase is large, particularly in comparison to the increase that occurred in 2001, it is similar in magnitude to the increase in 2000 and only somewhat more than half the size of the increase that occurred in 1999. Sales of railroad diesel increased by nearly 206 million gallons (6.8 percent) and sales of distillate bunker fuel increased slightly rising 34.9 million gallons (1.7 percent).

The impact on sales of the changing relationship between natural gas and oil prices and changing fuel use patterns can be seen in the commercial sector where distillate sales fell for the first time since 1998, falling by 11.4 percent (approximately 425 million gallons). At the same time, sales of natural gas to commercial consumers, which had fallen by 4.6 percent in 2001, increased by 2.8 percent in 2002. The increased use of natural gas in 2002 came about with the absence of fuel switching on the part of those commercial consumers with the ability to switch and the increase in natural gas demand to meet the number of both new gas-fired heating applications as well as the on-going process of conversion of existing heating equipment from oil to natural gas. Reflecting the overall drop in energy use in the industrial sector, and the impact of lower natural gas prices on fuel switching opportunities, sales of distillate fuel for use in industrial applications dropped by 82 million gallons (3.3 percent).

In 2002, weather, the ever present and often dominant factor in influencing fuel sales to the agricultural sector, negatively impacted the production of a number of the major crops including wheat, corn, and soybeans. Drier, hotter weather and, in some cases, severe drought conditions played the major role in reducing the production of soybeans by 6 percent, corn by 5 percent and wheat by 17 percent.[8] As the volume of crops harvested shrank, the volume of distillate sold to the agricultural sector also fell, dropping by 166 million gallons (4.6 percent).

Although low interest rates helped boost construction of new residential units by 6.8 percent, lingering economic problems and the growth in unemployment, contributed to depressed distillate sales to the off-highway and the construction sectors.[9] Due to the drop in the value of new commercial and industial construction of 23.4 percent, sales of distillate fuel oil for construction and off-highway uses fell by 350 million gallons (12.9 percent).

Despite a drop in the number of operating drilling rigs of nearly 28 percent and the credit crunch that led to budget cuts by some energy companies, oil company direct use of distillate fuel increased slightly during 2002. The number of active drilling rigs continued to fall through April when the level reached 750, the lowest number since October 1999. After April, the number of rigs increased, slowly at first but continuing throughout the remainder of the year. By December, the number of rigs was only 5 percent below the number in operation during December of 2001. Not unexpectedly, given the circumstances, the increase in distillate sales for oil company use was less than half the size of the increase that occurred in 2001. In 2002, sales increased by 24 million gallons (3.1 percent) compared to an increase of 61.2 million gallons (8.9 percent) in 2001.[10]

On a regional basis, sales of distillate to the home heating oil sector decreased in PAD Districts 1, 2, 4 and 5.[11] Sales in PAD District 1 (East Coast), fell the most, decreasing by approximately 215 million gallons (3.7 percent). Sales of home heating oil fell in each of the three subdistricts, by 33 million gallons in New England, by 157 million gallons in Central Atlantic, and by approximately 24 million gallons in Lower Atlantic. Sales also fell in PAD District 2 by approximately 27 million gallons; in PAD District 4 (Rocky Mountain) sales dropped by approximately 4 million gallons; and in PAD District 5 (West Coast) sales fell by 21 million gallons. Sales in PAD District 3 (Gulf Coast) increased sharply, by nearly 29 percent, however, on a volumetric basis sales, increased by less than one million gallons compared to the level of sales achieved in 2001.

Sales to the commercial sector fell throughout all regions of the U.S. without exception. Sales fell the most in the Lower Atlantic portion of PAD District 1 and in

[8]Department of Agriculture, National Agricultural Statistics Service, *Statistical Highlights 2003: Overview, U.S. Crop Summary, p. 68 and ff.*

[9]*Economic Indicators*, April 2003, Washington, D.C. U.S Government Printing Office, p. 12.

[10]Baker Hughes, North American Rig Counts, U.S. Monthly Averages by State 1992-2003, (http://www.bakerhughes.com/investor/rig/rig_na.htm).

[11]The U.S. is divided into 5 Petroleum Administration for Defense Districts (PAD Districts). District 1, East Coast, District 2, Midwest, District 3, Gulf Coast, District 4, Rocky Mountain, and District 5, West Coast. PAD District 1 is broken into three subdistricts: Subdistrict 1A, New England, Subdistrict 1B, Central Atlantic, and Subdistrict 1C, Lower Atlantic.

PAD District 2; sales fell the least in the Central Atlantic portion of PAD District 1 and in the Rocky Mountain region, PAD District 4. To some extent, the decline reflects the absence of fuel switching opportunities and changing fuel use patterns including conversion of some commercial establishments from oil to natural gas.[12]

In 2002, sales of distillate to the industrial sector decreased generally, falling throughout the nation with the exception of PAD District 4 and PAD District 1C. Sales increased by 53.3 million gallons in the Lower Atlantic and by 7.1 million gallons in the Rocky Mountain region. Sales fell the most in PAD District 5 (by 80.5 million gallons) and in PAD District 1B (by 38.2 million gallons).

Unlike 2001, when the events of September 11 and support activity for the action in Afghanistan boosted sales to the military, during 2002 sales dropped by nearly 44 million gallons (10.9 percent). The drop in sales was particularly acute in PAD District 2 where sales fell by nearly one-half (8.9 million gallons). The largest drop in volume took place in PAD District 3 where sales fell by 22.2 million gallons (20.8 percent). Sales improved in only two areas, PAD District 4 and in PAD District 1B which includes Washington, D.C.. Sales increased in the Rocky Mountain region by 0.8 million gallons and by 2.3 million gallons in the Central Atlantic region.

The adverse weather conditions that resulted in a drop in sales to the farm sector nationally, were widespread regionally. Sales to the agricultural sector fell in all five PAD Districts as warm dry weather and drought in several states resulted in poor harvests and correspondingly reduced demand for fuels for processing and harvesting. Sales in PAD District 2 which includes several of the major agricultural states, fell the most (88.3 million gallons). The second largest drop in volume occurred in PAD District 5 (West Coast), which includes California, the leading agricultural state in terms of the value of the crop production. Sales in PAD District 5 fell by just under 50 million gallons. The single exception to the pattern of falling sales occurred in New England, where warmer than normal weather conditions helped to boost production and consequently demand for fuel. Sales in New England increased by approximately 3.4 million gallons (11.9 percent).

Although distillate sales to the electric power sector fell sharply in all regions of the country, sales fell the most in PAD District 1C by 146 million gallons (41.3 percent), and in PAD District 3 (Gulf Coast) where sales dropped by 291 million gallons (79.9 percent).

Residual Fuel Oil

Natural gas prices typically increase with the approach of winter, however, during the winter of 2001, natural gas prices surged to record levels and, as a consequence, consumers with the ability to switch from gas to oil did so in large numbers leading to sharp increases in the sales of residual fuel oil to industrial and large commercial consumers and, in particular, to electric power producers. In 2002 as natural gas prices moderated, price differentials between natural gas and oil returned to a more typical relationship; with no window of opportunity opening, significantly less fuel switching occurred and total sales of residual fuel oil plunged, dropping by nearly 3.2 billion gallons (23.9 percent).

Although the magnitude of the drop in the volume is very large, it should be viewed in the context of the unusual circumstances that contributed to the significant increase in volume in 2001. In apparent contradiction to the long-term trend of decline, total sales of residual fuel oil increased during 2001. However, a close examination of the data leads to the conclusion that sales increased as the result of unusually high prices for natural gas that led, in turn, to significant volumes of fuel-switching and resulted in a surge in demand in the industrial and electric power sectors sufficient to overcome losses in other areas of the market. In 2001, with the exception of sales to those two sectors, residual fuel oil sales fell by more than 1 billion gallons. Consequently, absent the unusual circumstances in play in 2001, it is not surprising that sales of residual fuel oil dropped sharply during 2002.

The drop in sales continued a trend of more than a decade that reflects both factors within in the energy sector and externalities as well. Between 1989 and 2002, total sales of residual fuel oil have fallen by more than 52.5 percent. A number of factors contributed to this sustained and general decline in the production of and demand for residual fuel oil. Among the principle reasons for the decline are: changing crude oil specifications and increased refinery sophistication resulting in

[12] Some sales of distillate fuel for use in school buses were reclassified from commercial to the on-road category.

increased production of gasoline and distillate at the expense of production of heavier products such as residual fuel oil.[13] In addition, environmental constraints and restrictions on fuel oil use, and availability of abundant, relatively inexpensive natural gas have contributed to a diminished use of residual fuel oil in the production of electric power.[14] For residual fuel oil, although the overall trend is down, significant fluctuations in the amount of fuel sold will occur whenever price differentials make switching attractive and whenever interruptible gas contracts take effect during the coldest winter periods.

In 2002, sales to the electric power sector plunged, falling throughout the country. By far, the largest drop in sales for electric power generation occurred in Central Atlantic and Lower Atlantic portions of PAD District 1 where the sales increase of 2001 had been the largest. Sales plunged by 621 million gallons (47.6 percent) in Central Atlantic, and by 628 million gallons (23.6 percent) in Lower Atlantic. In PAD District 5 sales of residual fuel for the generation of electric power fell by 78 million gallons (14.3 percent). This compares to the situation that existed in 2001, when natural gas prices reached unusually high levels leading to an increase of residual fuel oil use for electric power of 29.5 percent. Residual fuel oil was delivered to California and Arizona by rail from the Gulf Coast, by ship from the Orient, and even by truck to supply fuel to some power plants in the region.

Sales of residual fuel to the bunker fuel market continued to fall. Although sales dropped by 562 million gallons (10.4 percent), the amount of the decline was nonetheless considerably smaller than was the case in 2001 when sales fell by 1 billion gallons. However, it should be noted that at least some portion of the apparent drop in sales during 2001 resulted from reporting errors in the past that included sales for resale along with actual bunker sales data.

Although sales for direct use by oil companies fell by 17.8 percent nationally, that figure may be somewhat misleading. Sales increased in PAD Districts 3, 4 and 5 as well as in New England and Lower Atlantic portions of PAD District 1. Sales fell sharply in PAD District 2 (down by 41.7 percent) and in the Central Atlantic portion of PAD District 1 where sales fell by nearly one third and where the losses more than made up for the small volumetric increases elsewhere in the district.

Despite the fact that sales of residual fuel oil to the industrial sector fell at the national level, regional sales were somewhat mixed. The largest drop occurred along the East Coast where sales fell by a total of 451 million gallons and accounted for approximately 91 percent of the total decline in sales to the industrial sector. Sales in the Gulf Coast, Rocky Mountain, and West Coast regions of the country increased somewhat. It should be noted that although the increases appear significant in percentage terms the volumetric gains amounted to less than 4 percent of total residual sales to the industrial sector.

Overall, total sales to the commercial sector declined by 76 million gallons (11.7 percent). However, on a regional basis, sales were mixed. The bulk of the drop in sales occurred in Central Atlantic and Lower Atlantic portions of PAD District 1 where sales in the two regions fell by approximately 73 million gallons. The remainder of the decline in sales occurred in PAD Districts 3, 4, and 5 but amounted to less than 6 million gallons in total. On a volumetric basis, sales to the commercial sector increased very slightly (by approximately 3 million gallons) in the New England portion of PAD District 1 and in PAD District 2.

The downward trend in sales of residual fuel oil to the military continued during 2002.[15] On a regional basis, sales fell sharply in the three PAD Districts (1, 2, and 5) where sales to the military were recorded.[16]

Kerosene

Sales of kerosene fell in all consuming sectors. Total sales decreased by 445 million gallons, a drop of 40.1 percent. Sales fell the most in the residential sector, down 260 million gallons (37.0 percent). Sales to the

[13] It should be noted that the ability to increase production of light higher-value products does not typically mean that refineries with upgraded processing capacity no longer possess the ability to produce heavier products such as residual fuel; rather, the economics involved dictate the production of the higher value products.

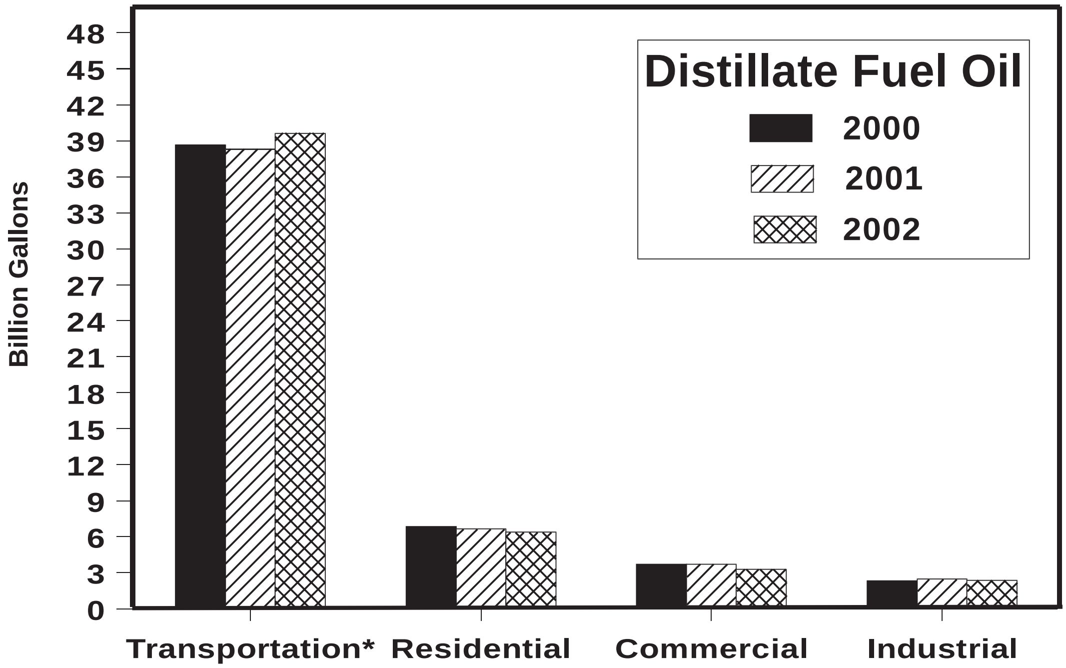
[14] Due to the divestiture of many electric power generation facilities, changes in fuel use and plant operations also contributed to the decline of residual fuel oil. For example, operators of these merchant plants blend fuels to achieve greater efficiency and to lower emissions of dirtier fuels (oil blended with natural gas and even oil and coal). When it is advantageous, the operators also may purchase power rather than generate electricity and re-sell the fuel.

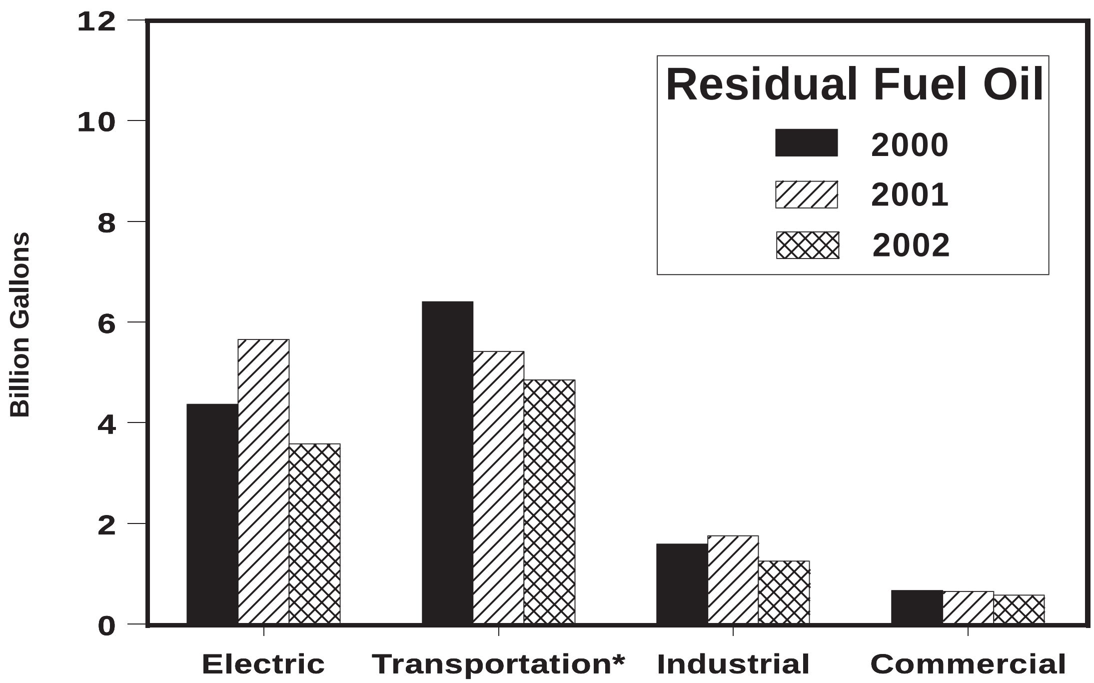
[15] Since 1997, sales have fallen by approximately 92 percent.

[16] No sales of residual fuel to the military were recorded in PAD District 3 or 4 in either 2001 or 2002.

commercial sector fell by 114 million gallons (49.2 percent). Sales to the industrial and farm sectors also fell by 45.2 percent and 28.6 percent, respectively.

Figure HL1. U.S. Sales of Distillate and Residual Fuel Oils by Energy Use, 2000-2002

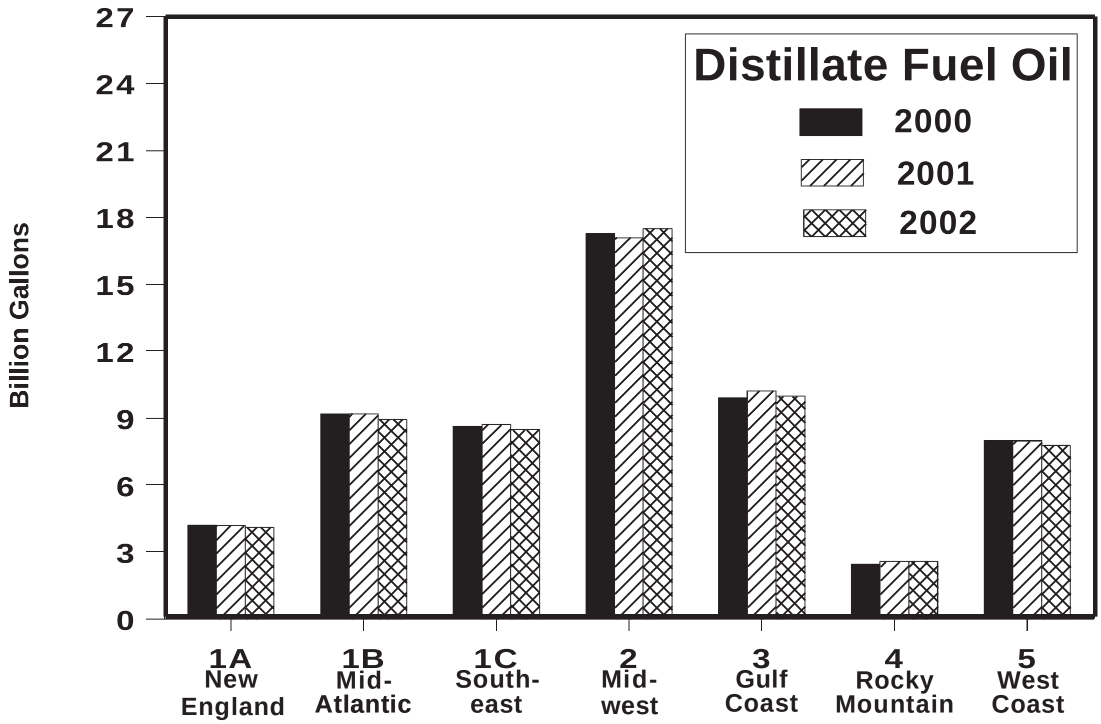


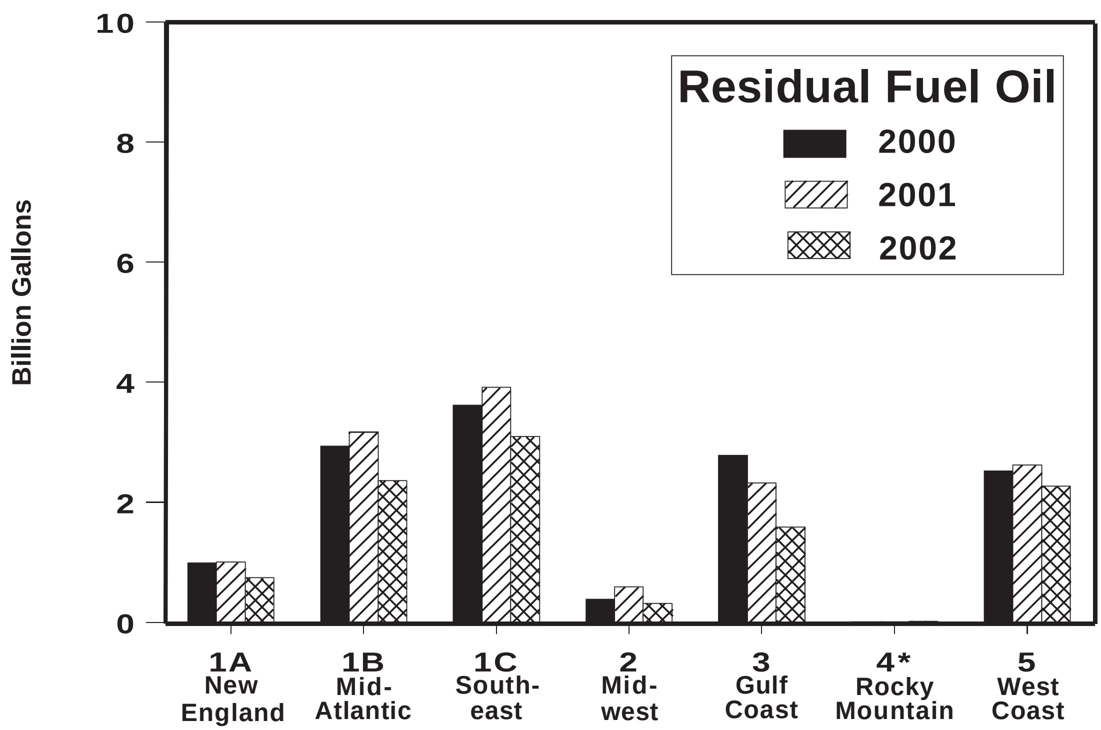


*For distillate fuel oil, transportation use comprises railroad, vessel bunkering, and on-highway diesel energy use categories. For residual fuel oil, transportation use comprises the vessel bunkering energy use category.

Sources: Energy Information Administration, Form EIA-821, "Fuel Oil and Kerosene Sales Report," 2001 and 2002.

Figure HL2. Volume Distribution of Distillate and Residual Fuel Oils by PAD District, 2000-2002



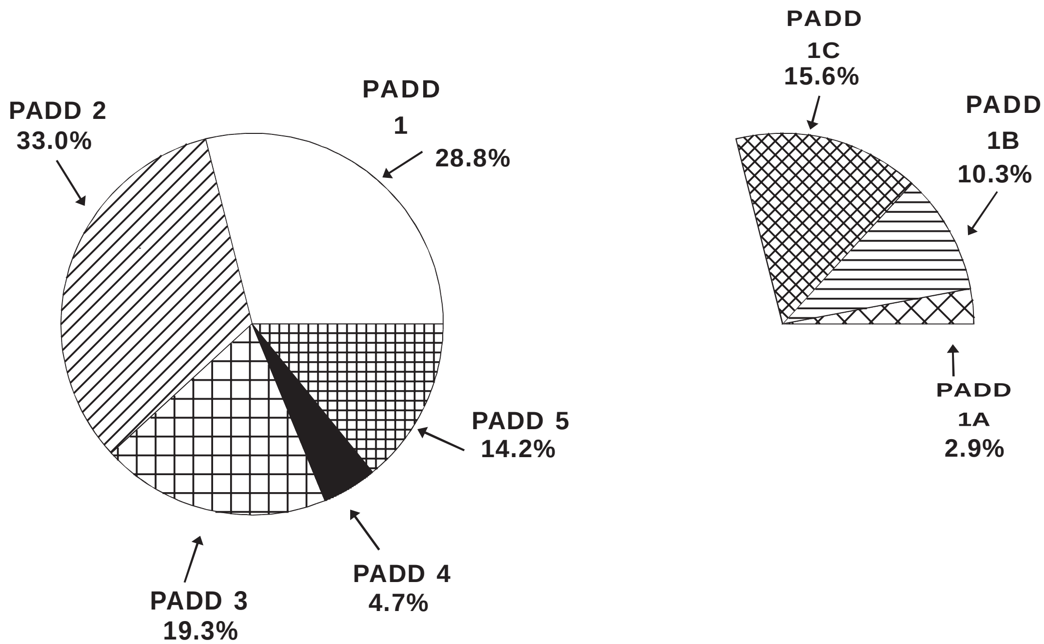


*Residual fuel oil sales in PAD District IV are too small to appear in this graph.

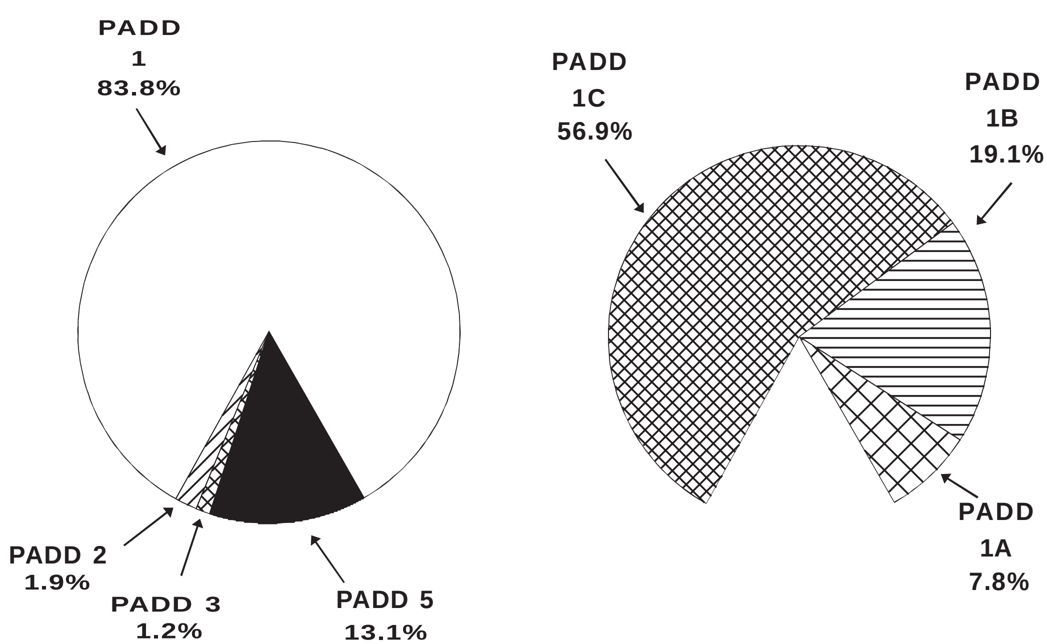
Sources: Energy Information Administration, Form EIA-821, “Fuel Oil and Kerosene Sales Report,” 2001 and 2002.

Figure HL3. Distillate and Residual Fuel Oil Sales for Selected Energy Use Categories by PAD District, 2002

Distillate: Transportation



Residual: Electric Power



Sources: Energy Information Administration, Form EIA-821, "Fuel Oil and Kerosene Sales Report," 2002.

Table 1. Sales of Distillate Fuel Oil by Energy Use in the United States: 1998-2002
(Thousand Gallons)

Energy Use	Distillate Fuel Oil				
	1998	1999	2000	2001	2002
U.S. Total	**55,305,694**	**57,573,018**	**59,601,230**	**59,911,345**	**59,342,633**
Residential	5,819,959	6,302,466	6,830,455	6,642,941	6,376,653
Commercial	3,233,350	3,338,242	3,706,345	3,717,862	3,293,387
Industrial	2,462,355	2,477,719	2,330,870	2,466,456	2,384,383
Oil Company	783,719	659,039	686,454	747,627	770,682
Farm	3,410,801	3,411,623	3,454,861	3,584,104	3,418,452
Electric Power	840,731	816,008	1,015,100	1,343,761	750,557
Railroad	3,180,124	3,239,044	3,290,507	3,039,761	3,245,482
Vessel Bunkering	2,595,076	2,419,336	2,261,422	2,044,049	2,078,921
On-Highway Diesel	30,150,191	32,062,447	33,129,664	33,215,320	34,308,885
Military	352,189	356,602	306,170	401,236	357,359
Off-Highway Diesel	2,477,199	2,490,492	2,589,383	2,708,228	2,357,872

Notes: • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 1998-2002. • On-Highway Diesel data are Federal Highway Administation statistics of highway special fuels use.

Table 2. Sales of Residual Fuel Oil by Energy Use in the United States: 1998-2002
(Thousand Gallons)

Energy Use	Residual Fuel Oil				
	1998	1999	2000	2001	2002
U.S. Total	**14,729,841**	**13,328,058**	**13,210,935**	**13,609,379**	**10,361,615**
Commercial	715,111	645,927	664,360	647,758	572,039
Industrial	1,797,906	1,700,054	1,585,140	1,747,367	1,250,634
Oil Company	127,464	123,984	153,522	132,177	108,673
Electric Power	6,431,746	4,990,083	4,362,680	5,647,433	3,575,249
Vessel Bunkering	5,620,417	5,838,128	6,409,863	5,409,378	4,847,704
Military	33,648	25,702	28,427	20,117	3,882
All Other	3,549	4,181	6,942	5,149	3,435

Notes: • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 1998-2002.

Table 3. Sales of Kerosene by Energy Use in the United States: 1998-2002
(Thousand Gallons)

Energy Use	Kerosene				
	1998	1999	2000	2001	2002
U.S. Total	**1,196,580**	**1,118,124**	**1,036,014**	**1,108,926**	**664,314**
Residential	802,348	823,436	700,532	704,305	443,919
Commercial	230,743	199,577	219,633	232,608	118,125
Industrial	123,246	58,279	86,844	141,317	77,508
Farm	26,823	26,312	23,084	27,162	19,390
All Other	13,420	10,521	5,921	3,535	5,372

Notes: • See Technical Note 3 for further explanation on adjustments. • Kerosene data in the Sales tables (1-12) are adjusted at the national level. • Totals may not equal sum of components due to independent rounding.

Sources: • Kerosene data are based on data from the Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 1998-2002 and the "Petroleum Supply Annual," Volume 1, 1998-2002, (DOE/EIA-0340(98)/1 - (02)/1).

Table 4. Sales of Distillate Fuel Oil by Energy Use, 2001 and 2002

(Thousand Gallons)

Destination	Residential		Commercial		Industrial	
	2001	2002	2001	2002	2001	2002
U.S. Total	**6,642,941**	**6,376,653**	**3,717,862**	**3,293,387**	**2,466,456**	**2,384,383**
PAD District 1 Total	**5,764,375**	**5,549,350**	**2,343,499**	**2,142,071**	**801,129**	**795,157**
Subdistrict 1A Total	**2,259,990**	**2,226,579**	**576,048**	**540,673**	**82,307**	**61,238**
Connecticut	579,489	565,684	144,988	124,644	24,716	16,094
Maine	291,822	291,542	107,198	117,558	15,389	16,577
Massachusetts	949,697	953,235	179,678	165,649	25,589	11,094
New Hampshire	192,669	179,862	74,362	66,826	7,691	7,331
Rhode Island	151,758	144,952	26,835	28,618	3,139	4,186
Vermont	94,555	91,304	42,986	37,377	5,783	5,956
Subdistrict 1B Total	**3,102,794**	**2,945,645**	**1,261,439**	**1,210,999**	**245,833**	**207,590**
Delaware	42,771	42,754	12,922	14,654	3,541	3,554
District of Columbia	8,481	15,199	23,065	12,778	262	192
Maryland	204,380	190,081	107,053	107,941	29,019	26,378
New Jersey	403,378	390,944	144,583	104,265	40,180	25,212
New York	1,555,018	1,420,939	718,463	649,354	46,039	45,491
Pennsylvania	888,766	885,729	255,353	322,007	126,792	106,763
Subdistrict 1C Total	**401,591**	**377,126**	**506,012**	**390,399**	**472,989**	**526,329**
Florida	5,178	4,042	129,360	110,928	74,386	55,149
Georgia	2,590	2,376	68,643	44,344	76,336	73,644
North Carolina	132,840	121,287	131,882	86,037	81,738	50,440
South Carolina	17,866	16,691	32,766	28,900	32,094	15,506
Virginia	220,962	210,973	126,065	106,131	99,407	88,602
West Virginia	22,155	21,757	17,295	14,060	109,029	242,990
PAD District 2 Total	**620,807**	**594,109**	**671,535**	**571,142**	**700,432**	**699,833**
Illinois	13,615	11,404	77,333	70,866	75,682	69,476
Indiana	33,187	36,407	67,134	59,558	133,003	131,292
Iowa	17,665	25,065	23,165	19,601	16,503	10,243
Kansas	1,894	1,549	34,363	27,456	18,810	13,301
Kentucky	19,441	17,506	47,825	46,117	135,362	146,214
Michigan	113,065	95,570	64,959	41,743	33,409	25,735
Minnesota	97,450	95,716	48,292	35,459	29,511	40,378
Missouri	17,217	12,533	66,382	42,960	40,370	49,072
Nebraska	3,459	2,940	10,356	3,991	4,030	5,766
North Dakota	20,943	18,335	11,144	6,121	12,656	10,000
Ohio	117,761	137,168	80,330	97,454	80,167	85,446
Oklahoma	108	85	28,652	15,108	20,238	20,373
South Dakota	15,602	11,547	10,703	7,757	7,375	9,003
Tennessee	7,075	4,958	39,850	44,671	34,871	27,478
Wisconsin	142,324	123,325	61,048	52,280	58,445	56,056
PAD District 3 Total	**2,209**	**2,841**	**256,276**	**195,072**	**354,683**	**352,592**
Alabama	1,647	1,578	35,660	33,827	55,112	57,837
Arkansas	35	371	25,278	19,284	15,226	26,100
Louisiana	63	377	11,791	16,395	69,973	74,564
Mississippi	231	46	14,127	11,324	40,218	32,254
New Mexico	194	302	14,906	14,199	31,688	36,161
Texas	39	167	154,514	100,044	142,467	125,677
PAD District 4 Total	**30,129**	**26,360**	**98,512**	**77,924**	**230,315**	**237,408**
Colorado	2,392	1,066	26,943	21,465	26,000	30,808
Idaho	15,570	15,140	15,831	14,188	26,089	19,094
Montana	7,243	5,290	8,381	5,935	20,473	22,592
Utah	3,868	3,564	29,656	24,110	32,856	38,951
Wyoming	1,056	1,300	17,700	12,225	124,897	125,964
PAD District 5 Total	**225,420**	**203,993**	**348,039**	**307,178**	**379,897**	**299,393**
Alaska	77,691	64,396	71,817	53,512	40,794	48,987
Arizona	278	406	32,624	35,937	95,410	73,780
California	12,502	6,338	120,908	94,610	76,558	52,537
Hawaii	12	13	5,807	13,397	3,714	2,483
Nevada	9,307	8,979	14,293	15,440	69,716	60,700
Oregon	44,851	41,948	51,301	44,367	51,650	35,596
Washington	80,778	81,914	51,289	49,915	42,054	25,310

See footnotes at end of table.

Table 4. Sales of Distillate Fuel Oil by Energy Use, 2001 and 2002 (Continued)

(Thousand Gallons)

Destination	Oil Company		Farm		Electric Power	
	2001	2002	2001	2002	2001	2002
U.S. Total	**747,627**	**770,682**	**3,584,104**	**3,418,452**	**1,343,761**	**750,557**
PAD District 1 Total	**22,612**	**26,012**	**514,314**	**495,343**	**501,708**	**345,651**
Subdistrict 1A Total	**196**	**40**	**28,818**	**32,254**	**17,627**	**8,881**
Connecticut	8	6	6,376	7,960	2,105	1,367
Maine	–	34	7,108	8,088	38	320
Massachusetts	188	–	3,618	5,482	9,303	3,405
New Hampshire	–	–	4,950	4,997	2,201	2,185
Rhode Island	–	–	60	136	2,499	1,191
Vermont	–	–	6,706	5,592	1,482	414
Subdistrict 1B Total	**14,713**	**19,255**	**113,382**	**111,400**	**130,668**	**129,282**
Delaware	9,132	11,183	7,197	8,432	5,371	4,456
District of Columbia	–	–	–	–	17,406	19,246
Maryland	61	8	20,663	15,315	56,665	23,845
New Jersey	181	296	11,617	10,149	5,420	18,415
New York	93	1	40,530	44,649	16,864	10,697
Pennsylvania	5,246	7,767	33,375	32,855	28,942	52,622
Subdistrict 1C Total	**7,702**	**6,716**	**372,114**	**351,690**	**353,413**	**207,488**
Florida	209	219	124,165	133,634	153,989	125,324
Georgia	969	90	142,755	118,586	32,033	10,335
North Carolina	1	276	45,286	44,171	48,642	31,432
South Carolina	–	603	21,835	20,873	30,151	14,807
Virginia	218	425	35,370	32,970	71,647	10,281
West Virginia	6,305	5,104	2,703	1,455	16,952	15,308
PAD District 2 Total	**52,767**	**47,371**	**1,801,106**	**1,712,833**	**226,916**	**143,793**
Illinois	376	528	155,262	153,987	16,356	8,840
Indiana	66	66	90,329	87,329	31,702	15,010
Iowa	–	–	236,261	230,919	6,761	2,894
Kansas	6,313	8,844	158,360	151,596	10,238	5,184
Kentucky	999	467	37,374	36,361	6,059	10,319
Michigan	26	25	53,420	48,537	31,958	23,974
Minnesota	–	2	139,016	119,518	14,084	5,730
Missouri	74	155	63,132	70,146	14,083	6,910
Nebraska	–	–	196,784	201,222	2,833	683
North Dakota	5,955	3,838	115,070	97,073	1,586	1,620
Ohio	1,924	1,734	84,438	92,156	35,736	27,126
Oklahoma	36,952	31,621	64,083	64,616	10,468	10,348
South Dakota	73	12	67,538	56,734	1,102	701
Tennessee	9	–	35,829	31,413	36,174	18,185
Wisconsin	–	80	304,210	271,224	7,777	6,269
PAD District 3 Total	**591,089**	**620,054**	**539,050**	**537,705**	**363,916**	**73,061**
Alabama	67	245	22,000	21,295	21,733	3,005
Arkansas	1,976	1,427	116,946	112,539	4,754	5,344
Louisiana	308,492	338,520	66,094	70,195	28,705	8,390
Mississippi	4,468	8,830	71,705	65,022	2,904	1,317
New Mexico	25,571	20,613	17,981	15,745	3,222	2,785
Texas	250,516	250,419	244,324	252,909	302,599	52,221
PAD District 4 Total	**22,838**	**21,690**	**178,242**	**170,752**	**21,260**	**6,923**
Colorado	4,802	4,482	46,381	46,346	13,439	1,868
Idaho	–	–	59,057	60,617	448	19
Montana	3,212	1,268	41,229	38,649	497	–
Utah	275	771	15,169	12,362	2,271	1,896
Wyoming	14,541	15,169	16,406	12,778	4,604	3,140
PAD District 5 Total	**58,321**	**55,555**	**551,392**	**501,820**	**229,961**	**181,128**
Alaska	41,552	38,615	12	16	56,687	49,676
Arizona	176	378	36,015	38,030	21,819	4,988
California	12,187	12,618	401,893	360,343	22,859	6,915
Hawaii	92	4	10,704	9,526	104,601	112,254
Nevada	39	1,099	6,073	5,475	942	2,001
Oregon	335	2,057	47,253	51,794	11,929	4,807
Washington	3,939	785	49,442	36,635	11,124	488

See footnotes at end of table.

Table 4. Sales of Distillate Fuel Oil by Energy Use, 2001 and 2002 (Continued)

(Thousand Gallons)

Destination	Railroad		Vessel Bunkering		On-Highway	
	2001	2002	2001	2002	2001	2002
U.S. Total	**3,039,761**	**3,245,482**	**2,044,049**	**2,078,921**	**33,215,320**	**34,308,885**
PAD District 1 Total	**533,739**	**547,030**	**486,383**	**481,186**	**10,283,551**	**10,373,983**
Subdistrict 1A Total	**29,216**	**18,360**	**42,770**	**60,636**	**1,054,431**	**1,077,477**
Connecticut	5,821	5,123	2,838	2,589	271,949	228,081
Maine	490	360	10,846	9,257	157,265	167,632
Massachusetts	21,683	12,757	23,556	38,573	400,652	398,217
New Hampshire	31	98	365	363	99,664	164,623
Rhode Island	45	–	4,522	9,002	54,843	54,785
Vermont	1,146	23	644	853	70,058	64,139
Subdistrict 1B Total	**144,833**	**160,288**	**152,020**	**131,213**	**3,757,549**	**3,785,263**
Delaware	246	896	1,218	634	56,556	62,154
District of Columbia	4,357	4,680	10	286	27,358	27,049
Maryland	3,718	1,337	24,473	12,020	499,563	501,802
New Jersey	14,262	31,802	86,860	85,235	833,297	833,183
New York	27,311	20,300	15,813	9,567	956,982	988,428
Pennsylvania	94,938	101,273	23,645	23,471	1,383,793	1,372,647
Subdistrict 1C Total	**359,690**	**368,382**	**291,593**	**289,337**	**5,471,571**	**5,511,243**
Florida	112,867	78,074	145,651	153,315	1,284,054	1,344,310
Georgia	74,348	122,300	24,580	23,841	1,406,878	1,313,424
North Carolina	81,961	88,461	13,785	10,739	954,529	976,151
South Carolina	16,796	12,646	15,662	21,123	618,958	634,567
Virginia	64,457	56,308	29,334	30,150	936,738	973,906
West Virginia	9,261	10,593	62,581	50,167	270,414	268,885
PAD District 2 Total	**1,056,240**	**1,227,782**	**318,923**	**313,245**	**10,946,605**	**11,548,458**
Illinois	74,602	117,340	53,791	51,965	1,242,862	1,137,642
Indiana	24,620	88,502	19,097	9,400	976,154	1,354,201
Iowa	15,577	22,255	5,606	3,574	494,746	504,461
Kansas	36,127	72,082	786	1,428	366,378	405,689
Kentucky	100,219	101,007	90,309	62,655	813,305	991,256
Michigan	10,455	26,776	4,172	5,515	898,950	939,587
Minnesota	54,015	58,524	4,435	4,181	629,517	649,613
Missouri	23,745	22,439	64,584	33,602	911,037	946,940
Nebraska	2,525	2,781	–	–	365,060	373,857
North Dakota	47,024	51,746	–	–	149,766	152,301
Ohio	168,639	185,793	3,647	5,690	1,468,979	1,498,239
Oklahoma	355,803	342,948	159	190	947,603	819,929
South Dakota	5,085	4,792	–	–	148,841	191,656
Tennessee	91,736	90,602	62,362	125,340	867,065	903,682
Wisconsin	46,068	40,196	9,975	9,704	666,342	679,405
PAD District 3 Total	**758,918**	**762,793**	**990,369**	**943,474**	**5,743,372**	**5,945,268**
Alabama	47,925	53,202	66,785	65,786	680,321	667,844
Arkansas	84,949	114,146	256	804	580,583	610,663
Louisiana	52,410	46,931	597,624	546,297	599,491	615,227
Mississippi	21,319	16,913	18,540	61,545	503,217	538,079
New Mexico	15,532	8,982	1	–	402,953	419,853
Texas	536,783	522,619	307,163	269,043	2,976,807	3,093,602
PAD District 4 Total	**248,436**	**243,345**	**43**	**23**	**1,569,650**	**1,632,707**
Colorado	44,392	38,399	–	11	510,659	544,627
Idaho	26,753	24,390	43	12	218,109	223,184
Montana	66,659	58,404	–	–	197,340	201,566
Utah	27,016	31,095	–	–	336,377	353,215
Wyoming	83,615	91,057	–	–	307,165	310,115
PAD District 5 Total	**442,429**	**464,532**	**248,331**	**340,993**	**4,672,142**	**4,808,469**
Alaska	6,683	5,831	103,123	102,192	111,433	108,777
Arizona	7,696	15,353	–	–	675,847	642,850
California	281,963	296,168	79,241	68,957	2,627,366	2,703,680
Hawaii	–	–	31,332	92,960	32,754	38,122
Nevada	9,284	9,101	–	3	267,368	286,639
Oregon	81,593	76,495	12,925	15,836	414,373	458,057
Washington	55,208	61,584	21,710	61,045	543,001	570,344

See footnotes at end of table.

Table 4. Sales of Distillate Fuel Oil by Energy Use, 2001 and 2002 (Continued)

(Thousand Gallons)

Destination	Military 2001	Military 2002	Off-Highway 2001	Off-Highway 2002	Total 2001	Total 2002
U.S. Total	**401,236**	**357,359**	**2,708,228**	**2,357,872**	**59,911,345**	**59,342,633**
PAD District 1 Total	**75,963**	**67,941**	**737,336**	**697,516**	**22,064,610**	**21,521,241**
Subdistrict 1A Total	**14,197**	**10,033**	**68,727**	**68,559**	**4,174,329**	**4,104,730**
Connecticut	4,078	848	12,588	12,556	1,054,955	964,950
Maine	7,255	5,418	11,484	10,655	608,895	627,439
Massachusetts	572	1,062	25,244	25,659	1,639,782	1,615,132
New Hampshire	2,142	2,099	14,408	14,427	398,483	442,812
Rhode Island	19	32	1,909	2,218	245,629	245,119
Vermont	131	575	3,094	3,044	226,584	209,279
Subdistrict 1B Total	**20,113**	**22,447**	**238,594**	**212,210**	**9,181,937**	**8,935,591**
Delaware	922	394	5,534	3,333	145,409	152,445
District of Columbia	3,701	2,268	1,269	2,801	85,908	84,500
Maryland	5,323	7,721	49,680	34,626	1,000,600	921,074
New Jersey	1,578	1,826	51,712	57,178	1,593,068	1,558,504
New York	1,858	2,961	40,319	34,671	3,419,291	3,227,057
Pennsylvania	6,731	7,278	90,080	79,601	2,937,662	2,992,012
Subdistrict 1C Total	**41,654**	**35,461**	**430,015**	**416,748**	**8,708,344**	**8,480,919**
Florida	9,769	5,787	91,777	118,363	2,131,405	2,129,145
Georgia	3,922	3,466	116,489	90,890	1,949,543	1,803,296
North Carolina	7,348	7,263	72,174	52,463	1,570,186	1,468,723
South Carolina	2,227	2,120	50,775	63,815	839,131	831,650
Virginia	18,197	16,573	81,878	75,415	1,684,272	1,601,735
West Virginia	190	252	16,922	15,801	533,806	646,371
PAD District 2 Total	**18,871**	**9,938**	**673,893**	**625,502**	**17,088,096**	**17,494,005**
Illinois	1,102	482	90,609	95,439	1,801,589	1,717,970
Indiana	265	55	42,187	40,565	1,417,745	1,822,384
Iowa	6	2,215	37,477	27,076	853,767	848,303
Kansas	5,812	190	25,357	19,340	664,437	706,659
Kentucky	547	1,090	53,767	43,848	1,305,207	1,456,839
Michigan	1,137	720	62,003	45,223	1,273,553	1,253,403
Minnesota	3,050	246	51,034	56,518	1,070,406	1,065,885
Missouri	2,129	1,354	72,300	80,500	1,275,053	1,266,611
Nebraska	961	7	19,440	9,618	605,448	600,865
North Dakota	517	395	12,011	11,718	376,672	353,146
Ohio	1,392	1,674	66,527	56,137	2,109,541	2,188,616
Oklahoma	67	–	39,281	32,823	1,503,414	1,338,042
South Dakota	53	156	9,292	10,957	265,664	293,314
Tennessee	287	155	40,920	36,880	1,216,177	1,283,365
Wisconsin	1,546	1,200	51,689	58,863	1,349,423	1,298,602
PAD District 3 Total	**106,520**	**84,351**	**507,480**	**461,273**	**10,213,883**	**9,978,484**
Alabama	1,982	1,948	59,657	62,343	992,888	968,910
Arkansas	185	601	61,335	47,707	891,522	938,985
Louisiana	1,307	1,387	74,819	66,575	1,810,770	1,784,857
Mississippi	6,871	7,089	41,213	44,965	724,812	787,383
New Mexico	27	37	17,612	17,251	529,687	535,928
Texas	96,147	73,288	252,844	222,432	5,264,204	4,962,421
PAD District 4 Total	**5,039**	**5,856**	**163,109**	**154,107**	**2,567,572**	**2,577,094**
Colorado	443	396	66,372	62,329	741,824	751,798
Idaho	4,160	4,168	22,858	23,377	388,926	384,189
Montana	137	10	16,343	17,053	361,513	350,767
Utah	298	1,279	28,461	26,492	476,248	493,736
Wyoming	1	2	29,075	24,855	599,060	596,605
PAD District 5 Total	**194,844**	**189,274**	**626,409**	**419,474**	**7,977,185**	**7,771,809**
Alaska	8,106	7,625	15,120	13,349	533,019	492,975
Arizona	–	12	53,194	49,816	923,059	861,550
California	43,399	57,735	433,811	207,088	4,112,688	3,866,990
Hawaii	40,505	12,731	5,627	7,834	235,150	289,323
Nevada	1,440	580	31,937	28,240	410,400	418,256
Oregon	356	2,597	29,405	37,936	745,971	771,490
Washington	101,038	107,995	57,316	75,211	1,016,899	1,071,224

Dashed (-) = No data reported.
Notes: • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2001-2002. • On-Highway Diesel data are Federal Highway Administration statistics of highway special fuels use.

Table 5. Sales of Residual Fuel Oil by Energy Use, 2001 and 2002

(Thousand Gallons)

Destination	Commercial		Industrial		Oil Company		Electric Power	
	2001	2002	2001	2002	2001	2002	2001	2002
U.S. Total	**647,758**	**572,039**	**1,747,367**	**1,250,634**	**132,177**	**108,673**	**5,647,433**	**3,575,249**
PAD District 1 Total	**603,014**	**532,346**	**1,308,073**	**857,039**	**88,244**	**61,152**	**4,358,323**	**2,996,269**
Subdistrict 1A Total	**86,149**	**88,501**	**474,236**	**319,056**	**235**	**1,172**	**390,256**	**277,957**
Connecticut	9,629	14,465	34,402	15,056	235	339	92,891	85,652
Maine	10,908	17,855	257,644	186,917	–	404	30,236	39,914
Massachusetts	30,464	28,946	125,502	77,637	–	429	233,838	106,304
New Hampshire	4,786	5,558	36,115	22,239	–	–	33,291	46,052
Rhode Island	25,012	16,235	11,900	11,243	–	–	–	34
Vermont	5,350	5,442	8,672	5,963	–	–	–	–
Subdistrict 1B Total	**485,510**	**433,113**	**240,402**	**145,183**	**87,553**	**59,483**	**1,304,358**	**683,071**
Delaware	12,541	9,648	30,062	22,164	48,158	30,073	115,478	33,212
District of Columbia	80	–	–	–	–	–	–	–
Maryland	1,971	2,849	30,774	18,006	683	591	112,948	89,029
New Jersey	22,425	12,574	33,025	11,317	1,958	1,831	364,802	86,559
New York	419,337	391,092	89,324	60,767	678	620	568,147	379,756
Pennsylvania	29,155	16,950	57,216	32,929	36,076	26,368	142,984	94,514
Subdistrict 1C Total	**31,355**	**10,733**	**593,435**	**392,800**	**456**	**498**	**2,663,709**	**2,035,241**
Florida	853	3,199	158,880	69,400	–	–	2,393,838	1,812,239
Georgia	11	–	53,766	81,668	–	–	22,490	3,690
North Carolina	7,434	3,356	197,551	139,573	111	111	–	–
South Carolina	6,612	848	99,018	66,418	111	132	3,319	–
Virginia	16,446	3,330	70,916	30,650	234	254	244,062	219,312
West Virginia	–	–	13,305	5,090	–	–	–	–
PAD District 2 Total	**34,883**	**35,593**	**251,284**	**159,458**	**25,394**	**14,809**	**241,944**	**69,638**
Illinois	3,404	580	17,910	3,908	94	–	127,190	2,298
Indiana	30	30	22,863	7,724	–	–	14,603	–
Iowa	44	93	2,525	2,643	–	–	684	–
Kansas	391	390	18,428	7,762	–	–	24,218	27,597
Kentucky	350	–	3,212	1,135	4,708	3,024	376	–
Michigan	995	2,888	16,400	12,635	4,100	2,829	70,618	36,342
Minnesota	12,729	8,809	35,564	19,704	5,152	4,180	3,152	2,251
Missouri	1,696	1,350	6,272	3,189	–	–	–	73
Nebraska	1,226	–	6,139	5,559	–	–	–	–
North Dakota	2,121	4,251	1,929	170	–	–	195	–
Ohio	41	198	51,565	34,078	3,852	4,253	909	1,077
Oklahoma	–	458	19,229	19,715	664	522	–	–
South Dakota	283	14	5,913	4,662	–	–	–	–
Tennessee	–	–	8,514	5,973	–	–	–	–
Wisconsin	11,572	16,531	34,822	30,600	6,824	–	–	–
PAD District 3 Total	**3,537**	**1,055**	**162,533**	**192,493**	**76**	**382**	**501,938**	**42,318**
Alabama	–	–	46,418	84,306	–	–	–	–
Arkansas	–	–	11,815	2,090	–	–	46,476	2,637
Louisiana	–	13	57,823	59,248	–	–	82,056	39,184
Mississippi	2,887	–	11,364	5,441	–	–	355,718	497
New Mexico	–	–	4,904	5,896	76	–	–	–
Texas	651	1,042	30,209	35,512	–	382	17,688	–
PAD District 4 Total	**1,059**	**–**	**5,610**	**10,461**	**–**	**5,405**	**–**	**–**
Colorado	–	–	238	–	–	–	–	–
Idaho	–	–	1,314	3,608	–	–	–	–
Montana	–	–	145	51	–	1,716	–	–
Utah	1,059	–	–	397	–	3,312	–	–
Wyoming	–	–	3,913	6,405	–	377	–	–
PAD District 5 Total	**5,264**	**3,044**	**19,868**	**31,184**	**18,463**	**26,925**	**545,228**	**467,024**
Alaska	–	–	1,065	–	–	–	–	–
Arizona	–	–	1,591	1,313	–	–	12,928	–
California	1,602	–	934	2,177	18,463	5,832	18,919	624
Hawaii	313	3	464	281	–	19,823	444,656	463,233
Nevada	–	–	–	292	–	–	68,725	2,588
Oregon	2,938	2,887	7,793	20,116	–	1,252	–	578
Washington	411	154	8,020	7,005	–	17	–	–

See footnotes at end of table.

Table 5. Sales of Residual Fuel Oil by Energy Use, 2001 and 2002 (Continued)

(Thousand Gallons)

Destination	Vessel Bunkering		Military		All Other		Total	
	2001	2002	2001	2002	2001	2002	2001	2002
U.S. Total	**5,409,378**	**4,847,704**	**20,117**	**3,882**	**5,149**	**3,435**	**13,609,379**	**10,361,615**
PAD District 1 Total	**1,699,958**	**1,735,512**	**12,673**	**1,175**	**4,832**	**2,489**	**8,075,116**	**6,185,982**
Subdistrict 1A Total	**46,830**	**51,445**	**2,207**	**254**	**223**	**264**	**1,000,134**	**738,649**
Connecticut	82	–	512	49	223	264	137,975	115,825
Maine	30,004	37,476	1,694	8	–	–	330,486	282,574
Massachusetts	16,743	13,969	–	197	–	–	406,548	227,484
New Hampshire	–	–	–	–	–	–	74,191	73,849
Rhode Island	–	–	–	–	–	–	36,912	27,512
Vermont	–	–	–	–	–	–	14,022	11,405
Subdistrict 1B Total	**1,038,444**	**1,036,387**	**8,947**	**396**	**–**	**–**	**3,165,215**	**2,357,633**
Delaware	75,287	52,593	731	–	–	–	282,257	147,690
District of Columbia	–	–	20	–	–	–	100	–
Maryland	30,940	31,279	4,770	–	–	–	182,087	141,755
New Jersey	605,678	650,531	420	238	–	–	1,028,309	763,051
New York	184,966	172,427	1,996	–	–	–	1,264,449	1,004,662
Pennsylvania	141,573	129,557	1,010	157	–	–	408,013	300,475
Subdistrict 1C Total	**614,684**	**647,680**	**1,519**	**524**	**4,609**	**2,225**	**3,909,767**	**3,089,701**
Florida	494,830	470,387	–	–	4,609	2,225	3,053,010	2,357,450
Georgia	37,895	80,874	–	–	–	–	114,161	166,232
North Carolina	6,090	35,958	–	–	–	–	211,185	178,998
South Carolina	16,293	23,241	–	–	–	–	125,353	90,640
Virginia	59,576	37,220	1,519	524	–	–	392,753	291,290
West Virginia	–	–	–	–	–	–	13,305	5,090
PAD District 2 Total	**30,002**	**31,419**	**7,080**	**2,707**	**203**	**167**	**590,789**	**313,792**
Illinois	813	965	6,995	2,378	–	11	156,406	10,139
Indiana	9,963	11,078	–	–	–	–	47,460	18,832
Iowa	–	–	–	–	7	58	3,260	2,794
Kansas	–	–	85	329	33	9	43,155	36,089
Kentucky	39	70	–	–	–	–	8,685	4,230
Michigan	4,124	2,130	–	–	40	28	96,277	56,854
Minnesota	10,440	11,788	–	–	–	3	67,036	46,736
Missouri	243	459	–	–	17	–	8,228	5,071
Nebraska	–	–	–	–	13	12	7,378	5,571
North Dakota	–	–	–	–	–	–	4,245	4,422
Ohio	3,974	4,617	–	–	76	46	60,417	44,269
Oklahoma	–	–	–	–	17	–	19,910	20,696
South Dakota	–	–	–	–	–	–	6,197	4,676
Tennessee	246	126	–	–	–	–	8,760	6,099
Wisconsin	160	185	–	–	–	–	53,378	47,316
PAD District 3 Total	**1,652,423**	**1,344,372**	**–**	**–**	**92**	**25**	**2,320,598**	**1,580,644**
Alabama	42,025	95,474	–	–	–	–	88,443	179,779
Arkansas	–	–	–	–	–	–	58,291	4,727
Louisiana	597,129	468,698	–	–	–	–	737,008	567,143
Mississippi	75,239	55,179	–	–	–	–	445,207	61,117
New Mexico	–	–	–	–	45	25	5,025	5,920
Texas	938,030	725,022	–	–	46	–	986,624	761,958
PAD District 4 Total	**–**	**–**	**–**	**–**	**23**	**19**	**6,692**	**15,885**
Colorado	–	–	–	–	–	–	238	–
Idaho	–	–	–	–	–	–	1,314	3,608
Montana	–	–	–	–	–	–	145	1,767
Utah	–	–	–	–	–	–	1,059	3,709
Wyoming	–	–	–	–	23	19	3,936	6,801
PAD District 5 Total	**2,026,996**	**1,736,400**	**364**	**–**	**–**	**735**	**2,616,183**	**2,265,312**
Alaska	3,149	2,279	–	–	–	–	4,214	2,279
Arizona	–	–	–	–	–	–	14,519	1,313
California	1,434,934	1,376,071	196	–	–	735	1,475,048	1,385,438
Hawaii	154,769	64,765	168	–	–	–	600,371	548,105
Nevada	–	–	–	–	–	–	68,725	2,881
Oregon	68,571	54,972	–	–	–	–	79,302	79,805
Washington	365,574	238,314	–	–	–	–	374,004	245,491

Dashed (-) = No data reported.
Notes: • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2001-2002.

Table 6. Sales of Kerosene by Energy Use, 2001 and 2002

(Thousand Gallons)

Destination	Residential		Commercial		Industrial	
	2001	2002	2001	2002	2001	2002
U.S. Total	**704,305**	**443,919**	**232,608**	**118,125**	**141,317**	**77,508**
PAD District 1 Total	**582,448**	**365,321**	**194,860**	**94,565**	**56,572**	**33,189**
Subdistrict 1A Total	**116,507**	**71,521**	**30,483**	**17,163**	**6,689**	**1,782**
Connecticut	6,742	3,870	9,684	5,546	2,775	312
Maine	70,328	42,072	6,402	4,721	688	452
Massachusetts	8,269	5,342	6,572	2,459	1,280	244
New Hampshire	14,819	10,992	2,238	1,458	330	300
Rhode Island	2,890	1,421	4,117	2,308	10	5
Vermont	13,459	7,824	1,470	670	1,605	470
Subdistrict 1B Total	**263,226**	**173,882**	**138,781**	**63,384**	**37,188**	**24,709**
Delaware	4,745	2,749	5,339	187	181	11
District of Columbia	4	–	8,705	12	–	–
Maryland	19,761	12,803	14,563	7,194	2,762	1,677
New Jersey	17,203	5,986	52,410	18,983	19,645	12,000
New York	100,395	68,977	36,704	20,717	6,279	8,503
Pennsylvania	121,118	83,366	21,060	16,290	8,321	2,519
Subdistrict 1C Total	**202,715**	**119,918**	**25,596**	**14,018**	**12,695**	**6,698**
Florida	3,833	2,665	1,043	655	4,756	38
Georgia	7,605	3,394	2,571	1,974	940	493
North Carolina	84,907	51,351	8,079	3,978	943	2,416
South Carolina	20,896	12,221	1,680	1,022	3,929	2,458
Virginia	70,602	39,275	9,564	3,688	1,679	1,047
West Virginia	14,873	11,012	2,660	2,701	448	245
PAD District 2 Total	**85,756**	**58,983**	**23,163**	**14,436**	**17,116**	**9,205**
Illinois	5,040	5,981	2,715	1,560	2,087	1,530
Indiana	15,025	11,916	1,828	1,299	1,016	805
Iowa	1,538	932	545	268	197	117
Kansas	603	402	282	229	142	106
Kentucky	11,382	7,118	2,437	1,342	2,183	1,256
Michigan	9,341	6,740	1,460	1,189	1,085	553
Minnesota	7,886	682	1,479	915	117	42
Missouri	3,279	2,137	983	775	455	192
Nebraska	438	127	109	86	31	3
North Dakota	175	87	105	53	16	2
Ohio	18,555	13,808	6,153	3,892	4,319	3,243
Oklahoma	277	641	334	208	1,347	373
South Dakota	153	115	54	82	10	6
Tennessee	10,365	7,046	3,778	1,977	3,752	840
Wisconsin	1,699	1,250	899	560	360	139
PAD District 3 Total	**7,703**	**3,508**	**6,760**	**4,278**	**63,955**	**33,641**
Alabama	1,627	917	1,077	690	431	181
Arkansas	1,014	820	392	172	85	45
Louisiana	1,120	551	674	308	46,033	30,111
Mississippi	1,325	385	426	338	1,111	738
New Mexico	197	108	680	355	136	64
Texas	2,420	728	3,511	2,416	16,159	2,501
PAD District 4 Total	**1,198**	**653**	**980**	**665**	**519**	**263**
Colorado	748	377	431	401	181	60
Idaho	214	111	194	56	15	2
Montana	26	21	1	33	6	3
Utah	131	97	329	148	237	192
Wyoming	79	46	25	26	81	5
PAD District 5 Total	**27,199**	**15,455**	**6,845**	**4,182**	**3,156**	**1,210**
Alaska	670	1	22	9	1	–
Arizona	36	24	135	71	54	23
California	14,701	9,087	2,647	1,147	1,134	308
Hawaii	–	–	3	1	4	3
Nevada	295	289	86	30	16	6
Oregon	7,254	4,602	3,049	1,952	1,392	759
Washington	4,243	1,451	903	972	555	110

See footnotes at end of table.

Table 6. Sales of Kerosene by Energy Use, 2001 and 2002 (Continued)

(Thousand Gallons)

Destination	Farm		All Other		Total	
	2001	2002	2001	2002	2001	2002
U.S. Total	**27,162**	**19,390**	**3,535**	**5,372**	**1,108,926**	**664,314**
PAD District 1 Total	**8,366**	**4,026**	**1,776**	**3,362**	**844,021**	**500,462**
Subdistrict 1A Total	**1,240**	**617**	**495**	**503**	**155,414**	**91,585**
Connecticut	18	5	135	155	19,354	9,887
Maine	638	264	65	23	78,120	47,531
Massachusetts	6	9	71	135	16,198	8,188
New Hampshire	313	206	163	129	17,863	13,085
Rhode Island	–	–	–	19	7,017	3,753
Vermont	266	133	62	42	16,862	9,141
Subdistrict 1B Total	**4,251**	**1,822**	**900**	**1,523**	**444,346**	**265,320**
Delaware	37	20	–	–	10,301	2,968
District of Columbia	–	–	–	–	8,709	12
Maryland	327	194	27	17	37,440	21,885
New Jersey	16	2	6	26	89,280	36,997
New York	827	670	475	831	144,679	99,698
Pennsylvania	3,045	937	392	649	153,936	103,761
Subdistrict 1C Total	**2,875**	**1,587**	**380**	**1,335**	**244,261**	**143,557**
Florida	311	6	8	23	9,952	3,387
Georgia	42	336	6	6	11,164	6,205
North Carolina	484	227	87	487	94,499	58,459
South Carolina	1,217	472	71	431	27,792	16,604
Virginia	781	518	194	384	82,820	44,911
West Virginia	39	29	15	4	18,034	13,991
PAD District 2 Total	**12,502**	**13,238**	**1,137**	**1,010**	**139,675**	**96,872**
Illinois	824	316	110	203	10,777	9,591
Indiana	810	6,354	226	64	18,905	20,437
Iowa	1,536	862	90	29	3,905	2,208
Kansas	673	425	22	133	1,721	1,295
Kentucky	874	473	35	65	16,911	10,254
Michigan	787	234	26	22	12,699	8,739
Minnesota	384	192	108	86	9,975	1,917
Missouri	131	86	138	17	4,986	3,207
Nebraska	257	86	33	3	869	305
North Dakota	33	23	17	6	345	170
Ohio	4,151	3,083	89	44	33,268	24,071
Oklahoma	136	82	53	7	2,148	1,311
South Dakota	81	53	20	1	317	257
Tennessee	138	71	119	62	18,152	9,995
Wisconsin	1,688	896	52	270	4,698	3,114
PAD District 3 Total	**3,848**	**612**	**338**	**349**	**82,605**	**42,388**
Alabama	19	8	–	–	3,154	1,796
Arkansas	690	154	5	15	2,186	1,206
Louisiana	17	6	41	1	47,885	30,977
Mississippi	26	16	1	–	2,889	1,477
New Mexico	102	61	67	140	1,182	728
Texas	2,994	367	224	193	25,308	6,205
PAD District 4 Total	**596**	**525**	**29**	**460**	**3,321**	**2,565**
Colorado	39	108	16	273	1,414	1,220
Idaho	33	17	8	5	464	192
Montana	492	380	–	–	524	437
Utah	30	20	3	8	730	465
Wyoming	1	1	2	173	188	251
PAD District 5 Total	**1,850**	**989**	**255**	**192**	**39,304**	**22,027**
Alaska	–	–	–	–	693	11
Arizona	–	1	5	1	230	119
California	481	285	152	28	19,115	10,855
Hawaii	–	–	–	–	7	5
Nevada	9	1	–	–	407	326
Oregon	933	475	38	63	12,666	7,851
Washington	427	227	59	100	6,187	2,861

Dashed (-) = No data reported.

Notes: • Totals may not equal sum of components due to independent rounding.

Sources: • Kerosene data are based on data from the Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2001-2002 and "Petroleum Supply Annual," Volume 1, 2001-2002, (DOE/EIA-0340(01)/1 - (02)/1).

Table 7. Sales for Residential Use: Distillate Fuel Oil and Kerosene, 2002
(Thousand Gallons)

Destination	Distillate Fuel Oil			Kerosene
	No. 1	No. 2	Total	
U.S. Total	**111,154**	**6,265,498**	**6,376,652**	**443,919**
PAD District 1 Total	**4,403**	**5,544,947**	**5,549,350**	**365,321**
Subdistrict 1A Total	**2,120**	**2,224,459**	**2,226,579**	**71,521**
Connecticut	113	565,571	565,684	3,870
Maine	1,248	290,294	291,542	42,072
Massachusetts	14	953,221	953,235	5,342
New Hampshire	745	179,117	179,862	10,992
Rhode Island	–	144,952	144,952	1,421
Vermont	–	91,304	91,304	7,824
Subdistrict 1B Total	**652**	**2,944,993**	**2,945,645**	**173,882**
Delaware	–	42,754	42,754	2,749
District of Columbia	–	15,199	15,199	–
Maryland	2	190,079	190,081	12,803
New Jersey	–	390,944	390,944	5,986
New York	424	1,420,515	1,420,939	68,977
Pennsylvania	226	885,502	885,728	83,366
Subdistrict 1C Total	**1,631**	**375,495**	**377,126**	**119,918**
Florida	–	4,042	4,042	2,665
Georgia	–	2,376	2,376	3,394
North Carolina	–	121,287	121,287	51,351
South Carolina	49	16,642	16,691	12,221
Virginia	1,126	209,847	210,973	39,275
West Virginia	456	21,301	21,757	11,012
PAD District 2 Total	**65,401**	**528,708**	**594,109**	**58,983**
Illinois	1,488	9,916	11,404	5,981
Indiana	4,894	31,513	36,407	11,916
Iowa	3,525	21,540	25,065	932
Kansas	408	1,141	1,549	402
Kentucky	395	17,111	17,506	7,118
Michigan	8,396	87,174	95,570	6,740
Minnesota	17,969	77,747	95,716	682
Missouri	1,580	10,953	12,533	2,137
Nebraska	876	2,063	2,939	127
North Dakota	3,016	15,318	18,334	87
Ohio	7,190	129,977	137,167	13,808
Oklahoma	46	39	85	641
South Dakota	3,006	8,541	11,547	115
Tennessee	451	4,507	4,958	7,046
Wisconsin	12,158	111,167	123,325	1,250
PAD District 3 Total	**29**	**2,812**	**2,841**	**3,508**
Alabama	2	1,576	1,578	917
Arkansas	1	369	370	820
Louisiana	–	377	377	551
Mississippi	–	46	46	385
New Mexico	26	276	302	108
Texas	–	167	167	728
PAD District 4 Total	**5,234**	**21,126**	**26,360**	**653**
Colorado	124	942	1,066	377
Idaho	3,121	12,019	15,140	111
Montana	1,732	3,558	5,290	21
Utah	155	3,409	3,564	97
Wyoming	102	1,199	1,301	46
PAD District 5 Total	**36,088**	**167,905**	**203,993**	**15,455**
Alaska	29,494	34,902	64,396	1
Arizona	20	386	406	24
California	81	6,257	6,338	9,087
Hawaii	–	13	13	–
Nevada	278	8,702	8,980	289
Oregon	3,082	38,866	41,948	4,602
Washington	3,134	78,780	81,914	1,451

Dashed (-) = No data reported.
Notes: • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2002. • Kerosene data are also based on data from Energy Information Administration's "Petroleum Supply Annual," Volume 1, 2002, (DOE/EIA-0340(02)/1).

Table 8. Sales for Commercial Use: Distillate Fuel Oil, Residual Fuel Oil, and Kerosene, 2002
(Thousand Gallons)

Destination	Distillate Fuel Oil							Residual Fuel Oil	Kerosene
	No. 1 Distillate	No. 2 Distillate				No. 4 Fuel	Total Distillate		
		No. 2 Fuel Oil	Low Sulfur Diesel	High Sulfur Diesel	No. 2 Total				
U.S. Total	**66,278**	**1,432,145**	**1,091,396**	**511,828**	**3,035,369**	**191,740**	**3,293,387**	**572,039**	**118,125**
PAD District 1 Total	**3,936**	**1,265,635**	**408,768**	**272,448**	**1,946,851**	**191,285**	**2,142,071**	**532,346**	**94,565**
Subdistrict 1A Total	**359**	**456,989**	**47,354**	**10,880**	**515,223**	**25,091**	**540,673**	**88,501**	**17,163**
Connecticut	94	97,422	22,130	1,279	120,831	3,719	124,644	14,465	5,546
Maine	70	111,583	2,996	1,860	116,439	1,049	117,558	17,855	4,721
Massachusetts	–	140,222	9,883	1,991	152,096	13,553	165,649	28,946	2,459
New Hampshire	27	56,799	6,238	496	63,533	3,267	66,826	5,558	1,458
Rhode Island	168	23,360	2,607	644	26,610	1,840	28,618	16,235	2,308
Vermont	–	27,604	3,501	4,609	35,715	1,663	37,377	5,442	670
Subdistrict 1B Total	**2,064**	**715,227**	**209,708**	**119,326**	**1,044,261**	**164,674**	**1,210,999**	**433,113**	**63,384**
Delaware	–	8,880	2,892	2,476	14,248	406	14,654	9,648	187
District of Columbia	1	10,665	646	196	11,508	1,269	12,778	–	12
Maryland	52	50,880	21,744	34,314	106,938	951	107,941	2,849	7,194
New Jersey	25	84,197	7,683	8,716	100,596	3,644	104,265	12,574	18,983
New York	816	418,049	59,622	15,780	493,451	155,087	649,354	391,092	20,717
Pennsylvania	1,170	142,557	117,120	57,843	317,520	3,317	322,007	16,950	16,290
Subdistrict 1C Total	**1,512**	**93,418**	**151,705**	**142,243**	**387,366**	**1,521**	**390,399**	**10,733**	**14,018**
Florida	–	3,886	67,671	38,756	110,313	615	110,928	3,199	655
Georgia	42	2,589	25,580	16,134	44,302	–	44,344	–	1,974
North Carolina	6	32,887	22,449	30,507	85,843	188	86,037	3,356	3,978
South Carolina	–	5,040	15,537	8,323	28,900	–	28,900	848	1,022
Virginia	1,238	45,053	15,254	43,989	104,296	596	106,131	3,330	3,688
West Virginia	226	3,962	5,215	4,533	13,711	122	14,060	–	2,701
PAD District 2 Total	**26,294**	**121,810**	**297,960**	**125,065**	**544,835**	**13**	**571,142**	**35,593**	**14,436**
Illinois	5,371	5,651	35,381	24,463	65,495	–	70,866	580	1,560
Indiana	1,896	16,306	31,547	9,809	57,661	–	59,558	30	1,299
Iowa	1,539	8,558	7,572	1,931	18,061	–	19,601	93	268
Kansas	1,961	854	22,386	2,256	25,495	–	27,456	390	229
Kentucky	80	3,626	22,484	19,927	46,037	–	46,117	–	1,342
Michigan	647	8,167	25,033	7,890	41,089	6	41,743	2,888	1,189
Minnesota	3,622	13,445	11,691	6,694	31,830	7	35,459	8,809	915
Missouri	674	8,886	21,870	11,530	42,286	–	42,960	1,350	775
Nebraska	1,190	383	2,259	159	2,801	–	3,991	–	86
North Dakota	947	2,343	2,134	697	5,174	–	6,121	4,251	53
Ohio	2,970	29,573	43,236	21,675	94,484	–	97,454	198	3,892
Oklahoma	1	32	13,865	1,210	15,107	–	15,108	458	208
South Dakota	911	3,112	3,133	602	6,847	–	7,757	14	82
Tennessee	79	1,596	32,124	10,871	44,592	–	44,671	–	1,977
Wisconsin	4,406	19,279	23,244	5,351	47,874	–	52,280	16,531	560
PAD District 3 Total	**546**	**1,506**	**137,396**	**55,213**	**194,115**	**410**	**195,072**	**1,055**	**4,278**
Alabama	–	617	27,239	5,560	33,416	410	33,827	–	690
Arkansas	207	10	11,656	7,411	19,077	–	19,284	–	172
Louisiana	138	70	9,747	6,440	16,257	–	16,395	13	308
Mississippi	–	5	6,442	4,877	11,324	–	11,324	–	338
New Mexico	167	363	10,283	3,386	14,031	–	14,199	–	355
Texas	34	442	72,030	27,538	100,010	–	100,044	1,042	2,416
PAD District 4 Total	**5,799**	**6,963**	**52,350**	**12,812**	**72,125**	**–**	**77,924**	**–**	**665**
Colorado	1,590	831	18,287	757	19,875	–	21,465	–	401
Idaho	646	2,340	6,932	4,271	13,543	–	14,188	–	56
Montana	551	2,793	2,122	470	5,384	–	5,935	–	33
Utah	958	738	15,855	6,559	23,153	–	24,110	–	148
Wyoming	2,055	261	9,154	755	10,170	–	12,225	–	26
PAD District 5 Total	**29,704**	**36,231**	**194,923**	**46,290**	**277,443**	**31**	**307,178**	**3,044**	**4,182**
Alaska	25,483	11,700	2,612	13,689	28,001	28	53,512	–	9
Arizona	69	7	35,777	85	35,869	–	35,937	–	71
California	24	4,017	88,626	1,940	94,583	4	94,610	–	1,147
Hawaii	–	67	8,746	4,584	13,397	–	13,397	3	1
Nevada	886	2,279	12,092	182	14,553	–	15,440	–	30
Oregon	1,068	4,753	23,737	14,810	43,299	–	44,367	2,887	1,952
Washington	2,174	13,409	23,332	11,000	47,741	–	49,915	154	972

Dashed (-) = No data reported.

Notes: • Totals may not equal sum of components due to independent rounding.

Sources: • Energy Information Administration Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2002. • Kerosene data are also based on data from Energy Information Administration's "Petroleum Supply Annual," Volume 1, 2002, (DOE/EIA-0340(02)/1).

Table 9. Sales for Industrial Use: Distillate Fuel Oil, Residual Fuel Oil, and Kerosene, 2002
(Thousand Gallons)

Destination	Distillate Fuel Oil							Residual Fuel Oil	Kerosene
	No. 1 Distillate	No. 2 Distillate				No. 4 Fuel	Total Distillate		
		No. 2 Fuel Oil	Low Sulfur Diesel	High Sulfur Diesel	No. 2 Total				
U.S. Total	**49,712**	**322,541**	**829,028**	**1,150,692**	**2,302,261**	**32,409**	**2,384,383**	**1,250,634**	**77,508**
PAD District 1 Total	**1,046**	**199,862**	**89,802**	**476,970**	**766,634**	**27,477**	**795,157**	**857,039**	**33,189**
Subdistrict 1A Total	**443**	**39,820**	**6,679**	**3,339**	**49,838**	**10,957**	**61,238**	**319,056**	**1,782**
Connecticut	–	9,589	1,358	177	11,124	4,969	16,094	15,056	312
Maine	29	12,209	1,924	758	14,891	1,657	16,577	186,917	452
Massachusetts	14	6,520	1,236	1,612	9,368	1,712	11,094	77,637	244
New Hampshire	400	4,666	1,604	40	6,310	621	7,331	22,239	300
Rhode Island	–	2,923	162	–	3,086	1,101	4,186	11,243	5
Vermont	–	3,913	394	752	5,059	898	5,956	5,963	470
Subdistrict 1B Total	**6**	**87,600**	**22,863**	**83,284**	**193,747**	**13,836**	**207,590**	**145,183**	**24,709**
Delaware	–	1,043	1,552	213	2,809	746	3,554	22,164	11
District of Columbia	–	–	–	–	–	192	192	–	–
Maryland	–	13,754	3,050	9,205	26,009	369	26,378	18,006	1,677
New Jersey	–	17,455	929	1,269	19,652	5,559	25,212	11,317	12,000
New York	–	29,530	4,773	6,729	41,031	4,459	45,491	60,767	8,503
Pennsylvania	6	25,819	12,560	65,867	104,246	2,511	106,763	32,929	2,519
Subdistrict 1C Total	**597**	**72,442**	**60,260**	**390,347**	**523,049**	**2,683**	**526,329**	**392,800**	**6,698**
Florida	44	3,457	17,732	33,132	54,322	782	55,149	69,400	38
Georgia	–	9,320	23,043	41,275	73,638	6	73,644	81,668	493
North Carolina	–	13,592	10,666	25,455	49,713	727	50,440	139,573	2,416
South Carolina	–	6,313	1,127	7,678	15,118	387	15,506	66,418	2,458
Virginia	32	21,150	4,516	62,142	87,807	762	88,602	30,650	1,047
West Virginia	521	18,610	3,176	220,665	242,450	19	242,990	5,090	245
PAD District 2 Total	**18,958**	**110,818**	**204,321**	**362,451**	**677,590**	**3,285**	**699,833**	**159,458**	**9,205**
Illinois	4,231	8,712	22,790	33,723	65,225	20	69,476	3,908	1,530
Indiana	4,499	16,468	32,376	77,306	126,150	643	131,292	7,724	805
Iowa	527	1,916	6,515	1,286	9,716	–	10,243	2,643	117
Kansas	385	480	8,976	3,457	12,913	3	13,301	7,762	106
Kentucky	75	5,928	19,638	120,134	145,700	438	146,214	1,135	1,256
Michigan	1,407	5,255	6,483	12,590	24,328	–	25,735	12,635	553
Minnesota	1,943	20,204	16,526	1,706	38,435	–	40,378	19,704	42
Missouri	1,840	6,042	19,904	21,286	47,232	–	49,072	3,189	192
Nebraska	458	–	1,282	4,026	5,307	–	5,766	5,559	3
North Dakota	733	164	2,837	6,266	9,268	–	10,000	170	2
Ohio	326	21,137	25,424	36,848	83,409	1,711	85,446	34,078	3,243
Oklahoma	49	2,941	5,156	12,228	20,325	–	20,373	19,715	373
South Dakota	438	561	7,828	175	8,565	–	9,003	4,662	6
Tennessee	–	3,937	6,956	16,316	27,210	269	27,478	5,973	840
Wisconsin	2,046	17,074	21,629	15,105	53,807	202	56,056	30,600	139
PAD District 3 Total	**1,976**	**4,749**	**174,990**	**170,226**	**349,965**	**651**	**352,592**	**192,493**	**33,641**
Alabama	–	205	21,174	35,807	57,186	651	57,837	84,306	181
Arkansas	–	135	15,199	10,766	26,100	–	26,100	2,090	45
Louisiana	–	2,916	20,034	51,613	74,564	–	74,564	59,248	30,111
Mississippi	–	–	11,378	20,876	32,254	–	32,254	5,441	738
New Mexico	1,976	1,362	30,893	1,930	34,185	–	36,161	5,896	64
Texas	–	131	76,312	49,234	125,677	–	125,677	35,512	2,501
PAD District 4 Total	**8,820**	**6,498**	**193,882**	**28,208**	**228,588**	**–**	**237,408**	**10,461**	**263**
Colorado	1,525	197	27,197	1,889	29,282	–	30,808	–	60
Idaho	1,285	4,883	6,143	6,782	17,809	–	19,094	3,608	2
Montana	851	167	12,752	8,822	21,741	–	22,592	51	3
Utah	2,056	1,248	25,028	10,618	36,894	–	38,951	397	192
Wyoming	3,102	3	122,762	97	122,862	–	125,964	6,405	5
PAD District 5 Total	**18,912**	**615**	**166,033**	**112,837**	**279,484**	**996**	**299,393**	**31,184**	**1,210**
Alaska	18,649	388	8,098	21,851	30,337	–	48,987	–	–
Arizona	64	–	32,950	40,716	73,666	51	73,780	1,313	23
California	–	152	50,490	1,896	52,537	–	52,537	2,177	308
Hawaii	–	64	1,477	942	2,483	–	2,483	281	3
Nevada	121	–	44,708	14,926	59,634	946	60,700	292	6
Oregon	60	10	13,405	22,120	35,535	–	35,596	20,116	759
Washington	18	–	14,905	10,386	25,292	–	25,310	7,005	110

Dashed (-) = No data reported.
Notes: • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2002. • Kerosene data are also based on data from Energy Information Administration's "Petroleum Supply Annual," Volume 1, 2002, (DOE/EIA-0340(02)/1).

Table 10. Sales for Farm Use: Distillate Fuel Oil and Kerosene; Sales for Electric Power and Oil Company Uses: Distillate Fuel Oil and Residual Fuel Oil, 2002
(Thousand Gallons)

Destination	Farm				Electric Power		Oil Company Use	
	Diesel	Other Distillate	Total Distillate	Kerosene	Distillate Fuel Oil	Residual Fuel Oil	Distillate Fuel Oil	Residual Fuel Oil
U.S. Total	**3,342,918**	**75,534**	**3,418,452**	**19,390**	**750,557**	**3,575,249**	**770,682**	**108,673**
PAD District 1 Total	**450,508**	**44,836**	**495,343**	**4,026**	**345,651**	**2,996,269**	**26,012**	**61,152**
Subdistrict 1A Total	**17,083**	**15,171**	**32,254**	**617**	**8,881**	**277,957**	**40**	**1,172**
Connecticut	2,580	5,380	7,960	5	1,367	85,652	6	339
Maine	3,850	4,238	8,088	264	320	39,914	34	404
Massachusetts	4,830	651	5,482	9	3,405	106,304	–	429
New Hampshire	1,946	3,051	4,997	206	2,185	46,052	–	–
Rhode Island	106	30	136	–	1,191	34	–	–
Vermont	3,771	1,820	5,592	133	414	–	–	–
Subdistrict 1B Total	**89,399**	**22,000**	**111,400**	**1,822**	**129,282**	**683,071**	**19,255**	**59,483**
Delaware	8,320	112	8,432	20	4,456	33,212	11,183	30,073
District of Columbia	–	–	–	–	19,246	–	–	–
Maryland	15,124	191	15,315	194	23,845	89,029	8	591
New Jersey	9,630	519	10,149	2	18,415	86,559	296	1,831
New York	30,170	14,479	44,649	670	10,697	379,756	1	620
Pennsylvania	26,155	6,700	32,855	937	52,622	94,514	7,767	26,368
Subdistrict 1C Total	**344,025**	**7,665**	**351,690**	**1,587**	**207,488**	**2,035,241**	**6,716**	**498**
Florida	132,915	720	133,634	6	125,324	1,812,239	219	–
Georgia	118,586	–	118,586	336	10,335	3,690	90	–
North Carolina	39,574	4,598	44,171	227	31,432	–	276	111
South Carolina	19,526	1,347	20,873	472	14,807	–	603	132
Virginia	31,988	983	32,970	518	10,281	219,312	425	254
West Virginia	1,438	17	1,455	29	15,308	–	5,104	–
PAD District 2 Total	**1,686,421**	**26,412**	**1,712,833**	**13,238**	**143,793**	**69,638**	**47,371**	**14,809**
Illinois	149,199	4,788	153,987	316	8,840	2,298	528	–
Indiana	84,560	2,769	87,329	6,354	15,010	–	66	–
Iowa	226,629	4,289	230,919	862	2,894	–	–	–
Kansas	151,364	231	151,596	425	5,184	27,597	8,844	–
Kentucky	36,061	299	36,361	473	10,319	–	467	3,024
Michigan	47,166	1,371	48,537	234	23,974	36,342	25	2,829
Minnesota	115,933	3,585	119,518	192	5,730	2,251	2	4,180
Missouri	70,103	43	70,146	86	6,910	73	155	–
Nebraska	200,856	366	201,222	86	683	–	–	–
North Dakota	95,704	1,369	97,073	23	1,620	–	3,838	–
Ohio	91,378	778	92,156	3,083	27,126	1,077	1,734	4,253
Oklahoma	64,083	533	64,616	82	10,348	–	31,621	522
South Dakota	55,672	1,062	56,734	53	701	–	12	–
Tennessee	31,352	61	31,413	71	18,185	–	–	–
Wisconsin	266,359	4,865	271,224	896	6,269	–	80	–
PAD District 3 Total	**536,855**	**850**	**537,705**	**612**	**73,061**	**42,318**	**620,054**	**382**
Alabama	21,183	112	21,295	8	3,005	–	245	–
Arkansas	112,038	501	112,539	154	5,344	2,637	1,427	–
Louisiana	70,195	–	70,195	6	8,390	39,184	338,520	–
Mississippi	64,802	220	65,022	16	1,317	497	8,830	–
New Mexico	15,727	18	15,745	61	2,785	–	20,613	–
Texas	252,909	–	252,909	367	52,221	–	250,419	382
PAD District 4 Total	**167,511**	**3,241**	**170,752**	**525**	**6,923**	**–**	**21,690**	**5,405**
Colorado	43,937	2,409	46,346	108	1,868	–	4,482	–
Idaho	60,346	271	60,617	17	19	–	–	–
Montana	38,181	468	38,649	380	–	–	1,268	1,716
Utah	12,323	39	12,362	20	1,896	–	771	3,312
Wyoming	12,724	53	12,778	1	3,140	–	15,169	377
PAD District 5 Total	**501,623**	**197**	**501,820**	**989**	**181,128**	**467,024**	**55,555**	**26,925**
Alaska	16	–	16	–	49,676	–	38,615	–
Arizona	38,030	–	38,030	1	4,988	–	378	–
California	360,335	9	360,343	285	6,915	624	12,618	5,832
Hawaii	9,526	–	9,526	–	112,254	463,233	4	19,823
Nevada	5,473	1	5,475	1	2,001	2,588	1,099	–
Oregon	51,608	186	51,794	475	4,807	578	2,057	1,252
Washington	36,635	–	36,635	227	488	–	785	17

Dashed (-) = No data reported.
Notes: • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2002. • Kerosene data are also based on data from Energy Information Administration's "Petroleum Supply Annual," Volume 1, 2002, (DOE/EIA-0340(02)/1).

Table 11. Sales for Transportation Use: Distillate Fuel Oil and Residual Fuel Oil, 2002
(Thousand Gallons)

Destination	Railroad Use	Vessel Bunkering		On-Highway Diesel	Total Transportation Use	
	Distillate Fuel Oil	Distillate Fuel Oil	Residual Fuel Oil	Distillate Fuel Oil	Distillate Fuel Oil	Residual Fuel Oil
U.S. Total	**3,245,482**	**2,078,921**	**4,847,704**	**34,308,885**	**39,633,288**	**4,847,704**
PAD District 1 Total	**547,030**	**481,186**	**1,735,512**	**10,373,983**	**11,402,199**	**1,735,512**
Subdistrict 1A Total	**18,360**	**60,636**	**51,445**	**1,077,477**	**1,156,473**	**51,445**
Connecticut	5,123	2,589	–	228,081	235,793	–
Maine	360	9,257	37,476	167,632	177,248	37,476
Massachusetts	12,757	38,573	13,969	398,217	449,547	13,969
New Hampshire	98	363	–	164,623	165,084	–
Rhode Island	–	9,002	–	54,785	63,787	–
Vermont	23	853	–	64,139	65,016	–
Subdistrict 1B Total	**160,288**	**131,213**	**1,036,387**	**3,785,263**	**4,076,764**	**1,036,387**
Delaware	896	634	52,593	62,154	63,684	52,593
District of Columbia	4,680	286	–	27,049	32,015	–
Maryland	1,337	12,020	31,279	501,802	515,159	31,279
New Jersey	31,802	85,235	650,531	833,183	950,220	650,531
New York	20,300	9,567	172,427	988,428	1,018,295	172,427
Pennsylvania	101,273	23,471	129,557	1,372,647	1,497,390	129,557
Subdistrict 1C Total	**368,382**	**289,337**	**647,680**	**5,511,243**	**6,168,962**	**647,680**
Florida	78,074	153,315	470,387	1,344,310	1,575,700	470,387
Georgia	122,300	23,841	80,874	1,313,424	1,459,566	80,874
North Carolina	88,461	10,739	35,958	976,151	1,075,351	35,958
South Carolina	12,646	21,123	23,241	634,567	668,336	23,241
Virginia	56,308	30,150	37,220	973,906	1,060,364	37,220
West Virginia	10,593	50,167	–	268,885	329,645	–
PAD District 2 Total	**1,227,782**	**313,245**	**31,419**	**11,548,458**	**13,089,484**	**31,419**
Illinois	117,340	51,965	965	1,137,642	1,306,947	965
Indiana	88,502	9,400	11,078	1,354,201	1,452,103	11,078
Iowa	22,255	3,574	–	504,461	530,290	–
Kansas	72,082	1,428	–	405,689	479,199	–
Kentucky	101,007	62,655	70	991,256	1,154,918	70
Michigan	26,776	5,515	2,130	939,587	971,877	2,130
Minnesota	58,524	4,181	11,788	649,613	712,318	11,788
Missouri	22,439	33,602	459	946,940	1,002,981	459
Nebraska	2,781	–	–	373,857	376,638	–
North Dakota	51,746	–	–	152,301	204,047	–
Ohio	185,793	5,690	4,617	1,498,239	1,689,721	4,617
Oklahoma	342,948	190	–	819,929	1,163,067	–
South Dakota	4,792	–	–	191,656	196,448	–
Tennessee	90,602	125,340	126	903,682	1,119,624	126
Wisconsin	40,196	9,704	185	679,405	729,305	185
PAD District 3 Total	**762,793**	**943,474**	**1,344,372**	**5,945,268**	**7,651,535**	**1,344,372**
Alabama	53,202	65,786	95,474	667,844	786,832	95,474
Arkansas	114,146	804	–	610,663	725,613	–
Louisiana	46,931	546,297	468,698	615,227	1,208,455	468,698
Mississippi	16,913	61,545	55,179	538,079	616,537	55,179
New Mexico	8,982	–	–	419,853	428,835	–
Texas	522,619	269,043	725,022	3,093,602	3,885,264	725,022
PAD District 4 Total	**243,345**	**23**	**–**	**1,632,707**	**1,876,075**	**–**
Colorado	38,399	11	–	544,627	583,037	–
Idaho	24,390	12	–	223,184	247,586	–
Montana	58,404	–	–	201,566	259,970	–
Utah	31,095	–	–	353,215	384,310	–
Wyoming	91,057	–	–	310,115	401,172	–
PAD District 5 Total	**464,532**	**340,993**	**1,736,400**	**4,808,469**	**5,613,995**	**1,736,400**
Alaska	5,831	102,192	2,279	108,777	216,799	2,279
Arizona	15,353	–	–	642,850	658,203	–
California	296,168	68,957	1,376,071	2,703,680	3,068,805	1,376,071
Hawaii	–	92,960	64,765	38,122	131,082	64,765
Nevada	9,101	3	–	286,639	295,744	–
Oregon	76,495	15,836	54,972	458,057	550,389	54,972
Washington	61,584	61,045	238,314	570,344	692,973	238,314

Dashed (-) = No data reported.
Notes: • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2002. • On-Highway Diesel data are Federal Highway Administration statistics of highway special fuels use.

Table 12. Sales for Military, Off-Highway, and All Other Uses: Distillate Fuel Oil, Residual Fuel Oil, and Kerosene, 2002
(Thousand Gallons)

Destination	Military				Off-Highway Distillate Fuel Oil			All Other	
	Diesel	Other Distillate	Total Distillate	Residual Fuel Oil	Construction	Other	Total	Residual Fuel Oil	Kerosene
U.S. Total	**327,804**	**29,555**	**357,359**	**3,882**	**1,934,793**	**423,079**	**2,357,872**	**3,435**	**5,372**
PAD District 1 Total	**47,394**	**20,548**	**67,941**	**1,175**	**572,878**	**124,638**	**697,516**	**2,489**	**3,362**
Subdistrict 1A Total	**4,297**	**5,736**	**10,033**	**254**	**58,137**	**10,422**	**68,559**	**264**	**503**
Connecticut	280	567	848	49	12,148	407	12,556	264	155
Maine	2,341	3,077	5,418	8	9,376	1,279	10,655	–	23
Massachusetts	568	494	1,062	197	22,338	3,321	25,659	–	135
New Hampshire	755	1,344	2,099	–	10,507	3,920	14,427	–	129
Rhode Island	30	2	32	–	2,217	1	2,218	–	19
Vermont	323	253	575	–	1,550	1,494	3,044	–	42
Subdistrict 1B Total	**12,404**	**10,043**	**22,447**	**396**	**193,176**	**19,034**	**212,210**	**–**	**1,523**
Delaware	207	187	394	–	3,129	204	3,333	–	–
District of Columbia	1,516	752	2,268	–	2,801	–	2,801	–	–
Maryland	5,010	2,712	7,721	–	32,344	2,281	34,626	–	17
New Jersey	1,067	759	1,826	238	47,693	9,486	57,178	–	26
New York	1,140	1,820	2,961	–	31,365	3,306	34,671	–	831
Pennsylvania	3,464	3,813	7,278	157	75,844	3,757	79,601	–	649
Subdistrict 1C Total	**30,692**	**4,769**	**35,461**	**524**	**321,565**	**95,182**	**416,748**	**2,225**	**1,335**
Florida	5,787	–	5,787	–	107,920	10,443	118,363	2,225	23
Georgia	3,451	15	3,466	–	64,465	26,425	90,890	–	6
North Carolina	3,459	3,805	7,263	–	37,823	14,641	52,463	–	487
South Carolina	1,509	611	2,120	–	39,002	24,813	63,815	–	431
Virginia	16,326	248	16,573	524	62,033	13,382	75,415	–	384
West Virginia	161	91	252	–	10,323	5,478	15,801	–	4
PAD District 2 Total	**8,314**	**1,624**	**9,938**	**2,707**	**549,048**	**76,455**	**625,502**	**167**	**1,010**
Illinois	481	1	482	2,378	91,117	4,322	95,439	11	203
Indiana	55	–	55	–	35,762	4,803	40,565	–	64
Iowa	2,168	47	2,215	–	24,720	2,357	27,076	58	29
Kansas	190	1	190	329	17,016	2,324	19,340	9	133
Kentucky	864	226	1,090	–	38,550	5,298	43,848	–	65
Michigan	720	–	720	–	41,175	4,048	45,223	28	22
Minnesota	246	–	246	–	39,253	17,265	56,518	3	86
Missouri	1,122	232	1,354	–	72,230	8,270	80,500	–	17
Nebraska	7	–	7	–	7,404	2,214	9,618	12	3
North Dakota	395	–	395	–	10,965	752	11,718	–	6
Ohio	1,073	601	1,674	–	51,354	4,783	56,137	46	44
Oklahoma	–	–	–	–	30,244	2,579	32,823	–	7
South Dakota	153	3	156	–	9,262	1,694	10,957	–	1
Tennessee	136	19	155	–	28,642	8,238	36,880	–	62
Wisconsin	705	495	1,200	–	51,354	7,508	58,863	–	270
PAD District 3 Total	**84,351**	**–**	**84,351**	**–**	**345,505**	**115,768**	**461,273**	**25**	**349**
Alabama	1,948	–	1,948	–	32,107	30,236	62,343	–	–
Arkansas	601	–	601	–	20,844	26,864	47,707	–	15
Louisiana	1,387	–	1,387	–	51,950	14,625	66,575	–	1
Mississippi	7,089	–	7,089	–	28,986	15,979	44,965	–	–
New Mexico	37	–	37	–	14,147	3,104	17,251	25	140
Texas	73,288	–	73,288	–	197,471	24,961	222,432	–	193
PAD District 4 Total	**5,847**	**8**	**5,856**	**–**	**130,619**	**23,488**	**154,107**	**19**	**460**
Colorado	388	8	396	–	61,573	756	62,329	–	273
Idaho	4,168	–	4,168	–	11,892	11,486	23,377	–	5
Montana	10	–	10	–	9,920	7,132	17,053	–	–
Utah	1,279	–	1,279	–	24,332	2,160	26,492	–	8
Wyoming	2	–	2	–	22,902	1,953	24,855	19	173
PAD District 5 Total	**181,899**	**7,375**	**189,274**	**–**	**336,743**	**82,731**	**419,474**	**735**	**192**
Alaska	7,625	–	7,625	–	10,710	2,639	13,349	–	–
Arizona	12	–	12	–	46,496	3,320	49,816	–	1
California	57,735	–	57,735	–	178,366	28,722	207,088	735	28
Hawaii	12,731	–	12,731	–	7,834	–	7,834	–	–
Nevada	580	–	580	–	27,429	811	28,240	–	–
Oregon	2,577	20	2,597	–	21,500	16,436	37,936	–	63
Washington	100,640	7,355	107,995	–	44,409	30,802	75,211	–	100

Dashed (-) = No data reported.
Notes: • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2002. • Kerosene data are also based on data from Energy Information Administration's "Petroleum Supply Annual," Volume 1, 2002, (DOE/EIA-0340(02)/1).

Adjusted Sales of Fuel Oil and Kerosene in 2002

Tables 13 through 24 contain estimates of distillate fuel oil that have been adjusted at the PAD district level to equal published EIA volume estimates of petroleum products supplied in the U.S. Marketplace. The kerosene and residual fuel oil sales estimates have been adjusted at the nation level. The products supplied estimates can be found in the 1998 through 2002 issues of the *Petroleum Supply Annual, Volume 1 (PSA)*. In addition, electric power generation data and on-highway diesel data are used in lieu of adjusted survey results. See "Technical Note 3" in Appendix A for further explanation of data adjustments.

NOTE: The 2001 adjusted numbers have been revised since they were first published in the Fuel *Oil and Kerosene Sales 2001*. The revisions to the data were made to include new distillate and residual volumes for "Electric Power" and a new residual fuel oil product supplied number. In 2001, the Electric Power division began to revise their data collection process to include nonutility information. When we originally published the *Fuel Oil and Kerosene Sales 2001*, the "Electric Power" information was still being collected and verified. The residual fuel oil product supplied number was revised to include new export and import information. The 2002 PSA explains the revision within the Front Matter section in more detail. This information can be found on the EIA's WEB page or use the url:

http://www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/petroleum_supply_annual/psa_volume1/current/pdf/volume1_front_matter.pdf.

Table 13. Adjusted Sales of Distillate Fuel Oil by Energy Use in the United States: 1998-2002
(Thousand Gallons)

Energy Use	Distillate Fuel Oil				
	1998	1999	2000	2001	2002
U.S. Total	**53,063,934**	**54,758,718**	**57,217,230**	**58,971,486**	**57,884,652**
Residential	5,633,409	5,847,762	6,123,946	R6,275,678	5,928,071
Commercial	3,044,495	3,003,653	3,324,687	R3,512,488	3,065,777
Industrial	2,258,248	2,170,075	2,117,531	R2,329,029	2,238,458
Oil Company	565,174	576,997	671,170	R822,797	825,464
Farm	3,033,405	2,899,222	3,122,416	R3,434,936	3,179,309
Electric Power	962,921	912,807	1,139,740	R1,455,075	633,714
Railroad	2,833,276	2,789,926	3,026,147	R2,958,815	3,080,831
Vessel Bunkering	2,125,568	2,064,590	2,041,433	R2,099,011	2,069,514
On-Highway Diesel	30,150,191	32,062,447	33,129,664	33,215,320	34,308,885
Military	277,688	288,926	227,998	R347,220	330,542
Off-Highway Diesel	2,179,560	2,142,313	2,292,498	R2,521,118	2,224,086

R = Revised.

Notes: • See Technical Note 3 for further explanations on 2001 revised data and adjustments. • Distillate fuel oil data in the Adjusted Sales tables (13-24) are adjusted at the PAD District level. • Totals may not equal sum of components due to independent rounding.

Note: Distillate fuel oil data in the Adjusted Sales tables (13-24) are adjusted at the PAD District level. See Technical Note 3 for further explanation.

Sources: • Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 1998-2002 and "Petroleum Supply Annual," Volume 1, 1998-2002, (DOE/EIA-0340(98)/1 - (02)/1). • See Technical Note 3 for further explanation of Electric Power. • On-Highway Diesel data are Federal Highway Administration statistics of highway special fuels use.

Table 14. Adjusted Sales of Residual Fuel Oil by Energy Use in the United States: 1998-2002
(Thousand Gallons)

Energy Use	Residual Fuel Oil				
	1998	1999	2000	2001	2002
U.S. Total	**13,599,558**	**12,725,916**	**13,966,134**	**R13,508,460**	**10,724,994**
Commercial	590,388	619,429	641,810	R520,335	560,137
Industrial	1,484,331	1,630,313	1,531,336	R1,403,638	1,224,614
Oil Company	105,233	118,898	148,311	R106,176	106,412
Electric Power	6,748,744	4,729,990	5,418,215	R7,112,731	4,079,824
Vessel Bunkering	4,640,153	5,598,630	6,192,294	R4,345,284	4,746,843
Military	27,779	24,647	27,462	R16,160	3,801
All Other	2,930	4,009	6,706	R4,136	3,363

R = Revised.

Notes: • See "Technical Note 3" for further explanations on 2001 revised data and adjustments. • Residual fuel oil data in the Adjusted Sales tables (13-24) are adjusted at the national level. • Totals may not equal sum of components due to independent rounding.

Sources: • Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 1998-2002 and "Petroleum Supply Annual," Volume 1, 1998-2002, (DOE/EIA-0340(98)/1 - (02)/1). • See Technical Note 3 for further explanation of Electric Power.

Table 15. Adjusted Sales of Kerosene by Energy Use in the United States: 1998-2002
(Thousand Gallons)

Energy Use	Kerosene				
	1998	1999	2000	2001	2002
U.S. Total	**1,196,580**	**1,118,124**	**1,036,014**	**1,108,926**	**664,314**
Residential	802,348	823,436	700,532	704,305	443,919
Commercial	230,743	199,577	219,633	232,608	118,125
Industrial	123,246	58,279	86,844	141,317	77,508
Farm	26,823	26,312	23,084	27,162	19,390
All Other	13,420	10,521	5,921	3,535	5,372

Notes: • See Technical Note 3 for further explanation on adjustments. • Kerosene data in the Adjusted Sales tables (13-24) are adjusted at the national level. • Totals may not equal sum of components due to independent rounding.

Sources: • Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 1998-2002 and "Petroleum Supply Annual," Volume 1, 1998-2002, (DOE/EIA-0340(98)/1 - (02)/1).

Table 16. Adjusted Sales of Distillate Fuel Oil by Energy Use, 2001 and 2002

(Thousand Gallons)

Destination	Residential		Commercial		Industrial	
	[R]2001	2002	[R]2001	2002	[R]2001	2002
U.S. Total	**6,275,678**	**5,928,071**	**3,512,488**	**3,065,777**	**2,329,029**	**2,238,458**
PAD District 1 Total	**5,479,535**	**5,196,873**	**2,227,698**	**2,006,014**	**761,542**	**744,651**
Subdistrict 1A Total	**2,148,315**	**2,085,154**	**547,583**	**506,331**	**78,240**	**57,348**
Connecticut	550,854	529,753	137,823	116,727	23,495	15,072
Maine	277,402	273,024	101,901	110,091	14,628	15,524
Massachusetts	902,769	892,689	170,800	155,128	24,325	10,389
New Hampshire	183,148	168,438	70,688	62,582	7,311	6,865
Rhode Island	144,259	135,745	25,509	26,800	2,984	3,920
Vermont	89,882	85,505	40,862	35,003	5,497	5,578
Subdistrict 1B Total	**2,949,473**	**2,758,547**	**1,199,106**	**1,134,080**	**233,685**	**194,404**
Delaware	40,658	40,038	12,283	13,724	3,366	3,328
District of Columbia	8,062	14,234	21,925	11,966	249	180
Maryland	194,281	178,007	101,764	101,085	27,585	24,702
New Jersey	383,446	366,112	137,438	97,642	38,195	23,610
New York	1,478,178	1,330,685	682,961	608,109	43,764	42,601
Pennsylvania	844,849	829,470	242,735	301,554	120,526	99,982
Subdistrict 1C Total	**381,747**	**353,172**	**481,008**	**365,602**	**449,617**	**492,898**
Florida	4,922	3,785	122,968	103,882	70,710	51,646
Georgia	2,462	2,225	65,251	41,527	72,564	68,966
North Carolina	126,275	113,584	125,365	80,572	77,699	47,236
South Carolina	16,983	15,631	31,147	27,064	30,508	14,521
Virginia	210,044	197,573	119,836	99,390	94,495	82,974
West Virginia	21,060	20,375	16,441	13,167	103,641	227,556
PAD District 2 Total	**619,264**	**532,602**	**669,866**	**512,013**	**698,692**	**627,381**
Illinois	13,581	10,224	77,140	63,529	75,494	62,283
Indiana	33,104	32,638	66,967	53,392	132,673	117,699
Iowa	17,621	22,470	23,107	17,571	16,462	9,183
Kansas	1,889	1,388	34,277	24,614	18,763	11,924
Kentucky	19,392	15,694	47,706	41,343	135,025	131,077
Michigan	112,784	85,676	64,798	37,421	33,326	23,070
Minnesota	97,208	85,807	48,172	31,788	29,438	36,198
Missouri	17,174	11,235	66,217	38,513	40,270	43,992
Nebraska	3,451	2,635	10,330	3,578	4,020	5,169
North Dakota	20,891	16,436	11,116	5,487	12,625	8,965
Ohio	117,469	122,967	80,130	87,365	79,968	76,600
Oklahoma	108	76	28,581	13,544	20,188	18,264
South Dakota	15,564	10,351	10,677	6,954	7,357	8,071
Tennessee	7,058	4,445	39,751	40,046	34,784	24,633
Wisconsin	141,970	110,558	60,896	46,868	58,300	50,253
PAD District 3 Total	**2,579**	**3,170**	**299,198**	**217,649**	**414,085**	**393,400**
Alabama	1,923	1,761	41,632	37,742	64,342	64,531
Arkansas	41	414	29,512	21,516	17,776	29,120
Louisiana	73	420	13,766	18,293	81,692	83,193
Mississippi	270	51	16,493	12,634	46,953	35,987
New Mexico	227	337	17,402	15,842	36,995	40,346
Texas	46	187	180,392	111,623	166,328	140,223
PAD District 4 Total	**27,013**	**24,700**	**88,321**	**73,016**	**206,489**	**222,456**
Colorado	2,144	999	24,156	20,113	23,310	28,868
Idaho	13,959	14,186	14,194	13,295	23,390	17,892
Montana	6,494	4,957	7,514	5,561	18,355	21,169
Utah	3,468	3,340	26,588	22,592	29,457	36,498
Wyoming	947	1,218	15,869	11,455	111,976	118,031
PAD District 5 Total	**147,287**	**170,727**	**227,405**	**257,084**	**248,221**	**250,569**
Alaska	50,763	53,894	46,925	44,785	26,654	40,998
Arizona	181	339	21,316	30,077	62,340	61,748
California	8,169	5,305	79,000	79,182	50,022	43,970
Hawaii	8	11	3,794	11,212	2,427	2,078
Nevada	6,081	7,515	9,339	12,922	45,552	50,801
Oregon	29,305	35,107	33,519	37,132	33,748	29,791
Washington	52,779	68,556	33,512	41,775	27,478	21,182

See footnotes at end of table.

Table 16. Adjusted Sales of Distillate Fuel Oil by Energy Use, 2001 and 2002 (Continued)

(Thousand Gallons)

Destination	Oil Company		Farm		Electric Power	
	R2001	2002	R2001	2002	R2001	2002
U.S. Total	**822,797**	**825,464**	**3,434,936**	**3,179,309**	**1,455,075**	**633,714**
PAD District 1 Total	**21,494**	**24,359**	**488,899**	**463,881**	**543,269**	**291,842**
Subdistrict 1A Total	**187**	**38**	**27,394**	**30,205**	**19,088**	**7,499**
Connecticut	8	6	6,061	7,454	2,279	1,154
Maine	–	32	6,757	7,574	41	270
Massachusetts	179	–	3,439	5,134	10,074	2,875
New Hampshire	–	–	4,705	4,680	2,383	1,845
Rhode Island	–	–	57	127	2,706	1,005
Vermont	–	–	6,375	5,237	1,604	349
Subdistrict 1B Total	**13,986**	**18,032**	**107,779**	**104,324**	**141,492**	**109,156**
Delaware	8,681	10,473	6,841	7,896	5,816	3,762
District of Columbia	–	–	–	–	18,847	16,250
Maryland	58	7	19,642	14,342	61,359	20,133
New Jersey	172	277	11,043	9,505	5,869	15,548
New York	88	1	38,527	41,813	18,261	9,032
Pennsylvania	4,986	7,274	31,726	30,768	31,339	44,430
Subdistrict 1C Total	**7,321**	**6,290**	**353,727**	**329,352**	**382,689**	**175,188**
Florida	199	205	118,029	125,146	166,746	105,814
Georgia	921	84	135,701	111,054	34,686	8,726
North Carolina	1	259	43,049	41,366	52,671	26,539
South Carolina	–	564	20,756	19,547	32,649	12,502
Virginia	207	398	33,622	30,876	77,582	8,681
West Virginia	5,993	4,780	2,569	1,362	18,356	12,925
PAD District 2 Total	**52,636**	**42,467**	**1,796,630**	**1,535,508**	**245,714**	**121,408**
Illinois	375	473	154,876	138,046	17,711	7,464
Indiana	66	59	90,104	78,288	34,328	12,673
Iowa	–	–	235,674	207,012	7,321	2,443
Kansas	6,297	7,928	157,967	135,901	11,086	4,377
Kentucky	997	419	37,281	32,596	6,561	8,712
Michigan	26	22	53,287	43,512	34,605	20,242
Minnesota	–	2	138,671	107,145	15,251	4,838
Missouri	74	139	62,975	62,884	15,249	5,835
Nebraska	–	–	196,295	180,390	3,068	577
North Dakota	5,940	3,441	114,784	87,024	1,718	1,368
Ohio	1,920	1,554	84,228	82,616	38,696	22,903
Oklahoma	36,860	28,348	63,924	57,927	11,335	8,737
South Dakota	72	11	67,370	50,861	1,193	592
Tennessee	9	–	35,739	28,161	39,170	15,354
Wisconsin	–	72	303,454	243,145	8,421	5,293
PAD District 3 Total	**690,085**	**691,818**	**629,330**	**599,938**	**394,062**	**61,688**
Alabama	78	274	25,685	23,760	23,533	2,537
Arkansas	2,307	1,592	136,532	125,564	5,147	4,512
Louisiana	360,158	377,699	77,164	78,319	31,083	7,084
Mississippi	5,216	9,853	83,714	72,548	3,144	1,112
New Mexico	29,853	22,999	20,993	17,567	3,489	2,351
Texas	292,472	279,402	285,244	282,180	327,665	44,091
PAD District 4 Total	**20,475**	**20,324**	**159,803**	**159,998**	**23,021**	**5,846**
Colorado	4,305	4,199	41,583	43,427	14,553	1,577
Idaho	–	–	52,948	56,799	485	16
Montana	2,879	1,189	36,964	36,215	538	–
Utah	246	722	13,600	11,584	2,459	1,601
Wyoming	13,036	14,214	14,709	11,973	4,986	2,651
PAD District 5 Total	**38,106**	**46,495**	**360,274**	**419,985**	**249,010**	**152,931**
Alaska	27,149	32,318	8	13	61,383	41,943
Arizona	115	316	23,532	31,829	23,626	4,212
California	7,963	10,560	262,592	301,580	24,752	5,839
Hawaii	60	3	6,994	7,973	113,266	94,779
Nevada	26	919	3,968	4,582	1,020	1,689
Oregon	219	1,721	30,875	43,348	12,917	4,059
Washington	2,574	657	32,305	30,661	12,045	412

See footnotes at end of table.

Table 16. Adjusted Sales of Distillate Fuel Oil by Energy Use, 2001 and 2002 (Continued)

(Thousand Gallons)

Destination	Railroad		Vessel Bunkering		On-Highway	
	R2001	2002	R2001	2002	2001	2002
U.S. Total	**2,958,815**	**3,080,831**	**2,099,011**	**2,069,514**	**33,215,320**	**34,308,885**
PAD District 1 Total	**507,365**	**512,284**	**462,349**	**450,623**	**10,283,551**	**10,373,983**
Subdistrict 1A Total	**27,773**	**17,194**	**40,657**	**56,785**	**1,054,431**	**1,077,477**
Connecticut	5,533	4,797	2,697	2,425	271,949	228,081
Maine	466	337	10,310	8,669	157,265	167,632
Massachusetts	20,612	11,947	22,392	36,123	400,652	398,217
New Hampshire	30	91	347	340	99,664	164,623
Rhode Island	43	–	4,298	8,430	54,843	54,785
Vermont	1,089	22	612	799	70,058	64,139
Subdistrict 1B Total	**137,676**	**150,107**	**144,508**	**122,879**	**3,757,549**	**3,785,263**
Delaware	234	839	1,158	594	56,556	62,154
District of Columbia	4,142	4,383	10	268	27,358	27,049
Maryland	3,534	1,252	23,264	11,257	499,563	501,802
New Jersey	13,557	29,782	82,568	79,821	833,297	833,183
New York	25,962	19,011	15,032	8,959	956,982	988,428
Pennsylvania	90,247	94,840	22,477	21,980	1,383,793	1,372,647
Subdistrict 1C Total	**341,917**	**344,984**	**277,184**	**270,959**	**5,471,571**	**5,511,243**
Florida	107,290	73,115	138,453	143,577	1,284,054	1,344,310
Georgia	70,674	114,532	23,365	22,327	1,406,878	1,313,424
North Carolina	77,911	82,842	13,104	10,057	954,529	976,151
South Carolina	15,967	11,843	14,889	19,782	618,958	634,567
Virginia	61,272	52,732	27,885	28,235	936,738	973,906
West Virginia	8,803	9,920	59,489	46,981	270,414	268,885
PAD District 2 Total	**1,053,615**	**1,100,673**	**318,130**	**280,815**	**10,946,605**	**11,548,458**
Illinois	74,416	105,192	53,658	46,586	1,242,862	1,137,642
Indiana	24,559	79,340	19,050	8,427	976,154	1,354,201
Iowa	15,538	19,951	5,592	3,204	494,746	504,461
Kansas	36,037	64,619	784	1,280	366,378	405,689
Kentucky	99,969	90,550	90,084	56,169	813,305	991,256
Michigan	10,429	24,004	4,161	4,944	898,950	939,587
Minnesota	53,881	52,465	4,424	3,748	629,517	649,613
Missouri	23,686	20,116	64,423	30,123	911,037	946,940
Nebraska	2,519	2,493	–	–	365,060	373,857
North Dakota	46,907	46,389	–	–	149,766	152,301
Ohio	168,220	166,558	3,638	5,101	1,468,979	1,498,239
Oklahoma	354,919	307,443	159	170	947,603	819,929
South Dakota	5,073	4,296	–	–	148,841	191,656
Tennessee	91,508	81,222	62,207	112,364	867,065	903,682
Wisconsin	45,954	36,035	9,950	8,699	666,342	679,405
PAD District 3 Total	**886,021**	**851,077**	**1,156,237**	**1,052,670**	**5,743,372**	**5,945,268**
Alabama	55,951	59,360	77,971	73,400	680,321	667,844
Arkansas	99,176	127,357	298	897	580,583	610,663
Louisiana	61,188	52,363	697,715	609,524	599,491	615,227
Mississippi	24,889	18,870	21,645	68,668	503,217	538,079
New Mexico	18,134	10,021	1	–	402,953	419,853
Texas	626,684	583,106	358,607	300,181	2,976,807	3,093,602
PAD District 4 Total	**222,735**	**228,020**	**38**	**21**	**1,569,650**	**1,632,707**
Colorado	39,800	35,981	–	10	510,659	544,627
Idaho	23,985	22,854	38	11	218,109	223,184
Montana	59,763	54,726	–	–	197,340	201,566
Utah	24,222	29,136	–	–	336,377	353,215
Wyoming	74,965	85,323	–	–	307,165	310,115
PAD District 5 Total	**289,078**	**388,778**	**162,257**	**285,385**	**4,672,142**	**4,808,469**
Alaska	4,367	4,880	67,380	85,527	111,433	108,777
Arizona	5,029	12,850	–	–	675,847	642,850
California	184,232	247,870	51,775	57,712	2,627,366	2,703,680
Hawaii	–	–	20,472	77,800	32,754	38,122
Nevada	6,066	7,617	–	3	267,368	286,639
Oregon	53,312	64,021	8,445	13,254	414,373	458,057
Washington	36,072	51,541	14,185	51,090	543,001	570,344

See footnotes at end of table.

Table 16. Adjusted Sales of Distillate Fuel Oil by Energy Use, 2001 and 2002 (Continued)

(Thousand Gallons)

Destination	Military		Off-Highway		Total	
	R2001	2002	R2001	2002	R2001	2002
U.S. Total	**347,220**	**330,542**	**2,521,118**	**2,224,086**	**58,971,486**	**57,884,652**
PAD District 1 Total	**72,210**	**63,626**	**700,901**	**653,212**	**21,548,814**	**20,781,348**
Subdistrict 1A Total	**13,495**	**9,396**	**65,331**	**64,204**	**4,022,494**	**3,911,630**
Connecticut	3,876	794	11,966	11,758	1,016,542	918,021
Maine	6,896	5,074	10,917	9,978	586,584	598,204
Massachusetts	544	994	23,997	24,030	1,579,782	1,537,524
New Hampshire	2,037	1,965	13,696	13,511	384,008	424,941
Rhode Island	18	30	1,814	2,077	236,532	232,920
Vermont	125	539	2,941	2,851	219,046	200,022
Subdistrict 1B Total	**19,119**	**21,021**	**226,804**	**198,731**	**8,931,178**	**8,596,544**
Delaware	876	369	5,260	3,121	141,728	146,299
District of Columbia	3,518	2,124	1,206	2,623	85,317	79,077
Maryland	5,060	7,231	47,225	32,426	983,336	892,246
New Jersey	1,500	1,710	49,156	53,547	1,556,241	1,510,737
New York	1,766	2,772	38,326	32,469	3,299,849	3,083,880
Pennsylvania	6,399	6,815	85,629	74,545	2,864,707	2,884,305
Subdistrict 1C Total	**39,595**	**33,209**	**408,766**	**390,277**	**8,595,142**	**8,273,173**
Florida	9,286	5,419	87,242	110,845	2,109,900	2,067,745
Georgia	3,728	3,246	110,733	85,117	1,926,965	1,771,229
North Carolina	6,985	6,802	68,607	49,131	1,546,197	1,434,539
South Carolina	2,117	1,985	48,266	59,762	832,239	817,767
Virginia	17,298	15,521	77,832	70,625	1,656,809	1,560,909
West Virginia	180	236	16,086	14,797	523,033	620,984
PAD District 2 Total	**18,824**	**8,909**	**672,219**	**560,746**	**17,092,194**	**16,870,980**
Illinois	1,099	432	90,384	85,558	1,801,596	1,657,429
Indiana	265	49	42,082	36,365	1,419,352	1,773,132
Iowa	6	1,986	37,384	24,273	853,452	812,555
Kansas	5,798	171	25,294	17,338	664,570	675,230
Kentucky	546	977	53,633	39,308	1,304,501	1,408,100
Michigan	1,134	645	61,848	40,541	1,275,348	1,219,664
Minnesota	3,043	220	50,907	50,667	1,070,512	1,022,491
Missouri	2,124	1,213	72,120	72,166	1,275,349	1,233,156
Nebraska	958	6	19,391	8,622	605,092	577,328
North Dakota	516	354	11,981	10,505	376,244	332,269
Ohio	1,388	1,501	66,362	50,325	2,110,998	2,115,729
Oklahoma	67	–	39,184	29,425	1,502,926	1,283,864
South Dakota	52	140	9,269	9,822	265,468	282,753
Tennessee	286	139	40,819	33,062	1,218,396	1,243,109
Wisconsin	1,542	1,075	51,560	52,769	1,348,389	1,234,171
PAD District 3 Total	**124,360**	**94,113**	**592,473**	**514,660**	**10,931,802**	**10,425,450**
Alabama	2,314	2,174	69,648	69,559	1,043,397	1,002,939
Arkansas	216	671	71,608	53,229	943,196	975,534
Louisiana	1,526	1,547	87,350	74,280	2,011,205	1,917,950
Mississippi	8,022	7,909	48,116	50,169	761,679	815,880
New Mexico	31	41	20,561	19,248	550,640	548,606
Texas	112,250	81,771	295,190	248,176	5,621,685	5,164,541
PAD District 4 Total	**4,518**	**5,487**	**146,235**	**144,401**	**2,468,298**	**2,516,976**
Colorado	397	371	59,506	58,404	720,414	738,577
Idaho	3,730	3,905	20,493	21,905	371,339	374,047
Montana	123	9	14,652	15,979	344,622	341,370
Utah	267	1,199	25,517	24,824	462,202	484,710
Wyoming	1	2	26,067	23,290	569,722	578,271
PAD District 5 Total	**127,309**	**158,408**	**409,289**	**351,067**	**6,930,378**	**7,289,898**
Alaska	5,297	6,382	9,879	11,172	411,237	430,689
Arizona	–	10	34,756	41,692	846,743	825,922
California	28,356	48,320	283,448	173,317	3,607,676	3,677,333
Hawaii	26,465	10,655	3,677	6,556	209,918	249,189
Nevada	941	485	20,867	23,635	361,229	396,807
Oregon	233	2,174	19,213	31,750	636,159	720,412
Washington	66,017	90,383	37,450	62,946	857,418	989,546

Dashed (-) = No data reported. R = Revised.

Notes: • See "Technical Note 3" for further explanations on 2001 revised data. • Totals may not equal sum of components due to independent rounding.

Sources: • Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2001-2002 and "Petroleum Supply Annual," Volume 1, 2001-2002, (DOE/EIA-0340(01)/1 - (02)/1). • See "Technical Note 3" in for further explanation of Electric Power. • On-Highway Diesel data are Federal Highway Administration statistics of highway special fuels use.

Table 17. Adjusted Sales of Residual Fuel Oil by Energy Use, 2001 and 2002

(Thousand Gallons)

Destination	Commercial		Industrial		Oil Company		Electric Power	
	R2001	2002	R2001	2002	R2001	2002	R2001	2002
U.S. Total	**520,335**	**560,137**	**1,403,638**	**1,224,614**	**106,176**	**106,412**	**7,112,731**	**4,079,824**
PAD District 1 Total	**484,393**	**521,271**	**1,050,758**	**839,208**	**70,885**	**59,880**	**5,489,145**	**3,419,132**
Subdistrict 1A Total	**69,202**	**86,660**	**380,947**	**312,418**	**189**	**1,148**	**491,513**	**317,185**
Connecticut	7,735	14,164	27,635	14,743	189	332	116,993	97,741
Maine	8,762	17,484	206,962	183,028	–	395	38,081	45,547
Massachusetts	24,471	28,344	100,814	76,022	–	420	294,511	121,307
New Hampshire	3,844	5,442	29,010	21,776	–	–	41,929	52,551
Rhode Island	20,092	15,897	9,559	11,009	–	–	–	39
Vermont	4,298	5,329	6,966	5,839	–	–	–	–
Subdistrict 1B Total	**390,004**	**424,102**	**193,112**	**142,163**	**70,330**	**58,245**	**1,642,791**	**779,473**
Delaware	10,074	9,447	24,149	21,703	38,684	29,447	145,440	37,900
District of Columbia	64	–	–	–	–	–	–	–
Maryland	1,584	2,790	24,721	17,631	549	579	142,254	101,594
New Jersey	18,014	12,312	26,528	11,082	1,573	1,793	459,455	98,775
New York	336,848	382,955	71,753	59,503	545	607	715,560	433,351
Pennsylvania	23,420	16,597	45,961	32,244	28,979	25,819	180,083	107,853
Subdistrict 1C Total	**25,187**	**10,509**	**476,699**	**384,627**	**367**	**487**	**3,354,841**	**2,322,475**
Florida	685	3,132	127,626	67,956	–	–	3,014,949	2,068,001
Georgia	9	–	43,190	79,969	–	–	28,325	4,211
North Carolina	5,972	3,286	158,690	136,669	89	109	–	–
South Carolina	5,311	830	79,540	65,036	89	130	4,180	–
Virginia	13,211	3,261	56,966	30,013	188	249	307,387	250,263
West Virginia	–	–	10,688	4,984	–	–	–	–
PAD District 2 Total	**28,021**	**34,853**	**201,853**	**156,140**	**20,399**	**14,501**	**304,719**	**79,466**
Illinois	2,734	568	14,387	3,826	76	–	160,190	2,622
Indiana	24	29	18,366	7,563	–	–	18,393	–
Iowa	35	91	2,028	2,588	–	–	861	–
Kansas	314	382	14,803	7,601	–	–	30,501	31,492
Kentucky	281	–	2,580	1,112	3,782	2,961	473	–
Michigan	800	2,828	13,174	12,372	3,293	2,770	88,941	41,471
Minnesota	10,225	8,626	28,568	19,294	4,139	4,093	3,970	2,568
Missouri	1,363	1,322	5,038	3,123	–	–	–	83
Nebraska	985	–	4,931	5,443	–	–	–	–
North Dakota	1,704	4,163	1,550	167	–	–	245	–
Ohio	33	194	41,421	33,369	3,094	4,165	1,145	1,229
Oklahoma	–	449	15,446	19,305	533	511	–	–
South Dakota	228	14	4,750	4,565	–	–	–	–
Tennessee	–	–	6,839	5,849	–	–	–	–
Wisconsin	9,296	16,187	27,972	29,963	5,482	–	–	–
PAD District 3 Total	**2,841**	**1,033**	**130,561**	**188,488**	**61**	**374**	**632,172**	**48,290**
Alabama	–	–	37,287	82,552	–	–	–	–
Arkansas	–	–	9,491	2,047	–	–	58,535	3,009
Louisiana	–	13	46,449	58,015	–	–	103,347	44,714
Mississippi	2,319	–	9,128	5,328	–	–	448,013	567
New Mexico	–	–	3,939	5,773	61	–	–	–
Texas	523	1,020	24,266	34,774	–	374	22,278	–
PAD District 4 Total	**850**	**–**	**4,506**	**10,243**	**–**	**5,293**	**–**	**–**
Colorado	–	–	191	–	–	–	–	–
Idaho	–	–	1,056	3,533	–	–	–	–
Montana	–	–	116	50	–	1,681	–	–
Utah	850	–	–	388	–	3,243	–	–
Wyoming	–	–	3,143	6,272	–	369	–	–
PAD District 5 Total	**4,229**	**2,981**	**15,959**	**30,535**	**14,831**	**26,364**	**686,695**	**532,935**
Alaska	–	–	856	–	–	–	–	–
Arizona	–	–	1,278	1,286	–	–	16,282	–
California	1,287	–	750	2,131	14,831	5,711	23,828	712
Hawaii	252	3	373	275	–	19,410	560,028	528,609
Nevada	–	–	–	286	–	–	86,556	2,954
Oregon	2,360	2,826	6,260	19,697	–	1,226	–	660
Washington	330	151	6,442	6,860	–	17	–	–

See footnotes at end of table.

Table 17. Adjusted Sales of Residual Fuel Oil by Energy Use, 2001 and 2002 (Continued)

(Thousand Gallons)

Destination	Vessel Bunkering		Military		All Other		Total	
	R2001	2002	R2001	2002	R2001	2002	R2001	2002
U.S. Total	**4,345,284**	**4,746,843**	**16,160**	**3,801**	**4,136**	**3,363**	**13,508,460**	**10,724,994**
PAD District 1 Total	**1,365,554**	**1,699,403**	**10,180**	**1,150**	**3,881**	**2,437**	**8,474,797**	**6,542,481**
Subdistrict 1A Total	**37,618**	**50,375**	**1,773**	**249**	**179**	**258**	**981,420**	**768,292**
Connecticut	66	–	412	48	179	258	153,208	127,286
Maine	24,102	36,696	1,361	8	–	–	279,268	283,159
Massachusetts	13,450	13,679	–	193	–	–	433,246	239,965
New Hampshire	–	–	–	–	–	–	74,783	79,770
Rhode Island	–	–	–	–	–	–	29,651	26,945
Vermont	–	–	–	–	–	–	11,264	11,168
Subdistrict 1B Total	**834,169**	**1,014,824**	**7,187**	**388**	**–**	**–**	**3,137,593**	**2,419,194**
Delaware	60,477	51,499	587	–	–	–	279,412	149,995
District of Columbia	–	–	16	–	–	–	80	–
Maryland	24,854	30,628	3,832	–	–	–	197,792	153,223
New Jersey	486,533	636,996	338	233	–	–	992,441	761,192
New York	148,581	168,839	1,603	–	–	–	1,274,890	1,045,255
Pennsylvania	113,723	126,861	811	154	–	–	392,977	309,529
Subdistrict 1C Total	**493,768**	**634,205**	**1,220**	**514**	**3,703**	**2,179**	**4,355,784**	**3,354,995**
Florida	397,491	460,600	–	–	3,703	2,179	3,544,454	2,601,868
Georgia	30,440	79,191	–	–	–	–	101,963	163,371
North Carolina	4,892	35,210	–	–	–	–	169,643	175,274
South Carolina	13,088	22,758	–	–	–	–	102,208	88,754
Virginia	47,857	36,445	1,220	514	–	–	426,828	320,744
West Virginia	–	–	–	–	–	–	10,688	4,984
PAD District 2 Total	**24,100**	**30,766**	**5,687**	**2,651**	**163**	**164**	**584,942**	**318,540**
Illinois	653	945	5,619	2,328	–	11	183,660	10,300
Indiana	8,003	10,848	–	–	–	–	44,785	18,440
Iowa	–	–	–	–	6	56	2,930	2,735
Kansas	–	–	68	323	27	9	45,713	39,807
Kentucky	31	69	–	–	–	–	7,148	4,142
Michigan	3,313	2,086	–	–	32	28	109,552	61,556
Minnesota	8,386	11,543	–	–	–	3	55,287	46,128
Missouri	195	449	–	–	14	–	6,609	4,978
Nebraska	–	–	–	–	10	11	5,926	5,455
North Dakota	–	–	–	–	–	–	3,499	4,330
Ohio	3,192	4,521	–	–	61	45	48,947	43,522
Oklahoma	–	–	–	–	14	–	15,993	20,265
South Dakota	–	–	–	–	–	–	4,978	4,579
Tennessee	198	124	–	–	–	–	7,037	5,972
Wisconsin	129	181	–	–	–	–	42,878	46,331
PAD District 3 Total	**1,327,370**	**1,316,402**	**–**	**–**	**74**	**24**	**2,093,079**	**1,554,610**
Alabama	33,758	93,487	–	–	–	–	71,045	176,039
Arkansas	–	–	–	–	–	–	68,025	5,056
Louisiana	479,666	458,946	–	–	–	–	629,461	561,688
Mississippi	60,439	54,031	–	–	–	–	519,899	59,926
New Mexico	–	–	–	–	36	24	4,036	5,797
Texas	753,508	709,937	–	–	37	–	800,612	746,105
PAD District 4 Total	**–**	**–**	**–**	**–**	**19**	**19**	**5,375**	**15,555**
Colorado	–	–	–	–	–	–	191	–
Idaho	–	–	–	–	–	–	1,056	3,533
Montana	–	–	–	–	–	–	116	1,731
Utah	–	–	–	–	–	–	850	3,632
Wyoming	–	–	–	–	19	19	3,162	6,660
PAD District 5 Total	**1,628,260**	**1,700,273**	**293**	**–**	**–**	**720**	**2,350,266**	**2,293,808**
Alaska	2,529	2,231	–	–	–	–	3,385	2,231
Arizona	–	–	–	–	–	–	17,561	1,286
California	1,152,664	1,347,440	157	–	–	720	1,193,518	1,356,714
Hawaii	124,324	63,418	135	–	–	–	685,112	611,715
Nevada	–	–	–	–	–	–	86,556	3,240
Oregon	55,082	53,828	–	–	–	–	63,702	78,238
Washington	293,661	233,355	–	–	–	–	300,433	240,383

Dashed (-) = No data reported. R = Revised.

Notes: • See Technical Note 3 for further explanations on 2001 revised data. • Totals may not equal sum of components due to independent rounding.

Sources: • Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2001-2002 and "Petroleum Supply Annual," Volume 1, 2001-2002, (DOE/EIA-0340(01)/1 - (02)/1). • See Technical Note 3 for further explanation of Electric Power.

Table 18. Adjusted Sales of Kerosene by Energy Use, 2001 and 2002

(Thousand Gallons)

Destination	Residential 2001	Residential 2002	Commercial 2001	Commercial 2002	Industrial 2001	Industrial 2002
U.S. Total	**704,305**	**443,919**	**232,608**	**118,125**	**141,317**	**77,508**
PAD District 1 Total	**582,448**	**365,321**	**194,860**	**94,565**	**56,572**	**33,189**
Subdistrict 1A Total	**116,507**	**71,521**	**30,483**	**17,163**	**6,689**	**1,782**
Connecticut	6,742	3,870	9,684	5,546	2,775	312
Maine	70,328	42,072	6,402	4,721	688	452
Massachusetts	8,269	5,342	6,572	2,459	1,280	244
New Hampshire	14,819	10,992	2,238	1,458	330	300
Rhode Island	2,890	1,421	4,117	2,308	10	5
Vermont	13,459	7,824	1,470	670	1,605	470
Subdistrict 1B Total	**263,226**	**173,882**	**138,781**	**63,384**	**37,188**	**24,709**
Delaware	4,745	2,749	5,339	187	181	11
District of Columbia	4	–	8,705	12	–	–
Maryland	19,761	12,803	14,563	7,194	2,762	1,677
New Jersey	17,203	5,986	52,410	18,983	19,645	12,000
New York	100,395	68,977	36,704	20,717	6,279	8,503
Pennsylvania	121,118	83,366	21,060	16,290	8,321	2,519
Subdistrict 1C Total	**202,715**	**119,918**	**25,596**	**14,018**	**12,695**	**6,698**
Florida	3,833	2,665	1,043	655	4,756	38
Georgia	7,605	3,394	2,571	1,974	940	493
North Carolina	84,907	51,351	8,079	3,978	943	2,416
South Carolina	20,896	12,221	1,680	1,022	3,929	2,458
Virginia	70,602	39,275	9,564	3,688	1,679	1,047
West Virginia	14,873	11,012	2,660	2,701	448	245
PAD District 2 Total	**85,756**	**58,983**	**23,163**	**14,436**	**17,116**	**9,205**
Illinois	5,040	5,981	2,715	1,560	2,087	1,530
Indiana	15,025	11,916	1,828	1,299	1,016	805
Iowa	1,538	932	545	268	197	117
Kansas	603	402	282	229	142	106
Kentucky	11,382	7,118	2,437	1,342	2,183	1,256
Michigan	9,341	6,740	1,460	1,189	1,085	553
Minnesota	7,886	682	1,479	915	117	42
Missouri	3,279	2,137	983	775	455	192
Nebraska	438	127	109	86	31	3
North Dakota	175	87	105	53	16	2
Ohio	18,555	13,808	6,153	3,892	4,319	3,243
Oklahoma	277	641	334	208	1,347	373
South Dakota	153	115	54	82	10	6
Tennessee	10,365	7,046	3,778	1,977	3,752	840
Wisconsin	1,699	1,250	899	560	360	139
PAD District 3 Total	**7,703**	**3,508**	**6,760**	**4,278**	**63,955**	**33,641**
Alabama	1,627	917	1,077	690	431	181
Arkansas	1,014	820	392	172	85	45
Louisiana	1,120	551	674	308	46,033	30,111
Mississippi	1,325	385	426	338	1,111	738
New Mexico	197	108	680	355	136	64
Texas	2,420	728	3,511	2,416	16,159	2,501
PAD District 4 Total	**1,198**	**653**	**980**	**665**	**519**	**263**
Colorado	748	377	431	401	181	60
Idaho	214	111	194	56	15	2
Montana	26	21	1	33	6	3
Utah	131	97	329	148	237	192
Wyoming	79	46	25	26	81	5
PAD District 5 Total	**27,199**	**15,455**	**6,845**	**4,182**	**3,156**	**1,210**
Alaska	670	1	22	9	1	–
Arizona	36	24	135	71	54	23
California	14,701	9,087	2,647	1,147	1,134	308
Hawaii	–	–	3	1	4	3
Nevada	295	289	86	30	16	6
Oregon	7,254	4,602	3,049	1,952	1,392	759
Washington	4,243	1,451	903	972	555	110

See footnotes at end of table.

Table 18. Adjusted Sales of Kerosene by Energy Use, 2001 and 2002 (Continued)

(Thousand Gallons)

Destination	Farm		All Other		Total	
	2001	2002	2001	2002	2001	2002
U.S. Total	**27,162**	**19,390**	**3,535**	**5,372**	**1,108,926**	**664,314**
PAD District 1 Total	**8,366**	**4,026**	**1,776**	**3,362**	**844,021**	**500,462**
Subdistrict 1A Total	**1,240**	**617**	**495**	**503**	**155,414**	**91,585**
Connecticut	18	5	135	155	19,354	9,887
Maine	638	264	65	23	78,120	47,531
Massachusetts	6	9	71	135	16,198	8,188
New Hampshire	313	206	163	129	17,863	13,085
Rhode Island	–	–	–	19	7,017	3,753
Vermont	266	133	62	42	16,862	9,141
Subdistrict 1B Total	**4,251**	**1,822**	**900**	**1,523**	**444,346**	**265,320**
Delaware	37	20	–	–	10,301	2,968
District of Columbia	–	–	–	–	8,709	12
Maryland	327	194	27	17	37,440	21,885
New Jersey	16	2	6	26	89,280	36,997
New York	827	670	475	831	144,679	99,698
Pennsylvania	3,045	937	392	649	153,936	103,761
Subdistrict 1C Total	**2,875**	**1,587**	**380**	**1,335**	**244,261**	**143,557**
Florida	311	6	8	23	9,952	3,387
Georgia	42	336	6	6	11,164	6,205
North Carolina	484	227	87	487	94,499	58,459
South Carolina	1,217	472	71	431	27,792	16,604
Virginia	781	518	194	384	82,820	44,911
West Virginia	39	29	15	4	18,034	13,991
PAD District 2 Total	**12,502**	**13,238**	**1,137**	**1,010**	**139,675**	**96,872**
Illinois	824	316	110	203	10,777	9,591
Indiana	810	6,354	226	64	18,905	20,437
Iowa	1,536	862	90	29	3,905	2,208
Kansas	673	425	22	133	1,721	1,295
Kentucky	874	473	35	65	16,911	10,254
Michigan	787	234	26	22	12,699	8,739
Minnesota	384	192	108	86	9,975	1,917
Missouri	131	86	138	17	4,986	3,207
Nebraska	257	86	33	3	869	305
North Dakota	33	23	17	6	345	170
Ohio	4,151	3,083	89	44	33,268	24,071
Oklahoma	136	82	53	7	2,148	1,311
South Dakota	81	53	20	1	317	257
Tennessee	138	71	119	62	18,152	9,995
Wisconsin	1,688	896	52	270	4,698	3,114
PAD District 3 Total	**3,848**	**612**	**338**	**349**	**82,605**	**42,388**
Alabama	19	8	–	–	3,154	1,796
Arkansas	690	154	5	15	2,186	1,206
Louisiana	17	6	41	1	47,885	30,977
Mississippi	26	16	1	–	2,889	1,477
New Mexico	102	61	67	140	1,182	728
Texas	2,994	367	224	193	25,308	6,205
PAD District 4 Total	**596**	**525**	**29**	**460**	**3,321**	**2,565**
Colorado	39	108	16	273	1,414	1,220
Idaho	33	17	8	5	464	192
Montana	492	380	–	–	524	437
Utah	30	20	3	8	730	465
Wyoming	1	1	2	173	188	251
PAD District 5 Total	**1,850**	**989**	**255**	**192**	**39,304**	**22,027**
Alaska	–	–	–	–	693	11
Arizona	–	1	5	1	230	119
California	481	285	152	28	19,115	10,855
Hawaii	–	–	–	–	7	5
Nevada	9	1	–	–	407	326
Oregon	933	475	38	63	12,666	7,851
Washington	427	227	59	100	6,187	2,861

Dashed (-) = No data reported.
Notes: • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2001-2002 and "Petroleum Supply Annual," Volume 1, 2001-2002, (DOE/EIA-0340(01)/1 - (02)/1).

Table 19. Adjusted Sales for Residential Use: Distillate Fuel Oil and Kerosene, 2002
(Thousand Gallons)

Destination	Distillate Fuel Oil			Kerosene
	No. 1	No. 2	Total	
U.S. Total	**97,892**	**5,830,179**	**5,928,071**	**443,919**
PAD District 1 Total	**4,123**	**5,192,749**	**5,196,872**	**365,321**
Subdistrict 1A Total	**1,986**	**2,083,168**	**2,085,154**	**71,521**
Connecticut	106	529,648	529,754	3,870
Maine	1,169	271,855	273,024	42,072
Massachusetts	13	892,675	892,688	5,342
New Hampshire	698	167,740	168,438	10,992
Rhode Island	–	135,745	135,745	1,421
Vermont	–	85,505	85,505	7,824
Subdistrict 1B Total	**610**	**2,757,936**	**2,758,546**	**173,882**
Delaware	–	40,038	40,038	2,749
District of Columbia	–	14,234	14,234	–
Maryland	2	178,006	178,008	12,803
New Jersey	–	366,112	366,112	5,986
New York	397	1,330,288	1,330,685	68,977
Pennsylvania	212	829,258	829,470	83,366
Subdistrict 1C Total	**1,527**	**351,645**	**353,172**	**119,918**
Florida	–	3,785	3,785	2,665
Georgia	–	2,225	2,225	3,394
North Carolina	–	113,584	113,584	51,351
South Carolina	46	15,585	15,631	12,221
Virginia	1,055	196,518	197,573	39,275
West Virginia	427	19,948	20,375	11,012
PAD District 2 Total	**58,630**	**473,972**	**532,602**	**58,983**
Illinois	1,334	8,889	10,223	5,981
Indiana	4,387	28,251	32,638	11,916
Iowa	3,160	19,310	22,470	932
Kansas	366	1,023	1,389	402
Kentucky	354	15,340	15,694	7,118
Michigan	7,527	78,149	85,676	6,740
Minnesota	16,109	69,698	85,807	682
Missouri	1,417	9,819	11,236	2,137
Nebraska	786	1,850	2,636	127
North Dakota	2,704	13,733	16,437	87
Ohio	6,446	116,521	122,967	13,808
Oklahoma	41	35	76	641
South Dakota	2,695	7,656	10,351	115
Tennessee	405	4,040	4,445	7,046
Wisconsin	10,899	99,658	110,557	1,250
PAD District 3 Total	**32**	**3,138**	**3,170**	**3,508**
Alabama	2	1,759	1,761	917
Arkansas	2	412	414	820
Louisiana	–	420	420	551
Mississippi	–	51	51	385
New Mexico	29	308	337	108
Texas	–	187	187	728
PAD District 4 Total	**4,904**	**19,796**	**24,700**	**653**
Colorado	116	883	999	377
Idaho	2,924	11,262	14,186	111
Montana	1,623	3,334	4,957	21
Utah	146	3,194	3,340	97
Wyoming	95	1,123	1,218	46
PAD District 5 Total	**30,203**	**140,524**	**170,727**	**15,455**
Alaska	24,684	29,210	53,894	1
Arizona	17	323	340	24
California	68	5,237	5,305	9,087
Hawaii	–	11	11	–
Nevada	232	7,283	7,515	289
Oregon	2,579	32,528	35,107	4,602
Washington	2,623	65,933	68,556	1,451

Dashed (-) = No data reported.
Notes: • See Technical Note 3 for further explanations. • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2002 and "Petroleum Supply Annual," Volume 1, 2002, (DOE/EIA-0340(02)/1).

Table 20. Adjusted Sales for Commercial Use: Distillate Fuel Oil, Residual Fuel Oil, and Kerosene, 2002
(Thousand Gallons)

Destination	Distillate Fuel Oil							Residual Fuel Oil	Kerosene
	No. 1 Distillate	No. 2 Distillate				No. 4 Fuel	Total Distillate		
		No. 2 Fuel Oil	Low Sulfur Diesel	High Sulfur Diesel	No. 2 Total				
U.S. Total	**58,160**	**1,332,973**	**1,015,403**	**479,610**	**2,827,986**	**179,631**	**3,065,777**	**560,137**	**118,125**
PAD District 1 Total	**3,686**	**1,185,246**	**382,804**	**255,143**	**1,823,193**	**179,135**	**2,006,014**	**521,271**	**94,565**
Subdistrict 1A Total	**336**	**427,963**	**44,346**	**10,189**	**482,498**	**23,497**	**506,331**	**86,660**	**17,163**
Connecticut	88	91,234	20,724	1,198	113,156	3,482	116,727	14,164	5,546
Maine	66	104,495	2,806	1,742	109,043	983	110,091	17,484	4,721
Massachusetts	–	131,315	9,255	1,865	142,435	12,693	155,128	28,344	2,459
New Hampshire	25	53,191	5,842	464	59,497	3,059	62,582	5,442	1,458
Rhode Island	157	21,876	2,441	603	24,920	1,723	26,800	15,897	2,308
Vermont	–	25,851	3,279	4,316	33,446	1,557	35,003	5,329	670
Subdistrict 1B Total	**1,933**	**669,799**	**196,388**	**111,746**	**977,933**	**154,214**	**1,134,080**	**424,102**	**63,384**
Delaware	–	8,316	2,708	2,319	13,343	380	13,724	9,447	187
District of Columbia	1	9,988	605	184	10,777	1,188	11,966	–	12
Maryland	49	47,648	20,363	32,135	100,146	891	101,085	2,790	7,194
New Jersey	24	78,849	7,195	8,162	94,206	3,412	97,642	12,312	18,983
New York	764	391,496	55,835	14,778	462,109	145,236	608,109	382,955	20,717
Pennsylvania	1,096	133,502	109,681	54,169	297,352	3,106	301,554	16,597	16,290
Subdistrict 1C Total	**1,416**	**87,484**	**142,070**	**133,208**	**362,762**	**1,424**	**365,602**	**10,509**	**14,018**
Florida	–	3,639	63,372	36,294	103,306	576	103,882	3,132	655
Georgia	39	2,424	23,955	15,109	41,488	–	41,527	–	1,974
North Carolina	5	30,798	21,023	28,569	80,391	176	80,572	3,286	3,978
South Carolina	–	4,720	14,550	7,794	27,064	–	27,064	830	1,022
Virginia	1,160	42,192	14,285	41,195	97,672	558	99,390	3,261	3,688
West Virginia	212	3,711	4,884	4,246	12,840	115	13,167	–	2,701
PAD District 2 Total	**23,572**	**109,200**	**267,113**	**112,117**	**488,430**	**12**	**512,013**	**34,853**	**14,436**
Illinois	4,815	5,066	31,718	21,931	58,715	–	63,529	568	1,560
Indiana	1,700	14,618	28,281	8,793	51,692	–	53,392	29	1,299
Iowa	1,380	7,672	6,788	1,731	16,192	–	17,571	91	268
Kansas	1,758	765	20,068	2,022	22,856	–	24,614	382	229
Kentucky	72	3,251	20,156	17,864	41,271	–	41,343	–	1,342
Michigan	580	7,321	22,441	7,073	36,836	5	37,421	2,828	1,189
Minnesota	3,247	12,053	10,481	6,001	28,535	6	31,788	8,626	915
Missouri	604	7,966	19,606	10,336	37,909	–	38,513	1,322	775
Nebraska	1,067	344	2,025	142	2,511	–	3,578	–	86
North Dakota	849	2,100	1,913	625	4,638	–	5,487	4,163	53
Ohio	2,663	26,512	38,760	19,431	84,702	–	87,365	194	3,892
Oklahoma	1	28	12,430	1,085	13,543	–	13,544	449	208
South Dakota	816	2,790	2,809	539	6,138	–	6,954	14	82
Tennessee	71	1,431	28,799	9,746	39,975	–	40,046	–	1,977
Wisconsin	3,950	17,283	20,838	4,797	42,918	–	46,868	16,187	560
PAD District 3 Total	**609**	**1,681**	**153,298**	**61,604**	**216,582**	**458**	**217,649**	**1,033**	**4,278**
Alabama	–	689	30,391	6,204	37,284	458	37,742	–	690
Arkansas	231	11	13,005	8,269	21,285	–	21,516	–	172
Louisiana	154	78	10,875	7,186	18,139	–	18,293	13	308
Mississippi	–	5	7,188	5,441	12,634	–	12,634	–	338
New Mexico	187	405	11,473	3,778	15,655	–	15,842	–	355
Texas	38	493	80,366	30,725	111,584	–	111,623	1,020	2,416
PAD District 4 Total	**5,434**	**6,525**	**49,053**	**12,005**	**67,582**	**–**	**73,016**	**–**	**665**
Colorado	1,490	779	17,135	709	18,623	–	20,113	–	401
Idaho	605	2,193	6,495	4,002	12,690	–	13,295	–	56
Montana	516	2,617	1,988	440	5,045	–	5,561	–	33
Utah	897	692	14,856	6,146	21,694	–	22,592	–	148
Wyoming	1,926	244	8,578	708	9,530	–	11,455	–	26
PAD District 5 Total	**24,860**	**30,322**	**163,135**	**38,741**	**232,199**	**26**	**257,084**	**2,981**	**4,182**
Alaska	21,327	9,792	2,186	11,457	23,435	23	44,785	–	9
Arizona	57	6	29,943	71	30,019	–	30,077	–	71
California	20	3,362	74,173	1,624	79,159	3	79,182	–	1,147
Hawaii	–	56	7,320	3,836	11,212	–	11,212	3	1
Nevada	742	1,908	10,120	152	12,180	–	12,922	–	30
Oregon	894	3,977	19,866	12,395	36,238	–	37,132	2,826	1,952
Washington	1,819	11,222	19,527	9,206	39,955	–	41,775	151	972

Dashed (-) = No data reported.

Notes: • See Technical Note 3 for further explanations. • Totals may not equal sum of components due to independent rounding.

Sources: • Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2002 and "Petroleum Supply Annual," Volume 1, 2002, (DOE/EIA-0340(02)/1).

Table 21. Adjusted Sales for Industrial Use: Distillate Fuel Oil, Residual Fuel Oil, and Kerosene, 2002
(Thousand Gallons)

Destination	Distillate Fuel Oil							Residual Fuel Oil	Kerosene
	No. 1 Distillate	No. 2 Distillate				No. 4 Fuel	Total Distillate		
		No. 2 Fuel Oil	Low Sulfur Diesel	High Sulfur Diesel	No. 2 Total				
U.S. Total	**44,272**	**298,414**	**783,138**	**1,082,396**	**2,163,949**	**30,237**	**2,238,458**	**1,224,614**	**77,508**
PAD District 1 Total	**980**	**187,167**	**84,098**	**446,675**	**717,940**	**25,732**	**744,651**	**839,208**	**33,189**
Subdistrict 1A Total	**415**	**37,291**	**6,254**	**3,127**	**46,672**	**10,261**	**57,348**	**312,418**	**1,782**
Connecticut	–	8,980	1,272	166	10,418	4,654	15,072	14,743	312
Maine	27	11,433	1,802	710	13,945	1,552	15,524	183,028	452
Massachusetts	13	6,106	1,157	1,510	8,773	1,603	10,389	76,022	244
New Hampshire	375	4,370	1,502	37	5,909	582	6,865	21,776	300
Rhode Island	–	2,738	152	–	2,890	1,031	3,920	11,009	5
Vermont	–	3,664	369	704	4,737	841	5,578	5,839	470
Subdistrict 1B Total	**6**	**82,036**	**21,411**	**77,994**	**181,441**	**12,957**	**194,404**	**142,163**	**24,709**
Delaware	–	977	1,454	200	2,630	698	3,328	21,703	11
District of Columbia	–	–	–	–	–	180	180	–	–
Maryland	–	12,880	2,856	8,621	24,357	346	24,702	17,631	1,677
New Jersey	–	16,346	870	1,189	18,404	5,206	23,610	11,082	12,000
New York	–	27,654	4,470	6,301	38,425	4,176	42,601	59,503	8,503
Pennsylvania	6	24,179	11,762	61,684	97,625	2,351	99,982	32,244	2,519
Subdistrict 1C Total	**559**	**67,841**	**56,432**	**365,553**	**489,826**	**2,513**	**492,898**	**384,627**	**6,698**
Florida	42	3,237	16,606	31,028	50,871	733	51,646	67,956	38
Georgia	–	8,728	21,579	38,653	68,960	6	68,966	79,969	493
North Carolina	–	12,729	9,989	23,838	46,556	681	47,236	136,669	2,416
South Carolina	–	5,912	1,056	7,190	14,158	362	14,521	65,036	2,458
Virginia	30	19,806	4,229	58,195	82,230	714	82,974	30,013	1,047
West Virginia	488	17,428	2,974	206,649	227,051	18	227,556	4,984	245
PAD District 2 Total	**16,995**	**99,345**	**183,168**	**324,928**	**607,441**	**2,945**	**627,381**	**156,140**	**9,205**
Illinois	3,793	7,810	20,430	30,232	58,473	18	62,283	3,826	1,530
Indiana	4,034	14,763	29,024	69,303	113,090	576	117,699	7,563	805
Iowa	473	1,717	5,840	1,152	8,710	–	9,183	2,588	117
Kansas	345	431	8,047	3,099	11,576	2	11,924	7,601	106
Kentucky	68	5,314	17,605	107,697	130,616	393	131,077	1,112	1,256
Michigan	1,261	4,711	5,812	11,287	21,809	–	23,070	12,372	553
Minnesota	1,742	18,112	14,815	1,529	34,456	–	36,198	19,294	42
Missouri	1,650	5,416	17,844	19,082	42,342	–	43,992	3,123	192
Nebraska	411	–	1,149	3,609	4,758	–	5,169	5,443	3
North Dakota	657	147	2,544	5,618	8,308	–	8,965	167	2
Ohio	292	18,949	22,792	33,033	74,774	1,534	76,600	33,369	3,243
Oklahoma	44	2,636	4,622	10,962	18,220	–	18,264	19,305	373
South Dakota	393	503	7,018	157	7,678	–	8,071	4,565	6
Tennessee	–	3,529	6,236	14,627	24,393	241	24,633	5,849	840
Wisconsin	1,834	15,306	19,390	13,541	48,237	181	50,253	29,963	139
PAD District 3 Total	**2,205**	**5,299**	**195,243**	**189,927**	**390,469**	**726**	**393,400**	**188,488**	**33,641**
Alabama	–	228	23,625	39,952	63,805	726	64,531	82,552	181
Arkansas	–	150	16,958	12,012	29,120	–	29,120	2,047	45
Louisiana	–	3,254	22,353	57,586	83,193	–	83,193	58,015	30,111
Mississippi	–	–	12,694	23,293	35,987	–	35,987	5,328	738
New Mexico	2,205	1,520	34,469	2,153	38,141	–	40,346	5,773	64
Texas	–	146	85,144	54,932	140,223	–	140,223	34,774	2,501
PAD District 4 Total	**8,265**	**6,089**	**181,672**	**26,431**	**214,192**	**–**	**222,456**	**10,243**	**263**
Colorado	1,429	184	25,484	1,770	27,438	–	28,868	–	60
Idaho	1,204	4,575	5,757	6,355	16,687	–	17,892	3,533	2
Montana	798	156	11,949	8,266	20,371	–	21,169	50	3
Utah	1,927	1,170	23,452	9,950	34,571	–	36,498	388	192
Wyoming	2,906	3	115,031	90	115,124	–	118,031	6,272	5
PAD District 5 Total	**15,828**	**514**	**138,957**	**94,436**	**233,907**	**834**	**250,569**	**30,535**	**1,210**
Alaska	15,608	325	6,777	18,288	25,390	–	40,998	–	–
Arizona	53	–	27,576	34,076	61,652	42	61,748	1,286	23
California	–	127	42,256	1,586	43,970	–	43,970	2,131	308
Hawaii	–	54	1,236	789	2,078	–	2,078	275	3
Nevada	101	–	37,417	12,492	49,909	791	50,801	286	6
Oregon	50	8	11,219	18,513	29,740	–	29,791	19,697	759
Washington	15	–	12,474	8,693	21,167	–	21,182	6,860	110

Dashed (-) = No data reported.

Notes: • See Technical Note 3 for further explanations. • Totals may not equal sum of components due to independent rounding.

Sources: • Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2002 and "Petroleum Supply Annual," Volume 1, 2002, (DOE/EIA-0340(02)/1).

Table 22. Adjusted Sales for Farm Use: Distillate Fuel Oil and Kerosene; Sales for Electric Power and Oil Company Uses: Distillate Fuel Oil and Residual Fuel Oil, 2002
(Thousand Gallons)

Destination	Farm				Electric Power		Oil Company Use	
	Diesel	Other Distillate	Total Distillate	Kerosene	Distillate Fuel Oil	Residual Fuel Oil	Distillate Fuel Oil	Residual Fuel Oil
U.S. Total	**3,109,494**	**69,815**	**3,179,309**	**19,390**	**633,714**	**4,079,824**	**825,464**	**106,412**
PAD District 1 Total	**421,893**	**41,988**	**463,881**	**4,026**	**291,842**	**3,419,132**	**24,359**	**59,880**
Subdistrict 1A Total	**15,998**	**14,207**	**30,205**	**617**	**7,499**	**317,185**	**38**	**1,148**
Connecticut	2,416	5,038	7,454	5	1,154	97,741	6	332
Maine	3,606	3,969	7,574	264	270	45,547	32	395
Massachusetts	4,523	610	5,134	9	2,875	121,307	–	420
New Hampshire	1,822	2,858	4,680	206	1,845	52,551	–	–
Rhode Island	99	28	127	–	1,005	39	–	–
Vermont	3,532	1,705	5,237	133	349	–	–	–
Subdistrict 1B Total	**83,721**	**20,603**	**104,324**	**1,822**	**109,156**	**779,473**	**18,032**	**58,245**
Delaware	7,791	105	7,896	20	3,762	37,900	10,473	29,447
District of Columbia	–	–	–	–	16,250	–	–	–
Maryland	14,164	179	14,342	194	20,133	101,594	7	579
New Jersey	9,019	486	9,505	2	15,548	98,775	277	1,793
New York	28,254	13,559	41,813	670	9,032	433,351	1	607
Pennsylvania	24,494	6,274	30,768	937	44,430	107,853	7,274	25,819
Subdistrict 1C Total	**322,174**	**7,178**	**329,352**	**1,587**	**175,188**	**2,322,475**	**6,290**	**487**
Florida	124,472	674	125,146	6	105,814	2,068,001	205	–
Georgia	111,054	–	111,054	336	8,726	4,211	84	–
North Carolina	37,060	4,306	41,366	227	26,539	–	259	109
South Carolina	18,286	1,261	19,547	472	12,502	–	564	130
Virginia	29,956	920	30,876	518	8,681	250,263	398	249
West Virginia	1,346	16	1,362	29	12,925	–	4,780	–
PAD District 2 Total	**1,511,831**	**23,677**	**1,535,508**	**13,238**	**121,408**	**79,466**	**42,467**	**14,501**
Illinois	133,753	4,292	138,046	316	7,464	2,622	473	–
Indiana	75,805	2,483	78,288	6,354	12,673	–	59	–
Iowa	203,167	3,845	207,012	862	2,443	–	–	–
Kansas	135,694	207	135,901	425	4,377	31,492	7,928	–
Kentucky	32,328	268	32,596	473	8,712	–	419	2,961
Michigan	42,283	1,229	43,512	234	20,242	41,471	22	2,770
Minnesota	103,931	3,214	107,145	192	4,838	2,568	2	4,093
Missouri	62,846	39	62,884	86	5,835	83	139	–
Nebraska	180,062	328	180,390	86	577	–	–	–
North Dakota	85,796	1,228	87,024	23	1,368	–	3,441	–
Ohio	81,918	698	82,616	3,083	22,903	1,229	1,554	4,165
Oklahoma	57,449	478	57,927	82	8,737	–	28,348	511
South Dakota	49,909	952	50,861	53	592	–	11	–
Tennessee	28,107	55	28,161	71	15,354	–	–	–
Wisconsin	238,783	4,362	243,145	896	5,293	–	72	–
PAD District 3 Total	**598,989**	**948**	**599,938**	**612**	**61,688**	**48,290**	**691,818**	**374**
Alabama	23,635	125	23,760	8	2,537	–	274	–
Arkansas	125,005	559	125,564	154	4,512	3,009	1,592	–
Louisiana	78,319	–	78,319	6	7,084	44,714	377,699	–
Mississippi	72,302	245	72,548	16	1,112	567	9,853	–
New Mexico	17,547	20	17,567	61	2,351	–	22,999	–
Texas	282,180	–	282,180	367	44,091	–	279,402	374
PAD District 4 Total	**156,962**	**3,037**	**159,998**	**525**	**5,846**	**–**	**20,324**	**5,293**
Colorado	41,170	2,258	43,427	108	1,577	–	4,199	–
Idaho	56,546	254	56,799	17	16	–	–	–
Montana	35,776	439	36,215	380	–	–	1,189	1,681
Utah	11,547	37	11,584	20	1,601	–	722	3,243
Wyoming	11,923	50	11,973	1	2,651	–	14,214	369
PAD District 5 Total	**419,820**	**164**	**419,985**	**989**	**152,931**	**532,935**	**46,495**	**26,364**
Alaska	13	–	13	–	41,943	–	32,318	–
Arizona	31,829	–	31,829	1	4,212	–	316	–
California	301,572	7	301,580	285	5,839	712	10,560	5,711
Hawaii	7,973	–	7,973	–	94,779	528,609	3	19,410
Nevada	4,581	1	4,582	1	1,689	2,954	919	–
Oregon	43,192	156	43,348	475	4,059	660	1,721	1,226
Washington	30,661	–	30,661	227	412	–	657	17

Dashed (-) = No data reported.

Notes: • See Technical Note 3 for further explanations on 2002 preliminary data.• Totals may not equal sum of components due to independent rounding.

Sources: • Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2002 and "Petroleum Supply Annual," Volume 1, 2002, (DOE/EIA-0340(02)/1). • See Technical Note 3 for further explanation of Electric Power.

Table 23. Adjusted Sales for Transportation Use: Distillate Fuel Oil and Residual Fuel Oil, 2002
(Thousand Gallons)

Destination	Railroad Use	Vessel Bunkering		On-Highway Diesel	Total Transportation Use	
	Distillate Fuel Oil	Distillate Fuel Oil	Residual Fuel Oil	Distillate Fuel Oil	Distillate Fuel Oil	Residual Fuel Oil
U.S. Total	**3,080,831**	**2,069,514**	**4,746,843**	**34,308,885**	**39,459,231**	**4,746,843**
PAD District 1 Total	**512,284**	**450,623**	**1,699,403**	**10,373,983**	**11,336,890**	**1,699,403**
Subdistrict 1A Total	**17,194**	**56,785**	**50,375**	**1,077,477**	**1,151,456**	**50,375**
Connecticut	4,797	2,425	–	228,081	235,303	–
Maine	337	8,669	36,696	167,632	176,637	36,696
Massachusetts	11,947	36,123	13,679	398,217	446,286	13,679
New Hampshire	91	340	–	164,623	165,054	–
Rhode Island	–	8,430	–	54,785	63,215	–
Vermont	22	799	–	64,139	64,960	–
Subdistrict 1B Total	**150,107**	**122,879**	**1,014,824**	**3,785,263**	**4,058,249**	**1,014,824**
Delaware	839	594	51,499	62,154	63,587	51,499
District of Columbia	4,383	268	–	27,049	31,700	–
Maryland	1,252	11,257	30,628	501,802	514,311	30,628
New Jersey	29,782	79,821	636,996	833,183	942,786	636,996
New York	19,011	8,959	168,839	988,428	1,016,398	168,839
Pennsylvania	94,840	21,980	126,861	1,372,647	1,489,467	126,861
Subdistrict 1C Total	**344,984**	**270,959**	**634,205**	**5,511,243**	**6,127,186**	**634,205**
Florida	73,115	143,577	460,600	1,344,310	1,561,003	460,600
Georgia	114,532	22,327	79,191	1,313,424	1,450,283	79,191
North Carolina	82,842	10,057	35,210	976,151	1,069,050	35,210
South Carolina	11,843	19,782	22,758	634,567	666,191	22,758
Virginia	52,732	28,235	36,445	973,906	1,054,873	36,445
West Virginia	9,920	46,981	–	268,885	325,786	–
PAD District 2 Total	**1,100,673**	**280,815**	**30,766**	**11,548,458**	**12,929,946**	**30,766**
Illinois	105,192	46,586	945	1,137,642	1,289,420	945
Indiana	79,340	8,427	10,848	1,354,201	1,441,968	10,848
Iowa	19,951	3,204	–	504,461	527,616	–
Kansas	64,619	1,280	–	405,689	471,589	–
Kentucky	90,550	56,169	69	991,256	1,137,975	69
Michigan	24,004	4,944	2,086	939,587	968,534	2,086
Minnesota	52,465	3,748	11,543	649,613	705,826	11,543
Missouri	20,116	30,123	449	946,940	997,179	449
Nebraska	2,493	–	–	373,857	376,350	–
North Dakota	46,389	–	–	152,301	198,690	–
Ohio	166,558	5,101	4,521	1,498,239	1,669,898	4,521
Oklahoma	307,443	170	–	819,929	1,127,543	–
South Dakota	4,296	–	–	191,656	195,952	–
Tennessee	81,222	112,364	124	903,682	1,097,268	124
Wisconsin	36,035	8,699	181	679,405	724,139	181
PAD District 3 Total	**851,077**	**1,052,670**	**1,316,402**	**5,945,268**	**7,849,015**	**1,316,402**
Alabama	59,360	73,400	93,487	667,844	800,603	93,487
Arkansas	127,357	897	–	610,663	738,917	–
Louisiana	52,363	609,524	458,946	615,227	1,277,114	458,946
Mississippi	18,870	68,668	54,031	538,079	625,617	54,031
New Mexico	10,021	–	–	419,853	429,874	–
Texas	583,106	300,181	709,937	3,093,602	3,976,889	709,937
PAD District 4 Total	**228,020**	**21**	**–**	**1,632,707**	**1,860,748**	**–**
Colorado	35,981	10	–	544,627	580,618	–
Idaho	22,854	11	–	223,184	246,049	–
Montana	54,726	–	–	201,566	256,292	–
Utah	29,136	–	–	353,215	382,351	–
Wyoming	85,323	–	–	310,115	395,438	–
PAD District 5 Total	**388,778**	**285,385**	**1,700,273**	**4,808,469**	**5,482,632**	**1,700,273**
Alaska	4,880	85,527	2,231	108,777	199,183	2,231
Arizona	12,850	–	–	642,850	655,700	–
California	247,870	57,712	1,347,440	2,703,680	3,009,261	1,347,440
Hawaii	–	77,800	63,418	38,122	115,922	63,418
Nevada	7,617	3	–	286,639	294,259	–
Oregon	64,021	13,254	53,828	458,057	535,332	53,828
Washington	51,541	51,090	233,355	570,344	672,975	233,355

Dashed (-) = No data reported.

Notes: • See Technical Note 3 for further explanations. • Totals may not equal sum of components due to independent rounding.

Sources: • Energy Information Administration’s Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2002 and "Petroleum Supply Annual," Volume 1, 2002, (DOE/EIA-0340(02)/1). • On-Highway Diesel data are Federal Highway Administration statistics of highway special fuels use.

Table 24. Adjusted Sales for Military, Off-Highway, and All Other Uses: Distillate Fuel Oil, Residual Fuel Oil, and Kerosene, 2002
(Thousand Gallons)

Destination	Military				Off-Highway Distillate Fuel Oil			All Other	
	Diesel	Other Distillate	Total Distillate	Residual Fuel Oil	Construction	Other	Total	Residual Fuel Oil	Kerosene
U.S. Total	**303,664**	**26,878**	**330,542**	**3,801**	**1,818,411**	**405,675**	**2,224,086**	**3,363**	**5,372**
PAD District 1 Total	**44,383**	**19,243**	**63,626**	**1,150**	**536,491**	**116,721**	**653,212**	**2,437**	**3,362**
Subdistrict 1A Total	**4,024**	**5,372**	**9,396**	**249**	**54,444**	**9,760**	**64,204**	**258**	**503**
Connecticut	263	531	794	48	11,377	381	11,758	258	155
Maine	2,192	2,882	5,074	8	8,780	1,198	9,978	–	23
Massachusetts	532	462	994	193	20,920	3,110	24,030	–	135
New Hampshire	707	1,258	1,965	–	9,840	3,671	13,511	–	129
Rhode Island	28	1	30	–	2,076	1	2,077	–	19
Vermont	302	237	539	–	1,452	1,399	2,851	–	42
Subdistrict 1B Total	**11,616**	**9,405**	**21,021**	**388**	**180,906**	**17,825**	**198,731**	**–**	**1,523**
Delaware	194	175	369	–	2,930	191	3,121	–	–
District of Columbia	1,420	704	2,124	–	2,623	–	2,623	–	–
Maryland	4,691	2,540	7,231	–	30,290	2,136	32,426	–	17
New Jersey	999	711	1,710	233	44,663	8,883	53,547	–	26
New York	1,068	1,705	2,772	–	29,372	3,096	32,469	–	831
Pennsylvania	3,244	3,571	6,815	154	71,027	3,518	74,545	–	649
Subdistrict 1C Total	**28,743**	**4,466**	**33,209**	**514**	**301,140**	**89,137**	**390,277**	**2,179**	**1,335**
Florida	5,419	–	5,419	–	101,065	9,780	110,845	2,179	23
Georgia	3,232	14	3,246	–	60,370	24,747	85,117	–	6
North Carolina	3,239	3,563	6,802	–	35,420	13,711	49,131	–	487
South Carolina	1,413	572	1,985	–	36,525	23,237	59,762	–	431
Virginia	15,289	232	15,521	514	58,093	12,532	70,625	–	384
West Virginia	151	85	236	–	9,667	5,130	14,797	–	4
PAD District 2 Total	**7,453**	**1,456**	**8,909**	**2,651**	**492,206**	**68,540**	**560,746**	**164**	**1,010**
Illinois	432	1	432	2,328	81,684	3,874	85,558	11	203
Indiana	49	–	49	–	32,060	4,306	36,365	–	64
Iowa	1,944	42	1,986	–	22,160	2,113	24,273	56	29
Kansas	170	–	171	323	15,254	2,083	17,338	9	133
Kentucky	775	203	977	–	34,559	4,749	39,308	–	65
Michigan	645	–	645	–	36,912	3,629	40,541	28	22
Minnesota	220	–	220	–	35,189	15,478	50,667	3	86
Missouri	1,006	208	1,213	–	64,753	7,413	72,166	–	17
Nebraska	6	–	6	–	6,637	1,985	8,622	11	3
North Dakota	354	–	354	–	9,830	674	10,505	–	6
Ohio	962	538	1,501	–	46,037	4,288	50,325	45	44
Oklahoma	–	–	–	–	27,113	2,312	29,425	–	7
South Dakota	137	2	140	–	8,303	1,519	9,822	–	1
Tennessee	122	17	139	–	25,677	7,385	33,062	–	62
Wisconsin	632	444	1,075	–	46,038	6,731	52,769	–	270
PAD District 3 Total	**94,113**	**–**	**94,113**	**–**	**385,493**	**129,167**	**514,660**	**24**	**349**
Alabama	2,174	–	2,174	–	35,824	33,735	69,559	–	–
Arkansas	671	–	671	–	23,256	29,973	53,229	–	15
Louisiana	1,547	–	1,547	–	57,962	16,317	74,280	–	1
Mississippi	7,909	–	7,909	–	32,341	17,828	50,169	–	–
New Mexico	41	–	41	–	15,784	3,464	19,248	24	140
Texas	81,771	–	81,771	–	220,326	27,850	248,176	–	193
PAD District 4 Total	**5,479**	**8**	**5,487**	**–**	**122,393**	**22,008**	**144,401**	**19**	**460**
Colorado	363	8	371	–	57,695	709	58,404	–	273
Idaho	3,905	–	3,905	–	11,143	10,762	21,905	–	5
Montana	9	–	9	–	9,296	6,683	15,979	–	–
Utah	1,199	–	1,199	–	22,800	2,024	24,824	–	8
Wyoming	2	–	2	–	21,460	1,830	23,290	19	173
PAD District 5 Total	**152,236**	**6,172**	**158,408**	**–**	**281,828**	**69,239**	**351,067**	**720**	**192**
Alaska	6,382	–	6,382	–	8,963	2,209	11,172	–	–
Arizona	10	–	10	–	38,914	2,778	41,692	–	1
California	48,320	–	48,320	–	149,279	24,038	173,317	720	28
Hawaii	10,655	–	10,655	–	6,556	–	6,556	–	–
Nevada	485	–	485	–	22,956	679	23,635	–	–
Oregon	2,157	17	2,174	–	17,994	13,756	31,750	–	63
Washington	84,228	6,156	90,383	–	37,167	25,779	62,946	–	100

Dashed (-) = No data reported.
Notes: • See Technical Note 3 for further explanations. • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2002 and "Petroleum Supply Annual," Volume 1, 2002, (DOE/EIA-0340(02)/1).
• Energy Information Administration's "Petroleum Supply Annual," Volume 1, 2002, (DOE/EIA-0340(02)/1).

Appendix A

Technical Notes

Appendix A

Technical Notes

Note 1: EIA-821: Annual Fuel Oil and Kerosene Sales Report, 2002

Background

The EIA-821, "Annual Fuel Oil and Kerosene Sales Report" survey was implemented to meet Energy Information Administration (EIA) legislative mandates and data user needs. Form EIA-821 is used to gather data on the sales to energy users of distillate fuel oil, residual fuel oil, and kerosene. The data are used to determine the level of demand by energy use category and product at the State, regional, and national levels. This mandatory report is authorized by the Federal Energy Administration Act of 1974 (P. L. 93-275).

The predecessor survey to the EIA-821 was the EIA-172, "Sales Report of Fuel Oil and Kerosene" survey. The EIA-172 was conducted for reference years 1979 through 1982. Due to a serious deterioration in the sample of respondents during the 4-year period, the Form EIA-172 data were not collected for 1983. Instead, estimates for 1983 were published and a new sample of respondents was designed and selected from an improved sampling frame. The EIA-821 survey commenced with reference year 1984.

Discussion of Sampling Frame

The target population for the fuel oil and kerosene sales survey is the universe of companies that sell fuel oil and kerosene to energy users.

The EIA-863 database provided the sampling frame for the EIA-821 survey. The EIA-863, "Petroleum Product Sales Identification Survey," was mailed to approximately 22,300 companies in January 1999 to collect 1998 State-level sales volume data for No. 2 distillate, residual fuel, motor gasoline, and propane. Companies also indicated if they sold kerosene. The No. 2 distillate data were further identified by residential and nonresidential energy use, and non-energy use sales; the residual data were identified by energy use and non-energy use; motor gasoline was identified by energy use and non-energy use and by conventional and oxygenated and/or reformulated; and propane was identified by residential, nonresidential, and non-energy use sales. The mailing list for the EIA-863 survey was constructed by merging and unduplicating the 1994 frame file and more than 50 State and commercial lists. In addition, company/State-level volumes for distillate fuel, residual fuel, motor gasoline, and propane from the 1998 EIA-821 survey were merged with the EIA-863 to yield a combined data file. The transformed and edited version of the frame was then used to design and select the 1999 EIA-821 sample.

It should be noted that truck stops selling No. 2 diesel fuel were not specifically included in the EIA-863 survey. Therefore, the EIA-821 survey does not include all sales of No. 2 distillate through retail truck stops. However, to compensate for this shortage in coverage, data from the Federal Highway Administration are presented in the tables for on-highway diesel sales.

The sampling frame also lacked full coverage of kerosene retailers, many of whom are hardware stores and service stations. To account for all kerosene volumes supplied to the marketplace, aggregate reported kerosene volumes are set equal to the products supplied volumes published in the *Petroleum Supply Annual*.

Discussion of the Sample Design

The purpose of the EIA-821 sample design was to produce State-level estimates of total sales for the following five target variables: (1) residential No. 2 distillate, (2) other retail No. 2 distillate, (3) wholesale No. 2 distillate, (4) retail residual, and (5) wholesale residual. A separate sample was initially designed for each target variable.

Companies were divided into two basic types of strata: certainty and noncertainty. Companies selected with certainty were:

- All refiners and gas plant operators.
- Companies doing business in four or more States.
- Companies accounting for 5 percent or more of the distillate or residual fuel oil volume for any target variable or particular energy use category sold in a State.
- Companies accounting for 5 percent or more of the kerosene volume sold in a State in an earlier EIA-821 survey.

- Augmented frame units, e.g., vessel bunkering, for which no attribute data were available.

Firms determined not to be selling distillate or residual fuel oil or kerosene were removed from the frame file. Volumes for nonrespondents to the EIA-863 who had reported in the previous frame survey or in a sample survey were imputed. The imputed nonrespondents and the noncertainty companies were stratified by sales volume for each target variable. Strata boundaries were determined using the Dalenius-Hodges procedures, allowing the number of strata and the strata boundaries to vary by State. Nonrespondents for whom no previous information was available were classified in a separate stratum and sampled with reduced probabilities of selection.

Neyman allocation was used to allocate the number of companies required for each strata to obtain the required levels of accuracy: a 2.5 percent coefficient of variation for residual fuel oil and a 5 percent coefficient of variation for distillate fuel oil. Sample selections were then performed simultaneously from the same random list for the five samples to produce a final linked sample of approximately 4,700 companies. This method reduced the total survey sample size while improving volume estimates. Selected companies were asked to report sales by end-use categories for distillate and residual fuel oil and kerosene.

Imputation and Estimation

Survey data gathered from the respondents may contain incomplete reporting, total nonresponse, or values that fail editing. Missing data are estimated, or implicitly imputed for, using the strata means and treated the same as reported data. The weighted estimate is defined as follows:

$$\hat{V} = \sum_h N_h \left(\sum_i W_{hi} V_{hi} \Big/ \sum_i W_{hi} \right)$$

where:

$\hat{V}$ = total estimated volume

$\sum_h$ = denotes summation over strata

N_h = stratum population for stratum h

$\sum_i$ = denotes summation over units within stratum h

V_{hi} = volume reported for unit i in stratum h

W_{hi} = weight attached to unit i in stratum h.

where: W_{hi} is inversely proportional to the probability of inclusion in the linked sample.

The degree of imputation by product and energy use at the U.S. total level ranged as follows for the 2002 EIA-821 data: distillate, 2.5 percent for railroad use to 23.1 percent for off-highway use; residual fuel oil, 0.1 percent for oil company use to 9.1 percent for industrial use; and kerosene, 3.8 percent for industrial use to 11.5 percent for residential use.

Collection Methods

The EIA-821 form was mailed in January 2002 to all companies selected for participation in the 2001 reference year survey. The completed form was due to EIA on March 4, 2002. A second request was sent by certified mail to nonrespondents approximately 1 month after the filing deadline. Follow-up telephone calls were made to collect outstanding data and to verify reported data. Late submissions and resubmissions were processed when received.

Data Processing

As EIA-821 forms were received, they were logged into an automated Survey Control File that maintains company identification and survey form status information for each company selected to participate in the survey. The data were reviewed manually, entered onto the computer files, and then processed through an automated edit program which detected missing data and outlying values. Data that failed the edits were resolved through telephone calls to the data reporters and corrections were entered onto the computer files. Preliminary estimates were generated and processed through a series of validation procedures to flag and rectify potential misreporting of data. Statistical reports, including publication tables, were produced using only acceptable and verified data.

Note 2: Reliability of the Data

Two types of errors are associated with data produced from a sample survey—sampling errors and nonsampling errors. Sampling errors occur because the estimates are based on a sample rather than on a census. The particular sample used for the EIA-821 survey is one of a large number of samples of equal size which could have been selected from the sampling frame using the same sample design. Each of these samples would produce a different estimate. If the estimates were averaged over all possible samples, the result would be the same as the estimate derived from a census of the sampling frame. The sampling error is a measure of variability among the estimates from all possible samples and, thus, is a measure of the precision with which an estimate from a particular sample approximates the results of a census.

Nonsampling errors and possibly biases can arise from a number of sources: (1) inability to obtain information about all cases in the sample, (2) response errors, (3) differences in the interpretation of questions or definitions, (4) mistakes in recording or coding of the data obtained, and (5) other errors of collection, response, coverage, and estimation for missing data. Bias is the difference between the average of the estimates over all possible samples of the same size and design, and the true value being estimated. It is not possible to estimate bias using the results of one sample.

Data obtained from alternate sources are not subject to sampling errors, but may be subject to nonsampling errors, the magnitudes of which are unknown. Nonsampling errors for survey estimates and estimates adjusted to alternate sources cannot be determined, but attempts are made throughout survey processing to minimize this type of error.

Data in Tables 1 through 12 are based on survey data which are subject to sampling errors. Coefficients of variation, which are estimates of sampling errors, are presented for the retail target variables in the following table for the 2001 survey. The coefficients of variation (CV) were estimated by:

$$CV(\hat{V}) = \frac{\sqrt{VAR(\hat{V})}}{\hat{V}}$$

where:

$$VAR(\hat{V}) = \sum_h n_h \left(1 - \frac{n_h}{N_h}\right) S_h^2$$

$$S_h^2 = \frac{\sum_{i=1}^{n_h} W_i^2 V_i^2 + \overline{V}_h^2 \sum_{i=1}^{n_h} W_i^2 - 2\overline{V}_h \sum_{i=1}^{n_h} W_i^2 V_i}{n_h - 1}$$

$$\overline{V}_h = \frac{\sum_{i=1}^{n_h} W_i V_i}{\sum_{i=1}^{n_h} W_i}$$

$\hat{V}$ = total estimated volume,

N_h = stratum population for stratum h,

n_h = number of sample units in stratum h,

V_i = volume for unit i,

W_i = weight for unit i.

Response rates also offer some indication of the reliability and comprehensiveness of survey results. For the 2002 EIA-821 survey, the overall response rate (the number of submissions received, divided by the number of submissions solicited and expected, times 100) was 91.2 percent.

Coefficients of Variation for Sales of Fuel Oil, 2002

Geographic Area	Residential Distillate Fuel Oil	Non-Residential Retail Distillate Fuel Oil	Retail Residual Fuel Oil
U.S. Average	**1.9**	**0.6**	**0.1**
PAD District 1 Average	**2.1**	**0.9**	**0.1**
Subdistrict 1A Average	**2.4**	**1.2**	**0.1**
Connecticut	5.5	3.5	0.1
Maine	5.6	1.8	0.0
Massachusetts	3.9	2.5	0.1
New Hampshire	5.4	2.2	0.0
Rhode Island	4.2	2.6	0.0
Vermont	2.8	2.0	0.0
Subdistrict 1B Average	**3.6**	**1.9**	**0.0**
Delaware	3.3	1.1	0.0
District of Columbia	0.1	0.1	0.0
Maryland	5.0	2.3	0.0
New Jersey	5.1	3.3	0.0
New York	6.8	3.2	0.0
Pennsylvania	4.0	3.7	0.0
Subdistrict 1C Average	**3.1**	**1.2**	**0.1**
Florida	7.5	2.9	0.0
Georgia	10.9	1.6	0.0
North Carolina	5.9	2.6	0.4
South Carolina	9.4	3.4	0.0
Virginia	4.3	3.5	0.1
West Virginia	5.1	1.4	0.0
PAD District 2 Average	**3.3**	**0.9**	**0.1**
Illinois	7.8	5.9	0.0
Indiana	9.0	2.6	0.0
Iowa	17.4	2.4	0.9
Kansas	17.6	2.3	0.0
Kentucky	6.6	1.7	0.0
Michigan	6.0	1.9	0.0
Minnesota	6.0	1.9	0.1
Missouri	29.8	4.1	0.0
Nebraska	19.8	5.6	0.1
North Dakota	8.0	4.5	0.0
Ohio	9.1	2.0	0.0
Oklahoma	44.6	2.8	2.1
South Dakota	8.0	2.9	0.0
Tennessee	10.5	1.9	0.0
Wisconsin	8.8	5.4	0.0
PAD District 3 Average	**37.3**	**1.6**	**0.0**
Alabama	63.7	3.0	0.0
Arkansas	80.1	3.8	0.0
Louisiana	40.7	4.5	0.0
Mississippi	1.5	2.5	0.0
New Mexico	5.8	3.5	0.0
Texas	2.2	2.7	0.0
PAD District 4 Average	**6.0**	**0.9**	**0.0**
Colorado	7.2	1.8	0.0
Idaho	10.0	2.5	0.0
Montana	6.3	1.7	0.0
Utah	9.5	1.7	0.0
Wyoming	1.5	2.0	0.0
PAD District 5 Average	**5.3**	**1.7**	**0.1**
Alaska	5.2	1.8	0.0
Arizona	0.1	1.6	0.0
California	8.2	3.5	0.0
Hawaii	0.0	0.7	0.0
Nevada	0.0	1.4	0.1
Oregon	6.1	3.5	0.0
Washington	12.1	3.6	0.0

Note: Coefficients of variation that are less than 0.1 and greater than zero are displayed as 0.1.
Sources: • Energy Information Administration Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2002.

Note 3: Data Adjustments

Alternate Source Data

After all preliminary tabulations were verified, comparisons were made between the survey results and available alternate source data. The following energy use categories were replaced by alternate source data at the U.S., Petroleum Administration for Defense (PAD) district, or State level:

Tables 1 through 12:

On-Highway Diesel. Distillate fuel oil by State was calculated from the Federal Highway Administration data on highway use of special fuels. Of the 1998 through 2002 special fuels, more than 99 percent is diesel.

Tables 13 through 24:

The 2001 adjusted numbers have been revised since they were first published in the *Fuel Oil and Kerosene Sales* 2001. The revisions to the data were made to include new distillate and residual volumes for "Electric Power" and a new resisidual product supplied number. See Electric Power below for further explanation on how the data are calculated.

Electric Power. National-level distillate and residual fuel oil sales for electric power use were calculated from annual aggregations of data collected on the EIA-906, "Power Plant Reprot." Form EIA-906 utility and nonutility, NAICS 22 companies, consumption data was added to the stock change of distillate and residual, respectively. Allocations at the State level were based on the EIA-821 survey.

On-Highway Diesel. Distillate fuel oil by State was calculated from the Federal Highway Administration data on highway use of special fuels. Of the 1998 through 2002 special fuels, more than 99 percent is diesel.

1998 through 2002 Adjustments

Kerosene volumes in Tables 1 through 24 are adjusted at the national level to equal products supplied volumes as published in the "Detailed Statistics" section of the *Petroleum Supply Annual* (PSA). The 2002 survey resulted in 629,520 thousand gallons of kerosene at the national level. The products supplied volume at the national level for kerosene was 664,314 thousand gallons. Hence, the adjustment factor at the national level for 2002 was 1.06.

Volumes of distillate fuel oil in Tables 13 through 24 were adjusted at the PAD district level to equal products supplied volumes. The adjustment factors at the PAD district level for 2002 are as follows:

Distillate Fuel Oil

- PAD District 1: .94
- PAD District 2: .90
- PAD District 3: 1.12
- PAD District 4: .94
- PAD District 5: .84

For Tables 13 through 24, total sales at the PAD district level equal the products supplied volumes as reported in the PSA, 1998 through 2002. For example, the 2002 survey yielded a volume for distillate residential use in PAD District 2 of 594,109 thousand gallons. The total distillate volume for PAD District 2 was 5,801,754 from the survey, after subtracting the volume coming from alternate sources. The product supplied total distillate volume for PAD District 2 was 5,201,114 after removing alternate source volume. Hence, the adjusted 2002 estimate of distillate for residential use in PAD District 2 was (5,201,114/5,801,754) x 594,109 = 532,602. For distillate fuel oil in Tables 13 through 24, the PAD district adjustments were made to each State and product-use category except on-highway diesel use and electric utility use.

Volumes of residual fuel oil in Tables 13 through 24 were adjusted at the national level to equal the products supplied estimate. The 2002 survey yielded 10,361,615 thousand gallons of residual fuel oil, while the products supplied volume at the national level was 10,724,994 thousand gallons. Thus, the adjustment factor at the national level for 2002 was .98, after subtracting the volumes coming from alternate sources. For residual fuel oil, the adjustments were made to each State and energy use category except electric power.

Note 4: Energy Use Descriptions and Petroleum Product Definitions

Energy Use Descriptions

Residential. An energy-consuming sector that consists of living quarters for private households. Common uses of energy associated with this sector include space heating, water heating, air conditioning, lighting, refrigeration, cooking, and running a variety of other appliances. Sales to farmhouses are reported under "Farm" and sales to apartment buildings are reported under " Commercial."

Commercial. An energy-consuming sector that consists of service-providing facilities and equipment of nonmanufacturing businesses; Federal, State, and local governments; and other private and public organizations, such as religious, social, or fraternal groups. The commercial sector includes institutional living quarters. Common uses of energy associated with this sector include space heating, water heating, air conditioning, lighting, refrigeration, cooking and running a wide variety of other equipment.

Industrial. An energy-consuming sector that consists of all facilities and equipment used for producing, processing, or assembling goods. The industrial sector encompasses the following types of activity: manufacturing and mining. Overall energy use in this sector is largely for process heat and cooling and powering machinery, with lesser amounts used for facility heating, air conditioning, and lighting. Fossil fuels are also used as raw material inputs to manufactured products.

Oil Company. An energy-consuming sector that consists of drilling companies, pipelines or other related oil companies not engaged in the selling of petroleum products. Includes fuel oil that was purchased or produced and used by company facilities for operation of drilling equipment, other field or refinery operations, and space heating at petroleum refineries, pipeline companies, and oil-drilling companies. Sales to other oil companies for field use are included, but sales for use as refinery charging stocks are excluded.

Farm. An energy-consuming sector that consists of establishments where the primary activity is growing crops and/or raising animals. Energy use by all facilities and equipment at these establishments is included, whether or not it is directly associated with growing crops and/or raising animals. Common types of energy-using equipment include tractors, irrigation pumps, crop dryers, smudge pots, and milking machines. Facility energy use encompasses all structures at the establishment, including the farm house.

Electric Power. An energy-consuming sector that consists of electricity only and combined heat and power(CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public--i.e., NAICS 22 plants. Volumes directly imported and used by the electric power companies are included.

Railroad. An energy-consuming sector that consists of all railroads for any use, including that used for heating buildings operated by railroads.

Vessel Bunkering. An energy-consuming sector that consists of commercial or private boats such as pleasure craft, fishing boats, tugboats, an ocean-going vessels, including vessels operated by oil companies. Excluded are volumes sold to the U. S. Armed Forces.

On-Highway Diesel. An energy-consuming sector that consists of motor vehicles: automobiles, trucks, and buses. Vehicles used in the marketing an distribution of petroleum products is also included.

Military. An energy-consuming sector that consists of the U.S. Armed Forces, Defense Energy Support Center (DESC), and all branches of the Department of Defense(DOD).

Off-Highway. An energy-consuming sector that consist of:

1. **Construction.** An energy-consuming sub sector that consist of all facilities and equipment including earthmoving equipment, cranes, generators, air compressors, etc.

2. **Other.** An energy-consuming sub sector that consists of all off-highway uses other that construction. Includes logging, scrape and junk yards, and refrigeration units on trucks.

All Other Uses. Sales for all other energy-consuming sectors not included elsewhere.

Definitions of Petroleum Products and Other Related Terms

ASTM. The acronym for the American Society for Testing and Materials.

Distillate Fuel Oil. A general classification for one of the petroleum fractions produced in conventional distillation operations. It includes diesel fuels and fuel oils. Products known as No. 1, No. 2, and No. 4 diesel fuel are used in on-highway diesel engines, such as those in trucks and automobiles, as well as off-highway engines, such as those in railroad locomotives and agricultural machinery. Products known as No. 1, No. 2, and No. 4 fuel oils are used primarily for space heating and electric power generation.

1. **No. 1 Distillate.** A light petroleum distillate that can be used as either a diesel fuels or a fuel oil.

   a. **No. 1 Diesel Fuel.** A light distillate fuel oil that has distillation temperatures of 550 degrees Fahrenheit at the 90-percent point and meets the specifications defined in

ASTM specification D 975. It is used in high-speed diesel engines generally operated under frequent speed and load changes, such as those in city buses and similar vehicles.

b. **No. 1 Fuel Oil.** A light distillate fuel oil that has distillation temperatures of 400 degrees Fahrenheit at the 10-percent recovery point and 550 degrees Fahrenheit at the 90-percent point and meets the specifications defined in ASTM Specification D 396. It is used primarily as fuel for portable outdoor stoves and portable outdoor heaters.

2. **No. 2 Distillate.** A petroleum distillate that can be used as either a diesel fuel or a fuel oil.

   a. **No. 2 Diesel Fuel.** A fuel that has distillation temperatures of 400 degrees Fahrenheit at the 10-percent recovery point and 640 degrees Fahrenheit at the 90-percent recovery point and meets the specifications defined in ASTM Specification D 975. It is used in high speed diesel engines that are generally operated under uniform speed and load conditions such as those in railroads locomotives, trucks, and automobiles.

      (1) **Low Sulfur No. 2 Diesel Fuel.** No. 2 diesel fuel that has a sulfur level no higher than 0.05 percent by weight. It is used primarily in motor vehicle diesel engines for on-highway use.

      (2) **High Sulfur No. 2 Diesel Fuel.** No. 2 diesel fuel that has a sulfur level above 0.05 percent by weight.

   b. **No. 2 Fuel Oil (Heating Oil).** A distillate fuel oil that has distillation temperatures of 400 degrees Fahrenheit at the 10-percent recovery point and 640 degrees Fahrenheit at the 90-percent recovery point and meets the specification defined in ASTM specification D 396. It is used in atomizing type burners for domestic heating or for moderate capacity commercial/industrial burner units.

3. **No. 4 Fuel.** A distillate fuel oil made by blending distillate fuel oil and residual fuel oil stocks. It conforms with ASTM Specification D 396 or Federal Specification VV-F-815C and is used extensively in industrial plants and in commercial burner installations that are not equipped with preheating facilities. It also includes No. 4 diesel fuel used for low-and medium-speed diesel engines and conforms to ASTM Specification D 975.

NOTE: Respondents to the EIA-821 survey were instructed to report all volumes in accordance with what the product was sold as, regardless of the actual specifications of that product. For example, if a No. 2 distillate was sold as a heating oil or fuel oil, the volume would be reported in the category "No. 2 Fuel Oil" even if the product conformed to the higher specifications of a diesel fuel.

Kerosene. A light petroleum distillate that is used in space heater, cook stoves, an water heaters and is suitable for use as a light source when burned in wick-fed lamps. Kerosene has a maximum distillation temperature of 400 degrees Fahrenheit at the 10-percent recovery point, a final boiling point of 572 degrees Fahrenheit, and a minimum flash point of 100 degrees Fahrenheit. Included are No. 1-k and No. 2-k, the two grades of kerosene called range or stove oil, which have properties similar to those of No. 1 fuel oil.

PAD District. Petroleum Administration for Defense Districts

PAD District 1 (East Coast):

Subdistrict 1A (New England): Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont
Subdistrict 1B (Central Atlantic): Delaware, District of Columbia, Maryland, New Jersey, New York, and Pennsylvania
Subdistrict 1C (Lower Atlantic): Florida, Georgia, North Carolina, South Carolina, Virginia, and West Virginia

PAD District 2 (Midwest):

Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, Ohio, Oklahoma, Tennessee, and Wisconsin

PAD District 3 (Gulf Coast):

Alabama, Arkansas, Louisiana, Mississippi, New Mexico, and Texas

PAD District 4 (Rocky Mountain):

Colorado, Idaho, Montana, Utah, and Wyoming

PAD District 5 (West Coast):

Alaska, Arizona, California, Hawaii, Nevada, Oregon, and Washington

Residual Fuel Oils. A general classification for the heavier oils, know as No. 5 and No. 6 fuel oils that remain after the distillate fuel oils an lighter hydrocarbons are distilled away in refinery operations. It conforms to ASTM Specification D 396 and D 975 and Federal Specification VV-F-815C. No. 5, a residual fuel oil of medium viscosity , is also know as Navy Special an is defined in Military Specification MIL-F859E, including Amendment 2 (NATO Symbol F-77). It is used in steam-powered vessels in government service and inshore power plants. No. 6 fuel oil includes Bunker C fuel oil and is used for the production of electric power,space heating, vessel bunkering , and various industrial purposes.

United States. The United States includes the 50 states and the District of Columbia.

Appendix B

Form EIA-821: Annual Fuel Oil and Kerosene Sales Report

Appendix B

U.S. DEPARTMENT OF ENERGY
Energy Information Administration

Form Approved
OMB Number: 1905-0174
Form Expires: 11/30/03

EIA-821: ANNUAL FUEL OIL AND KEROSENE SALES REPORT

This report is mandatory under Public Law 93-275. Title 18 U.S.C. 1001 makes it a criminal offense for any person knowingly and willingly to make to any Agency or Department of the United States any false, fictitious, or fraudulent statements as to any matter within its jurisdiction. For the provisions concerning the confidentiality of information and sanctions, see Sections 8 and 9 of the instructions.

PART I. IDENTIFICATION DATA

For assistance in completing this form call 1-800-592-2299

Provide **Corrections** to Company Name, Address, and Contact information in Items 1-8

1. Company Name	7. Name of Contact Person
2. Street	8. Contact Information a. Telephone Number ___ - ___ - ___
3. P.O. Box / RFD	b. Fax Number ___ - ___ - ___
4. City · 5. State · 6. Zip Code	c. Email Address ______

9. Reference Year **2002**

10. Type of Report (*Check One*) (1) ☐ Original (2) ☐ Resubmission

11. The Number of States for Which You Are Reporting

12. Which of the following best describes this firm at the end of 2002?

a. ☐ In operation - Sales include petroleum products — Skip to and complete items 22-25 and Part II

b. (1) ☐ Sold or Merged
(2) ☐ Leased — Complete items 13 to 25, and Part II for that portion of 2002 in which the firm was active under your ownership and control

c. ☐ Permanently ceased operation — Complete item 13, then skip to and complete items 22-25 and Part II for the portion of 2002 in which the firm was active under your ownership and control

d. ☐ Subsidiary of another
e. ☐ Commissioned Agent — Complete items 13 to 25, and Part II for that portion of 2002 in which the firm was active under your ownership and control

f. ☐ Not in petroleum business — Skip to and complete items 22-25

13. Effective Date of Status Change

Month	Day	Year

14. Name of Company Sold to / Leased to / Merged into / Subsidiary of / Agent for:

15. Name of Contact Person

16. Contact's Telephone Number ___ - ___ - ___

17. Street

18. PO Box / RFD

19. City 20. State 21. Zip Code

PREPARED BY: *Check appropriate box.* If preparer is different from contact person, complete lines 24 and 25.

22. ☐ Preparer same as contact person shown on label	23. Date
24. ☐ Preparer's Name	25. Preparer's Telephone number

Page 1

EIA-821 (12-02)

Name of Firm Reporting	DOE ID Number	Reference Year **2002**	Page_________ of ________

PART II. TOTAL SALES DURING THE REFERENCE YEAR. (READ PAGES 2-4 OF INSTRUCTIONS CAREFULLY)

Line No.	Type of Fuel and Use	States of Destination (*Enter* STANDARD ABBREVIATIONS)		
	Sold directly to consumers for	**Kerosene** (*Report in Actual Gallons*)		
1	Residential Use (Non-Farm):			
2	Commercial Use:			
3	Industrial Use:			
4	Farm Use:			
5	All Other Uses (*Include own company use*):			
6	Sold to Dealers, Resellers, and Refiners:			
7	**Total Kerosene (Add Lines 1 thru 6)**			
	Sold directly to consumers for	**Distillate Fuel Oil** (*Report in Actual Gallons*)		
	Residential Use (Non-Farm):			
8	No. 1			
9	No. 2			
	Commercial Use (See Reference Guide):	*Report sales of Low Sulfur Diesel to automobiles, trucks, buses, and school buses on line 28 On-highway Diesel Use with the exception of government vehicles which should be reported on line 12.*		
10	No. 1			
11	No. 2 Fuel Oil			
12	No. 2 Diesel ≤ .05% Sulfur, Low			
13	No. 2 Diesel > .05% Sulfur, High			
14	No. 4			
	Industrial Use (Manufacturing and Mining):			
15	No. 1			
16	No. 2 Fuel Oil			
17	No. 2 Diesel ≤ .05% Sulfur, Low			
18	No. 2 Diesel > .05% Sulfur, High			
19	No. 4			
20	Oil Company Use (Drilling and Own Company Refining):			
21	Railroad Use:			
22	Vessel Bunkering (Shipping and Boating):			

Name of Firm Reporting	DOE ID Number	Reference Year **2002**	Page________ of________

PART II. TOTAL SALES DURING THE REFERENCE YEAR. (READ PAGES 2-4 OF INSTRUCTIONS CAREFULLY)

Line No.	Type of Fuel and Use	States of Destination (*Enter* STANDARD ABBREVIATION)		
	Distillate Fuel Oil--Continued (*Report in Actual Gallons*)			
	Military Use:			
23	Diesel			
24	Other Distillate			
25	Electric Power Use (Electric utility and Nonutility power producers):			
	Farm Use:			
26	Diesel			
27	Other Distillate			
28	**On-highway Diesel Use:**			
	Off-highway Use:			
29	Construction			
30	Other (Specify e.g., Logging)____________			
31	All Other Uses (Specify):________________			
32	Sold to Dealers, Resellers, and Refiners:			
33	**Total Distillate (Add Lines 8 thru 32)**			
	Residual Fuel Oil - Include No.5 and No. 6 (*Report in Actual Gallons*)			
	Sold directly to consumers for			
34	Commercial Use (Nonmanufacturing):			
35	Industrial Use (Manufacturing and Mining):			
36	Oil Company Use (Drilling and Own Company Refining):			
37	Railroad Use (Include Volumes on line 41):			
38	Vessel Bunkering:			
39	Military Use:			
40	Electric Power Use (Electric utility and Nonutility power producers):			
41	All Other Uses (Specify):_______________			
42	Sold to Dealers, Resellers, and Refiners:			
43	**Total Residual (Add Lines 34 thru 42)**			

Name of Firm Reporting	DOE ID Number	Reference Year **2002**	Page________ of________

PART II. TOTAL SALES DURING THE REFERENCE YEAR. (READ PAGES 2-4 OF INSTRUCTIONS CAREFULLY)

Line No.	Type of Fuel and Use	States of Destination (*Enter* STANDARD ABBREVIATIONS)		
	Motor Gasoline -- Include Gasohol (*Report in Actual Gallons*)			
	Conventional (including Oxygenated) Motor Gasoline			
44C	Sold directly to the Ultimate Consumer (Include All grades of Gasoline - Exclude No. 2 Diesel and Aviation Gasoline):			
45C	Sold to Dealers, Resellers, and Refiners (Include Rack and DTW Sales):			
46C	**Total Conventional Motor Gasoline (Add Lines 44C and 45C)**			
	Reformulated Motor Gasoline			
44R	Sold directly to the Ultimate Consumer (Include All grades of Gasoline - Exclude No. 2 Diesel and Aviation Gasoline):			
45R	Sold to Dealers, Resellers, and Refiners (Include Rack and DTW Sales):			
46R	**Total Reformulated Motor Gasoline (Add Lines 44R and 45R)**			
	Propane (*Report in Actual Gallons*)			
47	Delivered Residential Propane:			
48	Sold to Customers for All Other End Uses:			
49	Sold to Dealers, Resellers, and Refiners:			
50	**Total Propane (Add Lines 47 thru 49)**			

51 Does this firm sell any of these petroleum products? *Check boxes for all that you sell.*

a. ☐ No. 1 Distillate b. ☐ Crude Oil c. ☐ Other LPG d. ☐ No. 4 Fuel Oil

e. ☐ Aviation Gasoline f. ☐ Jet Fuel g. ☐ Other:________________________ (*Specify*)

52 Does this firm sell and/or use propane for on-highway transportation use? *Check appropriate box(es).*

a. ☐ Sell b. ☐ Use c. ☐ No

53 Does this firm currently sell (or has it ever sold) distillate fuel oil to railroad companies?

a. ☐ Yes b. ☐ No

Send the completed form to: **U.S. Department of Energy**
Energy Information Administration (EIA-821)
P.O. Box 833
Merrifield, VA. 22116-0833

or telefax completed form by calling: **1(703) 676-7514, Attn: EIA-821**

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Appendix C

Fuel Oil and Kerosene Sales 2004

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DOE/EIA-0535(04)
Distribution Category UC-950

Fuel Oil and Kerosene Sales 2004

November 2005

Energy Information Administration
Office of Oil and Gas
U.S. Department of Energy
Washington DC 20585

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Contacts

The *Fuel Oil and Kerosene sales 2004* report is prepared by the Energy Information Administration (EIA) under the general direction of John Cook (202) 586-5214, Petroleum Division, Office of Oil and Gas.

Detailed, technical questions about tables referencing the form EIA-821 may be directed to:

Daniel Walzer (202) 586-3511

Fuel Oil and Kerosene Data Available Through Electronic Access

Annual petroleum marketing data are available through electronic access that contains statistics from the *Fuel Oil and Kerosene sales 2004* report. Included are annual sales data on petroleum volumes of kerosene, distillate fuel oils, and residual fuel oils by State. Annual historical data at the national level are provided in summary tables.

For *Fuel Oil and Kerosene Sales* on the Internet, access EIA's home page at http://www.eia.doe.gov.

Internet Addresses:

E-Mail: infoctr@eia.doe.gov
World Wide Web Site: http://www.eia.doe.gov

Further information as to content may be obtained from the National Energy Information Center (NEIC), telephone (202) 586-8800.

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Tables

Sales of Fuel Oil and Kerosene in 2004

Adjusted Sales of Fuel Oil and Kerosene in 2004

Introduction

The *Fuel Oil and Kerosene Sales 2004* report provides information, illustrations and State-level statistical data on energy use sales of kerosene; No.1, No. 2, and No. 4 distillate fuel oil; and residual fuel oil. State-level kerosene sales include volumes for residential, commercial, industrial, farm, and all other uses. State level distillate sales include volumes for residential, commercial, industrial, oil company, railroad, vessel bunkering, military, electric power, farm, on-highway, off highway construction, and other uses. State-level residual fuel sales include volumes for commercial, industrial, oil company, vessel bunkering, military, electric power, and other uses. The Petroleum Division, Office of Oil and Gas, Energy Information Administration ensures the accuracy, quality, and confidentiality of the published data in the *Fuel Oil and Kerosene Sales 2004*.

NOTE: The 2003 adjusted numbers have been revised since they were first published in the *Fuel Oil and Kerosene Sales 2003*. The revisions to the data were made to include new distillate fuel oil and residual fuel oil volumes for “Electric Power”. See the Adjusted Sales section and “Technical Note 3" in Appendix A for further explanation.

Except for the kerosene and on-highway diesel information, data presented in Tables 1 through 12 (Sales of Fuel Oil and Kerosene) present results of the EIA- 821 survey. Tables 13 through 24 (Adjusted Sales of Fuel Oil and Kerosene) include volumes that are based on the EIA-821 survey but have been adjusted to equal the products supplied volumes published in the *Petroleum Supply Annual* (PSA).

Tables 1 through 12 contain sales estimates resulting from the EIA-821 survey for all categories except kerosene and on-highway diesel. For on-highway diesel the survey was not expected to yield valid statistics because the sampling frame does not include a comprehensive listing of all truck stops. Hence, State-level data obtained from the Federal Highway Administration were used instead.

Kerosene sales data were not expected to be complete because a comprehensive listing of kerosene retailers was not available to serve as a sampling frame. It was thought that a complete frame would be expensive to construct because many kerosene retailers are convenience stores or other small businesses. Because of these concerns, kerosene sales data have been published only after adjusting the sales data so that they add to the U.S. total of kerosene product supplied from the PSA.

In Tables 13 through 24, estimates of distillate fuel oil are adjusted at the Petroleum Administration for Defense (PAD) district level to equal published PSA volume estimates of products supplied. For certain sales categories, data obtained from alternate sources are used instead of the adjusted numbers. See “Technical Note 3" in Appendix A for further explanation.

Kerosene and residual fuel oil in Tables 13 through 24 are adjusted at the national level to equal published PSA products supplied estimates. Thus the kerosene figures in Tables 13 through 24 are identical to those shown in Tables 1 through 12.

The sales data (Tables 1 through 12) differ from the adjusted sales estimates (Tables 13 through 24) with the exception of kerosene and on-highway diesel for many reasons, including:

- Some products are interchangeable (fungible) and may be supplied as one product and sold as another product. For example, kerosene, low sulfur kerosene type jet fuel, and low-sulfur No. 1 fuel oil can be used interchangeably.

- Products supplied into a PAD district may be blended prior to final sale. For example, residual fuel and No. 2 distillate may be blended and sold as No. 4 fuel oil or, in colder climates, kerosene maybe blended with distillate fuel oil and sold as heating oil.

- Geographic differences can be attributed to the transportation of product by truck or rail from the district of production. Inter-PAD district movements of products by these modes of transportation are not accounted for in Tables 13 through 24.

- Products maybe supplied into a PAD district but the final sale may cross PAD district boundaries. For example, a fuel oil dealer in Ohio (PAD District 2) may make retail sales into Pennsylvania (PAD District 1B) and/or West Virginia (PAD District 1C).

- Drawdowns or buildups in stocks will cause volumes supplied to differ from sales volumes.

Highlights

Sales of Fuel Oil and Kerosene in 2004

Market conditions in 2004 were very different from those in 2003 when a large increase in distillate sales combined with sizable increases in sales of residual fuel oil and kerosene, resulted in a new record for combined fuel oil sales. In 2004, a sharp drop in sales of distillate more than offset increased sales of residual fuel oil and kerosene. Consequently, total sales of fuel oil and kerosene totaled 75.0 billion gallons or just over one billion gallons less than the all-time record of 76.1 billion gallons set in 2003. Distillate sales accounted for 83.0 percent of total sales the smallest share since 2001 when distillates accounted for 80.3 percent. Sales of residual fuel oil accounted for approximately 15.7 percent up from 15.0 percent in 2003 and sales of kerosene accounted for the remaining 1.3 percent compared to 1.1 percent of total sales in 2003.[1]

Despite robust economic growth, sales of distillate declined during 2004. With the exception of sales of on highway diesel fuel and sales to the construction and off road sectors, distillate sales fell in comparison to the levels set in 2003. A number of factors had a negative influence on the market during the year, although high prices played a role, weather was an important factor as well. Not only was the winter warmer than normal but severe weather also had a negative impact on oil company direct use and sales to the agriculture sector. Total distillate sales were 62.3 billion gallons a drop of nearly 1.6 billion gallons (2.50 percent) from the all-time high set in 2003 of 63.9 billion gallons.

Despite a sharp decline in sales to the utility sector, overall sales of residual fuel oil increased on the strength of increased sales to the industrial and bunker sectors. Total sales of residual fuel increase by more than 381.5 million gallons (an increase of 3.3 percent) to reach 11.8 billion gallons, the highest level of sales since 2001.

Sales of kerosene also increased sharply continuing the recovery from the 2002 when sales plunged by 40 percent. Although sales increase by 18.1 percent to

Table HL1. Volume Distribution of Distillate and Residual Fuel Oils, 2003 and 2004

Energy Use	2004 Distillate		2003 Distillate		2004 Residual		2003 Residual	
	Volume (million gallons)	Percent Share	Volume (million gallons)	Percent Share	Volume (million gallons)	Percent Share	Volume (million gallons)	Percent Share
Residential.................	6,645	10.7	6,927	10.8	—	—	—	—
Commercial................	3,383	5.4	3,687	5.8	782	6.6	756	6.6
Industrial....................	2,327	3.7	2,394	3.7	1,540	13.1	1,414	12.4
Oil Company..............	473	0.8	514	0.8	47	0.4	84	0.7
Farm...........................	3,189	5.1	3,201	5.0	—	—	—	—
Electric Power............	823	1.3	1,148	1.8	4,704	39.9	5,273	46.2
Railroad.....................	3,047	4.9	3,657	5.7	—	—	—	—
Vessel Bunkering…….	2,140	3.4	2,217	3.5	4,690	39.8	3,874	34.0
On-Highway...............	37,125	59.6	37,104	58.1	—	—	—	—
Military.......................	359	0.6	416	0.7	30	0.3	10	0.1
Off-Highway...............	2,747	4.4	2,592	4.1	—	—	—	—
Other.........................	0	0.0	0	0.0	1	0.0	2	0.0
Total..........................	62,258		63,855		11,761		11,413	

Notes: Totals may not equal sum of components due to independent rounding.
Sources: Energy Information Administration Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2000-2004. On-Highway Diesel data are Federal Highway Administration statistics of highway special fuels use.

[1] Numbers may not sum to 100 percent due to rounding.

reach 988.7 million gallons, the total nonetheless remained below the record level of 1.1 billion gallons set in 2001.

Distillate Fuel Oil

In 2004, distillate sales fell by nearly 1.6 billion gallons reflecting a very different pattern of sales from that in 2003 when distillate sales surged to a new record. Distillate sales had grown throughout the 1990's and with the single exception of 2001continued to grow through 2003. The drop in 2004 not only goes against the long-term trend but also is nearly three times the size of the drop in sales that occurred in 2001 when total distillate sales fell by 588 million gallons.[2] In 2004, only two sectors showed any increase and the on-highway sector (accounting for more than half of all sales) was essentially unchanged increasing by less than one tenth of one percent. Only the off-highway and construction sector had more than a small increase growing by 6.0 percent or 155.1 million gallons. The overall decline in sales during 2004 came about as the result of a number of factors which for the most part acted to restrain sales, but which in some cases helped boost sales to a particular sector or region.

Economic conditions improved during 2004. Gross Domestic Product (GDP) a prime measure of the state of the economy increased by 4.4 percent in constant dollars, the highest increase since 2001. In 2003, rising fuel costs (especially for natural gas) contributed to a slight drop in the overall production of goods and an increase in industrial utilization of less than 0.3 percent. However, in 2004, even higher energy prices did not appear to restrain production. Instead, new construction in the commercial sector increased by 6.7 percent, production of durable goods increased by 6.9 percent, total manufacturing increased by 3.9 percent and the industrialization utilization rate increased by 3.4 percent.[3] Further, total energy consumption in the United States increased by 1.54 quads, an increase more than three times the increase of 2003. Consequently, total energy consumption for the nation reached an all-time high of 99.76 quads.[4] Improved economic conditions are also reflected by the drop in unemployment from 6.0 to 5.5 percent, the lowest rate since 2001.[5]

Higher prices for oil products throughout most of the year counteracted the positive influence of the growth in the economy on sales to result in declining sales to most sectors of the fuel oil market. In particular, sales to the transportation sector, which had grown dramatically during 2003, fell in 2004. Sales to railroads dropped by 16.7 percent, more than 600 million gallons and sales of bunker fuel dropped by 3.5 percent or 77.3 million gallons. Sales to the on-highway sector did increase but only by about 22 million gallons, less than one tenth of one percent compared to a jump in sales in 2003 of 4.5 billion gallons. Vehicle Miles Traveled (VMT), measures total miles driven throughout the country by all types of vehicles in both urban and rural settings, in 2004, VMT increased by only 1.4 percent less than half of the increase of 2.9 percent of 2003.[6]

In the industrial and commercial sectors, the impact of higher oil prices was offset to some extent by the fuel switching brought about by the price of natural gas, that was significantly higher on a heating value than the price of oil. In early in 2004 the differential between oil and gas helped to boost distillate sales to the industrial sector as customers with the ability to switch from gas to oil did so during a cold snap in January.[7] However, unlike 2003 when fuel switching helped boost sales to the industrial and commercial sectors, in 2004 the cold did not last as long, prices of natural gas moderated sooner, and the nature of the fuel switching differed to some extent from what occurred in 2003. Fuel switching in 2004 benefited distillate sales by about 100,000 b/d but jet fuel and kerosene were the primarily beneficiaries.[8]

Weather was another factor that played a significant role in curtailing distillate demand in 2004 and its impact was more widespread than typical. 2004 was both considerably warmer than 2003 and also considerably warmer than normal. Although the overall difference in 2004 compared to 2003 as measured in heating degree days was just 3.8 percent for the nation as a whole, when examined on a regional basis the differences are more pronounced,

[2] The average increase during the period 1991-2001 was 1.47 billion gallons.
[3] *Economic Indicators,* May 2005, Washington D.C. U.S. Government Printing Office, p 12. (Data are adjusted for inflation using 2000 as the base).
[4] One quad equals one quadrillion (a one followed by fifteen zeros) British thermal units (Btu), source EIA, MER May 2004, Table 2.1
[5] *Economic Indicators,* September 2004, p 12. (Data are adjusted for inflation using 1996 as the base).
[6] Traffic Volume Trends, April 2005, http://www.fhwa.dot.gov/ohim/tvtw/05aprtvt/page3.htm
[7] *Oil Daily* January 16, 2004, page 2.
[8] *Oil Daily*, January 27, 2004, page 5.

particularly in the principal fuel oil consuming sections of the country (New England, the Middle Atlantic and East North Central) where heating oil demand for both residential and commercial consumers is the greatest. The winter of 2004 was warmer than the winter of 2003 in all three of the principal consuming regions and was also warmer than normal in both the Middle Atlantic and the East North Central regions. Overall, sales of heating oil to the residential sector decreased by 282 million gallons or 4.1 percent to 6.6 billion gallons.

The warmer than normal winter also contributed to a sharp decline in distillate sales for use in the electric power generation. In addition, the summer was also cooler than the summer of 2003 in most regions of the U.S.; consequently, demand for distillate fuel to meet peak summer generation loads was not a great as it had been in 2003.[9] Sales to the utility sector fell in every region of the country, dropping by 324.3 million gallons a decline of 28.3 percent.

The one sector of the market that exhibited sizeable growth during 2004 was the off-highway and construction sector. New construction was stimulated by interest rates that remained relatively low, consequently, the number of new housing units surged, increasing by more than 18 percent. Further, new construction in the commercial sector also increased, up by 6.7 percent and the combination helped boost distillate sales to the off-highway and construction market by 6.0 percent or 155.1 million gallons.[10]

At the national level, distillate sales to the agricultural sector were essentially unchanged at 3.2 billion gallons. Sales dropped by only 12.0 million gallons, just 0.4 percent and that small change is also reflected in the number of acres of major crops harvested during 2004. Although the number of acres harvested of cotton, soybeans and corn increased, considerably less wheat was harvested, and as a result, the amount of acres harvested for the principal crops taken together changed by only about one percent. Nationally the amount of citrus fruit harvested increased slightly by 1.3 percent.[11] However, that conceals the fact that the increase took place primarily in the citrus growing regions in the far west, while Hurricane Ivan devastated portions of Florida, a major citrus production center. Distillate sales to the region of PAD District 1[12] that includes Florida plunged by 25.3 percent. Robust increases in the production of nuts, apples, and non-citrus fruits are reflected in a substantial gain in distillate sales for farm use of 16.4 percent in the PAD District 5.

Weather also had a negative impact on sales for direct use by oil companies. Hurricane Ivan also ravaged the oil and gas infrastructure in the Gulf of Mexico causing widespread and extensive damage to production platforms and to subsurface structures in the Gulf of Mexico that in some cases required months to repair. Sales of distillate for oil company direct use nationally fell by nearly 8 percent. The drop was primarily the result of plunging sales in the states adjacent to the Gulf of Mexico; sales in PAD District 3 fell by 15.8 percent. Two regions experienced growth in sales. In PAD District 2, the Middle West and the Rocky Mountains where major exploration efforts for natural gas especially in Wyoming and Colorado are underway. Sales increased by 7.5 million gallons or 10.4 percent in PAD District 2 and by 19.5 million gallons or 46.7 percent in PAD District 4.

On a regional basis, the warmer winter weather resulted in a drop in distillate sales to the residential sector in all three Subdistricts of PAD District 1 (the Atlantic Coast) and in PAD District 2 the Great Lakes and upper Mississippi River Valley. Sales also fell in PAD District 5 (the Pacific Coast). In PAD District 1, sales dropped by a total of 236.3 million gallons, in Subdistrict A, by 29.6 million gallons, in Subdistrict B by 189.7 million gallons, and in Subdistrict C by 16.8 million gallons. Sales increased in PAD District 4 (the Rocky Mountains) by 3.6 million gallons and in PAD District 3 (the Gulf Coast) by 6.6 million gallons.

[9] Smaller peaking units, especially older units are often combustion turbines (in some cases converted jet turbine engines that run on No 2 fuel oil). Such units are used in the winter when it is very cold, periods when interruptible contract provisions are triggered and some users of natural gas must switch to alternatives. It is also not unusual for distillate fuel to be used in such peaking units during the summer to meet peak cooling demand.
[10] *Economic Indicators*, May 2005, Washington, D.C., U.S. Government Printing Office, p 12.
[11] Department of Agriculture, National Agricultural Statistics Service,
[12] The U.S. is divided into 5 Petroleum Administration for Defense Districts (PAD Districts). District 1, East Coast, District 2, Midwest, District 3, Gulf Coast, District 4, Rocky Mountains, and District 5, Pacific Coast. PAD District 1 is broken into three subdivisions: Subdistrict 1A, New England, Subdistrict 1B, Middle Atlantic, and Subdistrict 1C, Southeast.

Sales to the commercial sector decreased sharply in Subdistricts A and B of PAD District 1 falling by 109.4 and 74.4 million gallons respectively. Sales also fell in PAD District 2, down by 52.2 million gallons, PAD District 3 was down by 67.6 million gallons and PAD District 5 where sales dropped by 13.9 million gallons. Sales increased in the South Atlantic portion of PAD District 1 by 11.2 million gallons. Sales also increased by 2.9 million gallons in the Rocky Mountain region. The substantial decreases in the Middle Atlantic and Northeast Subdistricts of PAD District 1, in large measure reflect reduced opportunities for fuel switching that resulted from warmer winter conditions than occurred in 2003.

In 2004, sales of distillate to the industrial sector were generally down on a regional basis. Sales increased only in Subdistrict B of PAD District 1, the Middle Atlantic and in PAD District 5, the Pacific Coast. The increase in the Middle Atlantic region of 35.3 million gallons reflects the significant degree of fuel switching on the part of some industrial consumers that took place in the region. Sales also increased sharply in the Pacific Coast region going up by 44.9 million gallons or 18.6 percent. Despite an increase in total energy consumption by the industrial sector of 0.34 percent sales elsewhere fell.[13] In the New England region of PAD District 1 sales plunged by 20.8 percent, in the South Atlantic portion of PAD District 1, sales dropped by 6.2 percent. Sales also dropped in PAD Districts 2, 3 and 4, by 2.9 percent or 18.8 million gallons, 13.2 percent or 57.0 million gallons, and 6.6 percent or 15.1 million gallons respectively.

Unlike the situation in 2003 when sales to the military surged, growing by more than 16 percent, in 2004 sales to the military fell by 13.7 percent nationally. Sales fell throughout the country with the exception of PAD District 2 where sales were essentially unchanged, registering a very small gain of only 13,000 gallons, about 0.1 percent. Sales in PAD District 1 dropped by 26.1 million gallons or 24.4 percent. In PAD District 3 sales dropped by 22.0 million gallons or 20.0 percent. In PAD District 4 sales fell by 4.9 million gallons or 82.9 percent. In PAD District 5 sales slipped by 4.0 million gallons or 2.2 percent.

Absent the opportunity for large-scale fuel-switching that occurred during the winter of 2003 coupled with extensive damage from severe weather, especially from Hurricane Ivan to areas along the Gulf Coast distillate sales to the electric power sector dropped throughout the U.S. Although there were significant regional differences in the magnitude of the drop in sales, there were no exceptions; sales for use in the generation of electricity fell in every region including all three Subdistricts of PAD District 1. The largest drops occurred in the areas that sustained the most damage from the severe weather, including Hurricane Ivan. Sales in Subdistrict C of PAD District 1 that includes Florida fell by 121.4 million gallons, a drop of 35.0 percent. Sales in PAD District 3, which includes the remainder of the states along the Gulf of Mexico, dropped by 138.6 million gallons, plunging by 83.3 percent.

Residual Fuel Oil

The strength of the economy, and a surge in sales of bunker fuel combined to boost overall sales of residual fuel oil by more than 380 million gallons, an increase of 3.3 percent. Although sales of residual fuel to the bunker market represented by far the largest increase in 2004, surging by more than 816 million gallons, or 21.1 percent, sales also increased to most other sectors as well. Prompted primarily by the high price of natural gas and by supplier constrained natural gas availability, some fuel switching on the part of some commercial and especially industrial consumers took place. Sales to the commercial sector were up by 26.0 million gallons or 3.4 percent and sales to the industrial sector grew by 125.8 million gallons or 8.9 percent.

Although overall sales of residual fuel oil increased, sales to two sectors declined. First, without the driver of a prolonged cold winter, sales of residual fuel for use in generating electric power fell by more than one third plunging by 569.1 million gallons. Although that drop in sales was substantial, it should be viewed in the context of the magnitude of the increase of more than one billion gallons that occurred in 2003. Approximately 40 percent of the gain in sales to utilities that took place during 2003 was retained in 2004 as the prolonged high prices for natural gas led some utilities to switch some dual-fueled units to oil on a long-term basis. Second, sales of residual fuel for direct use by oil companies fell by more than 40 percent dropping to 46.8 million gallons.

[13] EIA, *Monthly Energy Review*, May 2005, Table 2.1.

On a regional basis, sales of residual fuel to the commercial sector increased along the Atlantic Coast, in the Midwest and the Pacific regions of the country but declined in the Rocky Mountain and Gulf Coast sections of the country. The largest increase took place in PAD District 1 where more than 90 percent of sales are concentrated. In Subdistrict A, New England sales surged by nearly 30 percent, jumping from 88.5 to 150.2 million gallons. The largest decline in sales also took place in PAD District 1, in Subdistrict B, the Middle Atlantic where sales fell by 3.6 percent or 19.2 million gallons.

Sales to the industrial sector also increased the most along the Atlantic Coast. Sales increased in all three Subdistricts of PAD District 1. Sales jumped by 141.7 million gallons or 14.5 percent in the region. Sales fell the most in PAD District 3 along the Gulf Coast where a drop of 65.5 million gallons or 30.5 percent occurred.

For the second year in a row, sales to the military increased sharply. Sales increased by 22.3 million gallons or 544 percent in PAD District 1. Sales dropped the most in PAD District 2 where they fell by 4.7 million gallons, a drop of nearly 94 percent.[14]

Neither the relatively small drop of 37 million gallons of direct oil company sales nor the more substantial drop of nearly 570 million gallons to the utility sector was large enough to overwhelm the upsurge in the sales to the bunker, sector of more than 800 million gallons. Sales increased throughout every region of the country, including all three Subdistricts of PAD District 1.

Although sales of residual fuel oil increased in both 2003 and 2004 this does not necessarily mean that the long-trend in the decline of heavy fuel oil has been reversed. Rather, a new dynamic has entered the market. Whenever weather and high prices for competing fuels provide the incentive for fuel switching, larger customers in the industrial, commercial and especially the electric power sectors may take advantage of the situation and switch temporarily to oil. The long-term trend toward lower sales of residual fuel remains and continues to affect the market; however with long-term higher priced natural gas, some industrial and particularly utilities have switched some units to fuel oil on a longer term basis than simply reacting to seasonal price spikes. The principle reasons for the changing relationship are: changing crude oil specifications; enhanced refinery sophistication resulting in increased production of gasoline and distillate at the expense of production of heavier products such as residual fuel oil, environmental constraints and restrictions on fuel oil use, and the availability of abundant relatively inexpensive natural gas have contributed to a diminished use of residual fuel oil in the production of electric power.[15] For residual fuel oil, although the overall trend has been for declining sales, fluctuations in the amount of fuel sold will occur whenever those with the ability to fuel switch when they are curtailed because of gas supply constraints during the coldest winter periods, or when price differentials between natural gas and fuel oil make switching attractive to sell natural gas into the market. In the past, fuel switching was typically of relatively short-term from a minimum of several days to a few weeks. However, in 2004, prolonged higher prices for natural gas made fuel switching attractive for some consumers over several months or longer.

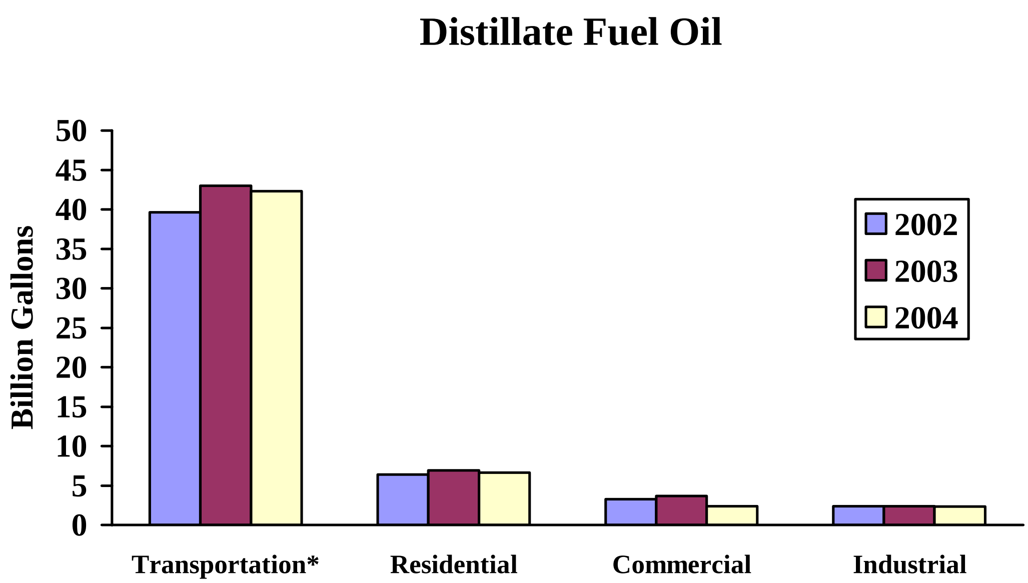
Kerosene

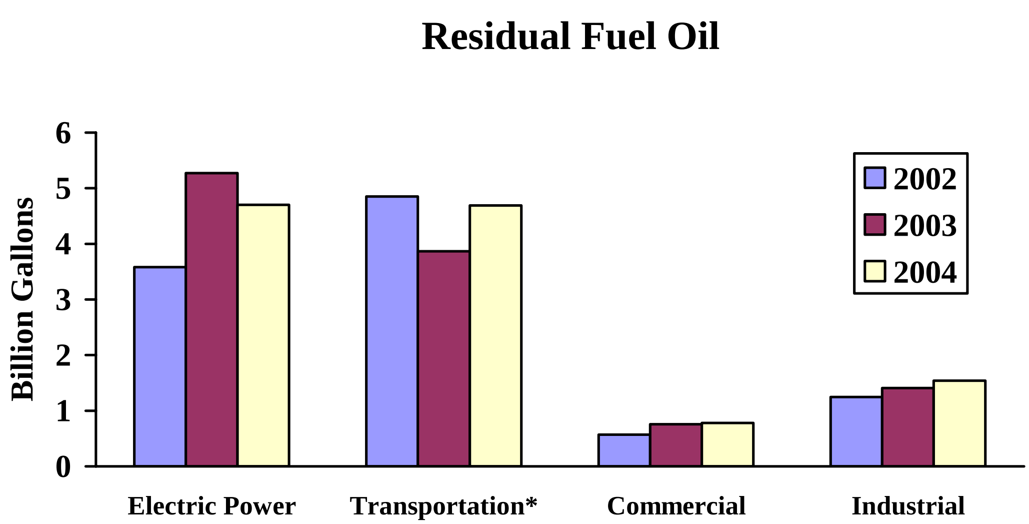
Sales of kerosene jumped by more than 18 percent increasing by 151.2 million gallons. Sales increased to all sectors generally in all regions of the country. The largest increases occurred residential and industrial sectors where sales increased by 107.0 million gallons and 28.2 million gallons respectively. Residential sales increased in all three Subdistricts of PAD District 1. Sales increased the most in Subdistrict B of PAD District 1 where they grew by 40.9 million gallons or 25.2 percent. Sales to the commercial sector increased in all regions with the exception of Subdistrict C of PAD District 1, the South Atlantic region which suffered damage from a number of hurricanes, particularly from Hurricane Ivan.

[14] No sales of residual fuel to the military were recorded in PAD District 3 or 4 in 2001, 2002, or 2003.

[15] It should be noted that the ability to increase production of light higher value products does not typically mean that refineries with upgraded processing capacity no longer possess the ability to produce heavier products such as residual fuel; rather, the economics involved dictate the production of the higher value products. Due to the divestiture of many electric power generation facilities, changes in fuel use and plant operations also contributed to the decline of residual fuel oil. For example, operators of these merchant plants blend fuels to achieve greater efficiency and to lower emissions of dirtier fuels (oil blended with natural gas and even oil and coal). When it is advantageous, the operators also may purchase power rather than generate electricity and re-sell the fuel.

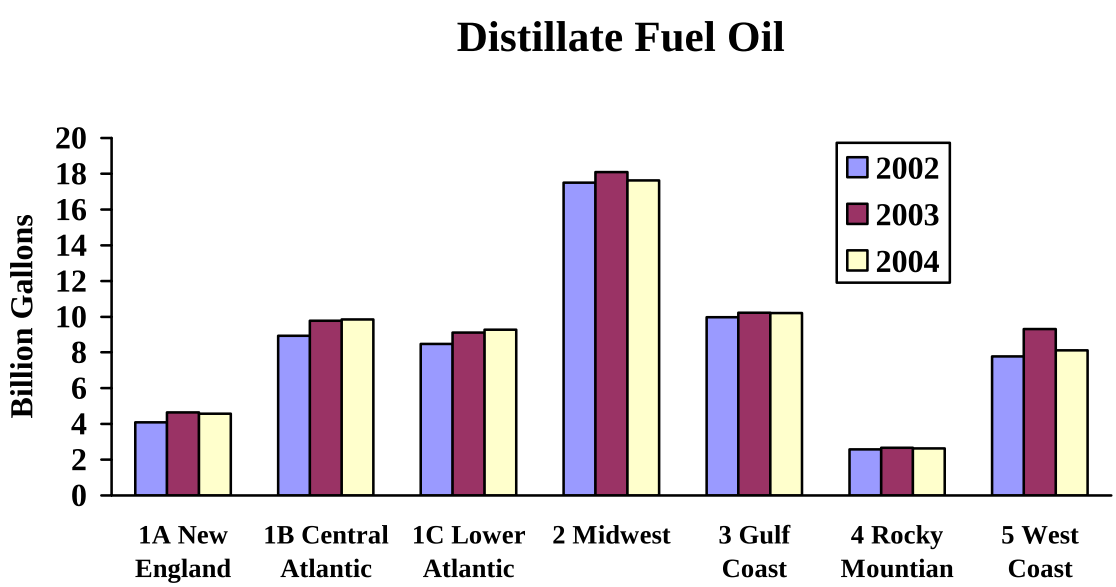
Figure HL1. U.S. Sales of Distillate and Residual Fuel Oils by Energy Use, 2002-2004

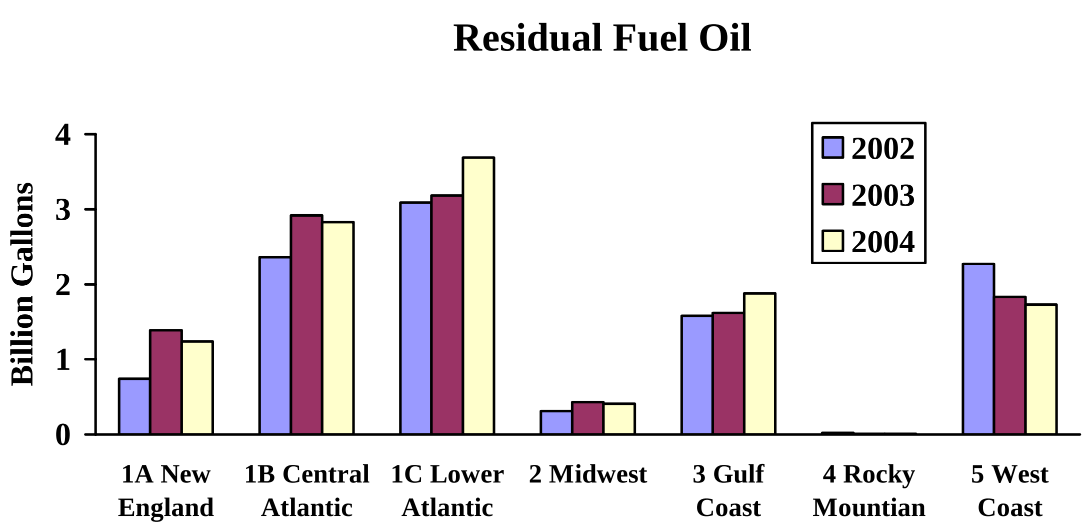




*For distillate fuel oil, transportation use comprises railroad, vessel bunkering, and on-highway diesel energy use categories. For residual fuel oil, transportation use comprises vessel bunkering energy use category.
Source: Energy Information Administration, Form EIA-821, “Fuel Oil and Kerosene Sales Report,” 2003 and 2004.

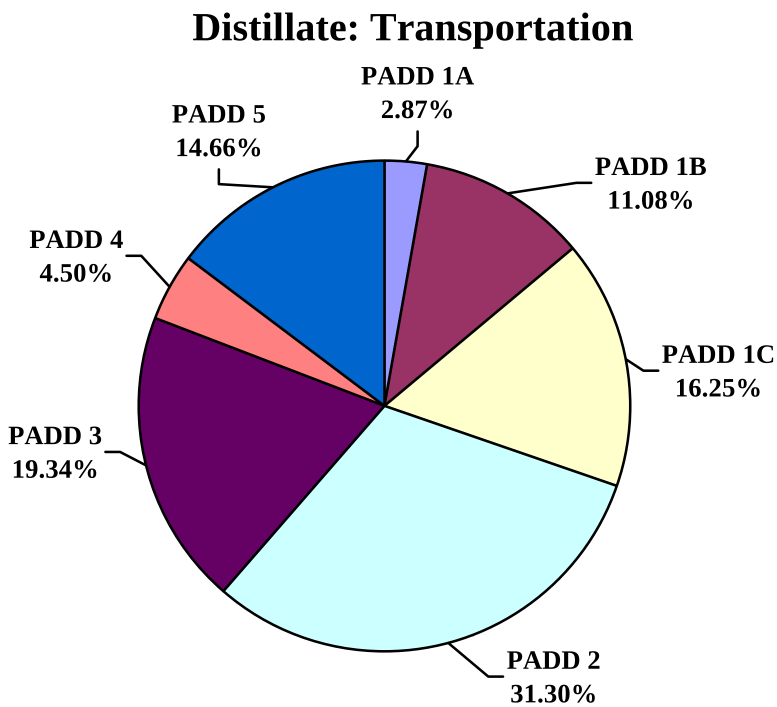
Figure HL2. Volume Distribution of Distillate and Residual Fuel Oils by PAD District, 2002-2004

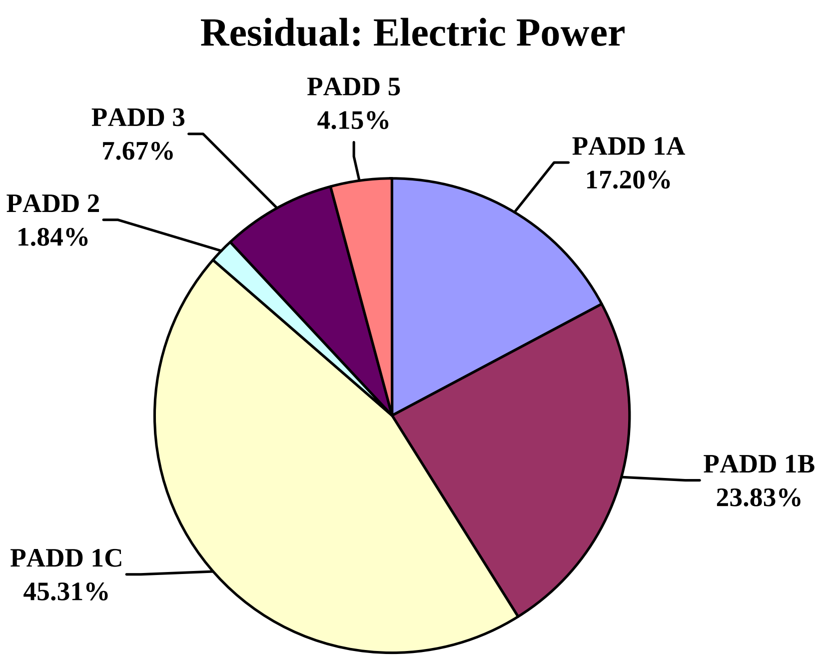




*Residual fuel oil sales in PAD District 4 are too small to appear in the graph.
Source: Energy Information Administration, Form EIA-821, "Fuel Oil and Kerosene Sales Report," 2003 and 2004.

Figure HL3. Distillate and Residual Fuel Oil Sales for Selected Energy Use Categories by PADD District, 2004





*Residual fuel oil sales in PAD District 4 are too small to appear in the graph..
Source: Energy Information Administration, Form EIA-821, “Fuel Oil and Kerosene Sales Report,” 2004.

Table 1. Sales of Distillate Fuel Oil by Energy Use in the United States: 2000-2004
(Thousand Gallons)

Energy Use	Distillate Fuel Oil				
	2000	2001	2002	2003	2004
U.S. Total	**59,601,230**	**59,911,345**	**59,342,633**	**63,854,776**	**62,257,934**
Residential	6,830,455	6,642,941	6,376,653	6,927,070	6,644,939
Commercial	3,706,345	3,717,862	3,293,387	3,686,537	3,383,061
Industrial	2,330,870	2,466,456	2,384,383	2,394,445	2,326,604
Oil Company	686,454	747,627	770,682	513,511	472,920
Farm	3,454,861	3,584,104	3,418,452	3,200,809	3,189,014
Electric Power	1,015,100	1,343,761	750,557	1,147,727	823,380
Railroad	3,290,507	3,039,761	3,245,482	3,656,657	3,047,491
Vessel Bunkering	2,261,422	2,044,049	2,078,921	2,216,921	2,139,643
On-Highway Diesel	33,129,664	33,215,320	34,308,885	37,103,563	37,125,239
Military	306,170	401,236	357,359	415,702	358,682
Off-Highway Diesel	2,589,383	2,708,228	2,357,872	2,591,833	2,746,960

Notes: • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2000-2004. • On-Highway Diesel data are Federal Highway Administation statistics of highway special fuels use.

Table 2. Sales of Residual Fuel Oil by Energy Use in the United States: 2000-2004
(Thousand Gallons)

Energy Use	Residual Fuel Oil				
	2000	2001	2002	2003	2004
U.S. Total	**13,210,935**	**13,609,379**	**10,361,615**	**11,412,833**	**11,794,362**
Commercial	664,360	647,758	572,039	755,956	781,944
Industrial	1,585,140	1,747,367	1,250,634	1,414,052	1,539,830
Oil Company	153,522	132,177	108,673	84,100	46,818
Electric Power	4,362,680	5,647,433	3,575,249	5,273,089	4,704,027
Vessel Bunkering	6,409,863	5,409,378	4,847,704	3,873,849	4,690,454
Military	28,427	20,117	3,882	10,249	30,286
All Other	6,942	5,149	3,435	1,538	1,004

Notes: • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2000-2004.

Table 3. Sales of Kerosene by Energy Use in the United States: 2000-2004
(Thousand Gallons)

Energy Use	Kerosene				
	2000	2001	2002	2003	2004
U.S. Total	**1,036,014**	**1,108,926**	**664,314**	**837,480**	**988,680**
Residential	700,532	704,305	443,919	520,799	627,842
Commercial	219,633	232,608	118,125	138,049	151,811
Industrial	86,844	141,317	77,508	164,386	192,588
Farm	23,084	27,162	19,390	11,674	14,757
All Other	5,921	3,535	5,372	2,572	1,683

Notes: • See Technical Note 3 for further explanation on adjustments. • Kerosene data in the Sales tables (1-12) are adjusted at the national level. • Totals may not equal sum of components due to independent rounding.

Sources: • Kerosene data are based on data from the Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2000-2004 and the "Petroleum Supply Annual," Volume 1, 2000-2004, (DOE/EIA-0340(00)/1 - (04)/1).

Table 4. Sales of Distillate Fuel Oil by Energy Use, 2003 and 2004

(Thousand Gallons)

Destination	Residential		Commercial		Industrial	
	2003	2004	2003	2004	2003	2004
U.S. Total	**6,927,070**	**6,644,939**	**3,686,537**	**3,383,061**	**2,394,445**	**2,326,604**
PAD District 1 Total	**6,084,041**	**5,847,740**	**2,573,044**	**2,400,362**	**841,484**	**819,670**
Subdistrict 1A Total	**2,466,734**	**2,436,994**	**740,712**	**631,293**	**117,292**	**92,871**
Connecticut	682,429	713,161	155,903	148,599	52,299	22,895
Maine	393,903	413,995	163,703	145,733	16,969	24,810
Massachusetts	901,158	810,208	248,404	180,658	21,300	16,832
New Hampshire	221,331	223,569	86,934	76,897	11,628	11,174
Rhode Island	165,277	163,092	43,729	35,993	6,762	7,603
Vermont	102,636	112,969	42,038	43,414	8,334	9,556
Subdistrict 1B Total	**3,208,522**	**3,018,796**	**1,401,364**	**1,326,940**	**199,572**	**234,918**
Delaware	47,141	40,435	13,076	12,589	2,942	3,460
District of Columbia	15,685	16,211	16,566	19,168	240	364
Maryland	183,736	171,686	99,564	88,334	25,913	27,141
New Jersey	459,552	415,197	136,140	112,288	41,790	40,424
New York	1,509,847	1,435,595	856,394	834,103	45,853	62,413
Pennsylvania	992,560	939,672	279,624	260,457	82,834	101,116
Subdistrict 1C Total	**408,785**	**391,949**	**430,968**	**442,130**	**524,620**	**491,881**
Florida	4,961	5,333	118,717	166,747	100,857	83,403
Georgia	1,673	1,687	40,750	45,141	102,886	73,123
North Carolina	132,353	120,172	94,803	70,391	59,001	62,064
South Carolina	19,273	12,053	26,132	23,155	27,943	26,605
Virginia	229,469	234,702	140,496	126,833	113,000	126,503
West Virginia	21,057	18,003	10,070	9,862	120,934	120,184
PAD District 2 Total	**634,278**	**586,370**	**566,128**	**513,895**	**649,349**	**630,589**
Illinois	10,972	12,734	61,951	35,069	60,344	52,020
Indiana	50,862	42,586	75,012	70,834	104,932	96,290
Iowa	16,836	13,478	30,179	19,530	8,063	11,240
Kansas	799	537	28,359	24,137	24,047	11,426
Kentucky	21,648	18,434	34,155	33,677	103,009	96,827
Michigan	98,834	85,472	51,267	44,523	24,051	27,631
Minnesota	104,485	98,500	32,906	33,688	48,803	60,808
Missouri	8,923	8,065	36,380	35,644	35,613	39,762
Nebraska	3,872	4,034	9,153	7,613	7,069	7,495
North Dakota	22,385	24,368	7,942	7,539	14,924	13,716
Ohio	144,629	140,283	78,193	80,936	81,723	88,047
Oklahoma	41	38	4,233	12,292	17,809	10,989
South Dakota	13,603	10,319	5,661	8,118	6,225	5,172
Tennessee	5,233	5,235	47,569	44,874	47,924	44,723
Wisconsin	131,154	122,287	63,168	55,421	64,813	64,445
PAD District 3 Total	**861**	**7,414**	**248,608**	**180,988**	**432,395**	**375,388**
Alabama	329	555	47,261	46,287	140,267	123,420
Arkansas	159	232	32,207	21,597	21,581	15,724
Louisiana	185	171	15,381	12,270	22,597	30,019
Mississippi	44	214	19,271	8,670	26,039	21,211
New Mexico	135	162	17,355	16,892	31,282	30,631
Texas	10	6,081	117,133	75,273	190,629	154,383
PAD District 4 Total	**27,227**	**30,839**	**64,525**	**67,457**	**229,829**	**214,693**
Colorado	494	687	13,524	13,538	31,496	28,345
Idaho	13,984	17,357	13,240	16,790	17,259	19,993
Montana	8,468	7,819	7,469	12,337	31,346	36,627
Utah	3,010	3,546	23,508	20,520	42,194	32,209
Wyoming	1,271	1,431	6,784	4,272	107,533	97,518
PAD District 5 Total	**180,662**	**172,576**	**234,233**	**220,359**	**241,389**	**286,264**
Alaska	63,728	70,667	40,349	48,515	45,195	44,427
Arizona	407	208	21,254	14,502	56,786	60,210
California	5,222	5,970	77,766	69,686	49,427	55,585
Hawaii	14	13	12,228	15,985	4,869	2,767
Nevada	7,363	7,145	12,137	15,592	42,498	83,402
Oregon	38,990	31,838	22,911	24,819	19,958	22,218
Washington	64,940	56,734	47,587	31,260	22,656	17,656

See footnotes at end of table.

Table 4. Sales of Distillate Fuel Oil by Energy Use, 2003 and 2004 (Continued)

(Thousand Gallons)

Destination	Oil Company		Farm		Electric Power	
	2003	2004	2003	2004	2003	2004
U.S. Total	**513,511**	**472,920**	**3,200,809**	**3,189,014**	**1,147,727**	**823,380**
PAD District 1 Total	**26,602**	**19,682**	**495,298**	**410,712**	**567,598**	**420,016**
Subdistrict 1A Total	**741**	**126**	**36,948**	**37,141**	**23,173**	**22,998**
Connecticut	7	38	7,830	6,574	4,379	6,306
Maine	218	–	12,037	12,208	537	552
Massachusetts	–	45	5,216	5,434	13,927	13,407
New Hampshire	–	17	5,865	5,449	1,777	958
Rhode Island	515	12	90	180	1,376	1,575
Vermont	–	14	5,910	7,297	1,176	199
Subdistrict 1B Total	**14,667**	**9,664**	**118,133**	**119,597**	**198,096**	**172,061**
Delaware	8,343	5,348	7,224	6,557	7,591	4,165
District of Columbia	–	–	–	–	8,386	4,888
Maryland	–	2	20,481	18,511	43,125	30,524
New Jersey	1,679	497	5,781	4,148	27,780	29,952
New York	2	11	47,339	47,399	31,030	37,736
Pennsylvania	4,643	3,807	37,308	42,981	80,185	64,797
Subdistrict 1C Total	**11,194**	**9,892**	**340,218**	**253,974**	**346,330**	**224,956**
Florida	35	16	162,871	86,513	92,893	97,653
Georgia	287	1,451	80,059	69,893	19,849	16,154
North Carolina	1,286	–	41,330	40,286	47,884	22,681
South Carolina	1,371	–	19,194	20,720	20,437	13,257
Virginia	4,175	1,707	35,458	34,922	128,922	38,742
West Virginia	4,040	6,718	1,306	1,639	36,346	36,468
PAD District 2 Total	**72,528**	**80,051**	**1,543,845**	**1,580,103**	**191,911**	**163,258**
Illinois	65	81	163,604	157,666	9,267	12,062
Indiana	–	20	129,943	118,994	16,274	10,615
Iowa	–	–	173,763	157,072	6,615	9,444
Kansas	9,525	11,343	160,998	181,777	6,912	5,870
Kentucky	1,423	1,754	30,406	30,002	8,308	7,698
Michigan	780	1,189	47,323	47,780	18,938	20,083
Minnesota	–	–	117,755	112,077	8,990	8,727
Missouri	128	64	92,388	114,780	6,078	6,042
Nebraska	2	2	204,781	208,871	2,844	1,548
North Dakota	6,009	8,651	96,665	106,496	2,017	2,817
Ohio	3,561	3,732	97,062	101,747	59,405	49,124
Oklahoma	50,751	52,609	44,449	49,793	4,516	2,309
South Dakota	–	368	60,953	57,823	1,534	1,371
Tennessee	42	238	30,095	33,819	30,002	13,100
Wisconsin	243	–	93,659	101,408	10,212	12,448
PAD District 3 Total	**322,635**	**271,798**	**610,229**	**596,059**	**166,290**	**27,743**
Alabama	903	6,030	27,808	30,667	15,323	9,864
Arkansas	2,735	2,137	172,817	189,776	7,490	5,765
Louisiana	74,171	36,576	54,984	45,121	9,764	2,460
Mississippi	2,059	1,401	50,466	52,733	2,319	3,745
New Mexico	25,834	30,590	35,192	27,952	3,074	2,492
Texas	216,933	195,064	268,961	249,810	128,322	3,417
PAD District 4 Total	**41,885**	**61,434**	**180,607**	**170,441**	**11,489**	**6,900**
Colorado	5,087	13,449	51,274	39,630	1,719	1,359
Idaho	–	–	52,982	55,285	9	21
Montana	12,682	16,743	48,225	56,046	3,242	–
Utah	8,937	12,035	20,875	9,410	3,289	1,331
Wyoming	15,179	19,207	7,251	10,070	3,229	4,189
PAD District 5 Total	**49,860**	**39,955**	**370,830**	**431,698**	**210,439**	**205,464**
Alaska	37,565	25,400	48	60	71,909	58,662
Arizona	142	309	19,919	16,557	4,847	5,020
California	10,552	12,649	283,635	337,603	7,014	6,359
Hawaii	6	5	6,347	5,913	124,840	128,272
Nevada	1,113	1,043	3,464	4,866	1,132	914
Oregon	–	–	24,909	31,133	215	5,060
Washington	482	549	32,508	35,567	483	1,177

See footnotes at end of table.

Table 4. Sales of Distillate Fuel Oil by Energy Use, 2003 and 2004 (Continued)

(Thousand Gallons)

Destination	Railroad		Vessel Bunkering		On-Highway	
	2003	2004	2003	2004	2003	2004
U.S. Total	**3,656,657**	**3,047,491**	**2,216,921**	**2,139,643**	**37,103,563**	**37,125,239**
PAD District 1 Total	**576,596**	**556,672**	**501,343**	**489,921**	**10,900,154**	**11,731,295**
Subdistrict 1A Total	**25,055**	**53,814**	**48,868**	**46,375**	**1,060,291**	**1,114,427**
Connecticut	3,745	3,656	6,198	7,306	221,316	284,212
Maine	1,133	74	17,242	14,031	201,804	174,373
Massachusetts	19,939	49,830	16,973	16,094	409,242	424,503
New Hampshire	210	185	3,226	3,820	101,598	111,503
Rhode Island	–	–	4,591	4,497	59,616	57,962
Vermont	29	69	638	627	66,715	61,874
Subdistrict 1B Total	**211,960**	**166,292**	**127,608**	**134,683**	**4,038,926**	**4,385,713**
Delaware	1,273	836	721	680	63,366	65,202
District of Columbia	9,608	11,315	4	39	25,579	24,276
Maryland	18,676	2,673	12,164	14,398	509,305	538,061
New Jersey	20,940	19,523	83,337	83,306	867,588	896,454
New York	89,239	76,068	10,408	13,296	1,258,604	1,410,982
Pennsylvania	72,224	55,877	20,974	22,964	1,314,484	1,450,738
Subdistrict 1C Total	**339,581**	**336,566**	**324,866**	**308,863**	**5,800,937**	**6,231,155**
Florida	90,854	72,790	158,234	148,556	1,425,356	1,567,480
Georgia	112,304	121,454	17,843	25,364	1,425,552	1,449,793
North Carolina	66,265	60,844	3,802	8,384	1,034,884	1,095,092
South Carolina	5,872	13,651	39,892	34,151	629,129	709,044
Virginia	53,887	54,029	31,101	22,204	1,015,930	1,115,628
West Virginia	10,398	13,799	73,993	70,203	270,086	294,118
PAD District 2 Total	**1,406,333**	**1,022,009**	**454,799**	**423,339**	**11,804,120**	**11,799,020**
Illinois	225,961	59,292	60,365	107,110	1,402,713	1,397,874
Indiana	105,881	85,757	8,665	7,289	1,474,547	1,242,988
Iowa	41,913	44,488	7,003	6,649	509,625	571,883
Kansas	85,755	49,475	–	–	403,967	413,594
Kentucky	99,327	85,954	85,727	89,374	712,342	856,232
Michigan	15,465	20,607	9,453	8,792	977,042	974,893
Minnesota	61,095	59,387	3,917	5,367	642,015	660,745
Missouri	54,960	47,388	95,010	65,819	968,144	1,013,808
Nebraska	42,528	40,805	–	–	377,378	402,763
North Dakota	51,041	54,422	–	–	158,901	156,154
Ohio	206,449	223,369	8,440	3,104	1,512,124	1,580,121
Oklahoma	295,345	148,118	7	6	855,483	636,979
South Dakota	4,547	4,843	–	–	169,583	175,679
Tennessee	78,685	65,590	174,700	127,881	967,596	990,608
Wisconsin	37,379	32,513	1,513	1,949	672,660	724,699
PAD District 3 Total	**963,668**	**757,761**	**886,124**	**849,224**	**5,991,419**	**6,574,471**
Alabama	51,997	56,889	71,712	116,401	706,097	786,306
Arkansas	118,065	78,238	9,133	40,574	589,387	600,997
Louisiana	52,802	37,267	470,422	419,196	673,766	658,561
Mississippi	40,828	29,989	72,120	70,417	591,531	598,448
New Mexico	15,447	11,690	–	–	439,259	465,748
Texas	684,530	543,688	262,737	202,637	2,991,379	3,464,411
PAD District 4 Total	**243,428**	**234,232**	**519**	**4**	**1,730,771**	**1,669,421**
Colorado	58,654	37,131	517	–	577,265	505,771
Idaho	21,071	21,083	2	4	228,873	238,093
Montana	25,241	38,900	–	–	193,427	222,384
Utah	36,293	33,904	–	–	350,491	365,585
Wyoming	102,167	103,214	–	–	380,715	337,588
PAD District 5 Total	**466,633**	**476,818**	**374,137**	**377,155**	**6,677,099**	**5,351,032**
Alaska	6,277	6,938	104,913	133,122	89,126	208,558
Arizona	17,106	16,354	–	–	730,271	776,419
California	270,892	310,156	61,933	46,117	4,478,284	2,844,083
Hawaii	–	–	133,725	115,769	36,631	42,788
Nevada	5,348	6,221	10	9	301,013	330,258
Oregon	77,503	58,830	12,988	11,606	448,164	521,796
Washington	89,508	78,319	60,568	70,532	593,610	627,130

See footnotes at end of table.

Table 4. Sales of Distillate Fuel Oil by Energy Use, 2003 and 2004 (Continued)

(Thousand Gallons)

Destination	Military		Off-Highway		Total	
	2003	2004	2003	2004	2003	2004
U.S. Total	**415,702**	**358,682**	**2,591,833**	**2,746,960**	**63,854,776**	**62,257,934**
PAD District 1 Total	**107,082**	**80,996**	**865,681**	**920,223**	**23,538,922**	**23,697,290**
Subdistrict 1A Total	**8,695**	**6,788**	**124,063**	**126,922**	**4,652,572**	**4,569,750**
Connecticut	1,270	1,438	15,810	16,223	1,151,186	1,210,408
Maine	3,844	2,818	26,908	25,181	838,300	813,777
Massachusetts	1,183	669	58,364	59,268	1,695,707	1,576,948
New Hampshire	2,000	1,674	14,798	15,840	449,367	451,084
Rhode Island	20	11	3,165	2,706	285,141	273,630
Vermont	377	177	5,018	7,704	232,870	243,902
Subdistrict 1B Total	**41,947**	**26,425**	**219,203**	**249,001**	**9,779,996**	**9,844,089**
Delaware	127	126	3,709	4,254	155,512	143,652
District of Columbia	2,808	3,692	3,943	1,612	82,819	81,564
Maryland	10,132	7,581	42,205	40,544	965,300	939,456
New Jersey	17,955	2,246	43,900	86,286	1,706,442	1,690,321
New York	2,481	4,270	38,837	36,031	3,890,033	3,957,904
Pennsylvania	8,444	8,510	86,609	80,274	2,979,890	3,031,192
Subdistrict 1C Total	**56,440**	**47,784**	**522,415**	**544,300**	**9,106,354**	**9,283,450**
Florida	4,348	3,283	191,008	182,078	2,350,133	2,413,852
Georgia	5,180	3,866	99,232	113,946	1,905,615	1,921,873
North Carolina	13,425	7,385	51,528	43,600	1,546,560	1,530,900
South Carolina	2,288	8,683	54,968	62,105	846,499	923,424
Virginia	31,005	24,344	105,969	120,020	1,889,413	1,899,634
West Virginia	195	223	19,710	22,551	568,134	593,768
PAD District 2 Total	**12,278**	**12,291**	**758,112**	**804,952**	**18,093,679**	**17,615,877**
Illinois	456	264	86,751	127,763	2,082,448	1,961,933
Indiana	581	237	48,293	47,876	2,014,989	1,723,486
Iowa	360	61	22,592	23,230	816,948	857,074
Kansas	895	310	19,608	21,795	740,866	720,264
Kentucky	728	613	54,283	45,451	1,151,355	1,266,015
Michigan	814	1,006	67,658	76,377	1,311,626	1,308,352
Minnesota	646	149	76,583	72,393	1,097,195	1,111,840
Missouri	3,039	3,642	83,901	87,307	1,384,564	1,422,320
Nebraska	65	102	17,714	15,057	665,407	688,289
North Dakota	912	487	7,141	19,142	367,938	393,793
Ohio	906	1,801	94,269	82,011	2,286,761	2,354,276
Oklahoma	–	2,058	50,136	39,329	1,324,228	954,521
South Dakota	224	114	8,692	9,889	271,023	273,698
Tennessee	120	250	54,507	69,448	1,436,472	1,395,766
Wisconsin	1,075	1,197	65,985	67,884	1,141,860	1,184,250
PAD District 3 Total	**110,147**	**88,144**	**499,015**	**475,287**	**10,231,392**	**10,204,276**
Alabama	9,268	9,909	135,133	125,771	1,206,098	1,312,099
Arkansas	474	419	33,630	26,307	987,678	981,766
Louisiana	649	33,872	81,282	109,558	1,456,002	1,385,070
Mississippi	4,622	881	66,225	99,586	875,523	887,293
New Mexico	601	694	11,290	6,361	579,469	593,211
Texas	94,533	42,369	171,454	107,704	5,126,621	5,044,838
PAD District 4 Total	**5,932**	**1,012**	**132,505**	**161,106**	**2,668,716**	**2,617,539**
Colorado	1,342	709	45,171	55,602	786,543	696,222
Idaho	4,362	55	22,415	31,155	374,198	399,836
Montana	45	40	16,283	26,229	346,428	417,125
Utah	183	45	35,071	34,113	523,852	512,696
Wyoming	–	163	13,565	14,008	637,695	591,659
PAD District 5 Total	**180,263**	**176,239**	**336,521**	**385,392**	**9,322,066**	**8,122,952**
Alaska	11,611	11,537	12,215	17,662	482,934	625,548
Arizona	687	571	55,059	54,536	906,477	944,685
California	47,011	58,066	121,741	189,909	5,413,476	3,936,183
Hawaii	54,170	65,999	7,798	8,361	380,628	385,873
Nevada	776	549	24,761	27,159	399,613	477,157
Oregon	1,735	2,022	41,863	39,541	689,235	748,864
Washington	64,273	37,493	73,085	48,223	1,049,703	1,004,641

Dashed (-) = No data reported.
Notes: • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2003-2004. • On-Highway Diesel data are Federal Highway Administration statistics of highway special fuels use.

Table 5. Sales of Residual Fuel Oil by Energy Use, 2003 and 2004

(Thousand Gallons)

Destination	Commercial		Industrial		Oil Company		Electric Power	
	2003	2004	2003	2004	2003	2004	2003	2004
U.S. Total	**755,956**	**781,944**	**1,414,052**	**1,539,830**	**84,100**	**46,818**	**5,273,089**	**4,704,027**
PAD District 1 Total	**706,251**	**731,691**	**977,763**	**1,119,427**	**52,566**	**29,438**	**4,453,268**	**4,061,320**
Subdistrict 1A Total	**150,209**	**192,682**	**224,662**	**233,570**	**691**	**231**	**1,013,906**	**808,988**
Connecticut	30,139	13,212	32,205	43,729	236	231	67,644	130,411
Maine	13,632	13,977	115,705	126,450	38	–	107,423	54,729
Massachusetts	77,455	111,228	41,435	28,913	–	–	690,853	532,774
New Hampshire	6,558	32,509	16,436	17,369	–	–	147,848	89,094
Rhode Island	15,954	15,871	12,861	11,065	417	–	139	1,981
Vermont	6,470	5,885	6,021	6,044	–	–	–	–
Subdistrict 1B Total	**527,840**	**508,662**	**181,283**	**189,255**	**51,432**	**28,801**	**1,261,743**	**1,121,164**
Delaware	11,640	7,666	16,060	31,091	11,628	–	73,067	28,365
Maryland	11,970	3,479	24,705	28,187	651	676	63,457	69,657
New Jersey	18,887	13,928	19,830	19,774	1,796	1,849	131,114	154,660
New York	461,239	459,167	67,043	58,721	695	785	808,354	699,915
Pennsylvania	24,104	24,422	53,645	51,482	36,662	25,491	185,751	168,567
Subdistrict 1C Total	**28,201**	**30,347**	**571,818**	**696,601**	**443**	**406**	**2,177,619**	**2,131,168**
Florida	714	4,712	79,550	123,045	–	–	1,839,037	1,871,445
Georgia	464	–	98,249	114,521	–	–	3,697	2,949
North Carolina	8,907	11,076	167,292	209,614	107	115	–	–
South Carolina	773	1,867	135,356	137,657	113	110	–	251
Virginia	17,343	12,692	89,236	97,974	224	181	334,885	256,522
West Virginia	–	–	2,135	13,791	–	–	–	–
PAD District 2 Total	**44,225**	**45,067**	**192,464**	**242,955**	**11,573**	**1,532**	**159,147**	**86,724**
Illinois	298	1,976	5,647	13,439	–	–	43,287	11,936
Indiana	2,711	4,582	13,349	21,366	–	–	–	–
Iowa	–	–	6,399	11,305	–	–	–	–
Kansas	–	–	26,695	26,755	–	–	60,129	38,782
Kentucky	–	–	2,497	2,344	2,638	–	–	–
Michigan	3,862	1,980	27,203	27,553	3,286	–	47,627	32,937
Minnesota	14,615	18,038	23,552	25,062	2,523	1,157	3,648	3,068
Missouri	937	656	3,573	5,072	–	–	–	–
Nebraska	615	1,963	5,410	7,242	–	–	–	–
North Dakota	4,284	735	1,829	1,787	–	–	–	–
Ohio	91	4,043	20,666	25,610	2,941	375	2,396	–
Oklahoma	–	39	20,436	24,536	–	–	2,060	–
South Dakota	–	511	1,830	3,223	130	–	–	–
Tennessee	–	525	10,562	11,504	–	–	–	–
Wisconsin	16,812	10,019	22,817	36,157	55	–	–	–
PAD District 3 Total	**3,146**	**2,826**	**215,671**	**149,972**	**8**	**8**	**230,858**	**360,694**
Alabama	–	–	11,718	17,284	–	–	–	–
Arkansas	–	14	8,039	17,887	–	–	11,825	31,887
Louisiana	3,048	2,459	122,070	54,961	–	–	85,900	141,180
Mississippi	98	352	6,922	12,431	8	8	113,126	186,401
New Mexico	–	–	6,699	4,179	–	–	–	–
Texas	–	–	60,223	43,229	–	–	20,007	1,226
PAD District 4 Total	**23**	**–**	**8,572**	**12,830**	**2,523**	**–**	**210**	**215**
Colorado	–	–	–	–	–	–	–	215
Idaho	–	–	17	–	–	–	–	–
Montana	23	–	–	1,694	242	–	–	–
Utah	–	–	2,906	6,849	1,839	–	210	–
Wyoming	–	–	5,649	4,287	441	–	–	–
PAD District 5 Total	**2,312**	**2,361**	**19,582**	**14,646**	**17,429**	**15,839**	**429,607**	**195,075**
Alaska	–	–	–	–	–	–	–	–
Arizona	–	–	–	1,314	–	–	–	–
California	–	–	1,536	560	714	–	134	–
Hawaii	–	169	62	–	15,495	15,839	428,696	195,075
Nevada	–	–	–	10	36	–	–	–
Oregon	2,262	2,192	15,019	12,119	618	–	680	–
Washington	49	–	2,965	643	565	–	96	–

See footnotes at end of table.

Table 5. Sales of Residual Fuel Oil by Energy Use, 2003 and 2004 (Continued)

(Thousand Gallons)

Destination	Vessel Bunkering 2003	Vessel Bunkering 2004	Military 2003	Military 2004	All Other 2003	All Other 2004	Total 2003	Total 2004
U.S. Total	**3,873,849**	**4,690,454**	**10,249**	**30,286**	**1,538**	**1,004**	**11,412,833**	**11,794,362**
PAD District 1 Total	**1,294,069**	**1,788,718**	**4,095**	**26,382**	**1,174**	**795**	**7,489,187**	**7,757,770**
Subdistrict 1A Total	**521**	**2,078**	**–**	**–**	**250**	**494**	**1,390,239**	**1,238,044**
Connecticut	93	888	–	–	250	316	130,567	188,787
Maine	107	1,096	–	–	–	179	236,906	196,431
Massachusetts	320	95	–	–	–	–	810,063	673,009
New Hampshire	–	–	–	–	–	–	170,842	138,973
Rhode Island	–	–	–	–	–	–	29,371	28,917
Vermont	–	–	–	–	–	–	12,491	11,929
Subdistrict 1B Total	**892,057**	**968,460**	**1,122**	**10,262**	**–**	**–**	**2,915,477**	**2,826,604**
Delaware	42,545	39,650	–	–	–	–	154,939	106,772
Maryland	17,293	42,027	–	7,936	–	–	118,077	151,963
New Jersey	510,405	494,761	341	–	–	–	682,372	684,972
New York	196,041	233,710	–	–	–	–	1,533,372	1,452,297
Pennsylvania	125,773	158,311	782	2,327	–	–	426,716	430,600
Subdistrict 1C Total	**401,492**	**818,180**	**2,973**	**16,120**	**924**	**300**	**3,183,471**	**3,693,122**
Florida	193,523	511,224	–	551	924	–	2,113,749	2,510,977
Georgia	85,164	152,998	–	–	–	–	187,574	270,469
North Carolina	33,431	16,104	–	–	–	300	209,736	237,209
South Carolina	25,387	80,005	–	–	–	–	161,629	219,890
Virginia	63,987	57,849	2,973	15,569	–	–	508,648	440,786
West Virginia	–	–	–	–	–	–	2,135	13,791
PAD District 2 Total	**17,064**	**31,850**	**4,968**	**306**	**46**	**56**	**429,487**	**408,490**
Illinois	477	635	4,642	–	–	–	54,351	27,986
Indiana	3,290	6,460	–	–	–	–	19,351	32,409
Iowa	–	–	–	–	2	–	6,401	11,305
Kansas	–	–	326	306	–	–	87,149	65,844
Kentucky	134	244	–	–	–	–	5,269	2,588
Michigan	8,454	10,056	–	–	–	9	90,432	72,535
Minnesota	3,003	11,866	–	–	–	11	47,341	59,203
Missouri	548	722	–	–	–	–	5,058	6,450
Nebraska	–	–	–	–	15	–	6,041	9,205
North Dakota	–	–	–	–	–	–	6,113	2,523
Ohio	700	45	–	–	29	36	26,824	30,109
Oklahoma	–	–	–	–	–	–	22,496	24,575
South Dakota	–	–	–	–	–	–	1,960	3,733
Tennessee	351	1,690	–	–	–	–	10,913	13,719
Wisconsin	106	132	–	–	–	–	39,790	46,308
PAD District 3 Total	**1,203,982**	**1,366,153**	**–**	**2,614**	**300**	**32**	**1,653,966**	**1,882,299**
Alabama	43,215	50,059	–	832	–	–	54,933	68,175
Arkansas	–	–	–	–	–	–	19,865	49,788
Louisiana	413,578	436,468	–	–	6	–	624,602	635,069
Mississippi	35,115	67,465	–	–	278	–	155,547	266,658
New Mexico	–	–	–	–	16	32	6,714	4,212
Texas	712,074	812,161	–	1,782	–	–	792,305	858,397
PAD District 4 Total	**–**	**–**	**–**	**–**	**18**	**–**	**11,345**	**13,045**
Colorado	–	–	–	–	–	–	–	215
Idaho	–	–	–	–	–	–	17	–
Montana	–	–	–	–	–	–	265	1,694
Utah	–	–	–	–	–	–	4,955	6,849
Wyoming	–	–	–	–	18	–	6,108	4,287
PAD District 5 Total	**1,358,734**	**1,503,732**	**1,185**	**984**	**–**	**120**	**1,828,848**	**1,732,757**
Alaska	535	–	–	–	–	–	535	–
Arizona	–	–	–	–	–	–	–	1,314
California	997,869	1,114,585	1,184	–	–	–	1,001,438	1,115,144
Hawaii	39,081	58,945	–	984	–	–	483,334	271,012
Nevada	–	–	–	–	–	–	36	10
Oregon	65,175	68,711	–	–	–	–	83,754	83,022
Washington	256,074	261,492	1	–	–	120	259,751	262,255

Dashed (-) = No data reported.
Notes: • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2003-2004.

Table 6. Sales of Kerosene by Energy Use, 2003 and 2004

(Thousand Gallons)

Destination	Residential 2003	Residential 2004	Commercial 2003	Commercial 2004	Industrial 2003	Industrial 2004
U.S. Total	**520,799**	**627,842**	**138,049**	**151,811**	**164,386**	**192,588**
PAD District 1 Total	**433,208**	**525,481**	**108,402**	**114,457**	**77,285**	**74,448**
Subdistrict 1A Total	**111,030**	**140,330**	**17,916**	**25,195**	**12,515**	**13,548**
Connecticut	11,336	14,660	5,241	7,227	8,755	10,157
Maine	58,456	73,100	6,751	10,540	305	704
Massachusetts	10,235	11,730	3,008	3,802	356	453
New Hampshire	17,450	21,972	1,806	1,926	540	425
Rhode Island	1,952	2,086	216	288	4	–
Vermont	11,602	16,781	894	1,413	2,555	1,809
Subdistrict 1B Total	**162,343**	**203,213**	**63,389**	**65,779**	**57,561**	**46,579**
Delaware	3,675	5,338	313	405	11	14
District of Columbia	1	3	23	31	–	–
Maryland	16,978	23,101	8,207	5,293	748	862
New Jersey	5,806	6,516	10,362	11,586	18,444	28,423
New York	68,826	86,750	27,923	31,280	35,947	14,408
Pennsylvania	67,057	81,506	16,561	17,184	2,412	2,871
Subdistrict 1C Total	**159,835**	**181,939**	**27,096**	**23,482**	**7,210**	**14,322**
Florida	4,055	3,973	802	857	272	1,568
Georgia	2,791	3,902	1,999	893	1,837	4,409
North Carolina	75,027	79,445	11,310	7,067	265	1,570
South Carolina	15,817	22,841	920	1,095	3,039	4,212
Virginia	52,954	61,068	8,190	10,171	1,380	1,960
West Virginia	9,191	10,710	3,874	3,399	417	603
PAD District 2 Total	**64,271**	**74,942**	**19,624**	**22,919**	**11,720**	**15,317**
Illinois	4,449	4,208	1,536	1,883	1,909	2,264
Indiana	8,660	10,771	1,372	1,830	948	1,693
Iowa	827	1,157	170	225	25	39
Kansas	460	441	207	345	41	47
Kentucky	7,658	8,690	1,641	1,342	1,138	1,490
Michigan	11,096	9,298	796	910	683	1,122
Minnesota	763	1,162	603	437	120	157
Missouri	3,021	3,675	889	1,283	180	424
Nebraska	183	231	146	275	45	39
North Dakota	115	204	43	83	36	34
Ohio	15,504	20,349	8,532	10,822	4,669	5,286
Oklahoma	596	704	203	277	278	308
South Dakota	95	107	87	76	5	4
Tennessee	9,693	12,255	2,268	1,799	967	1,610
Wisconsin	1,152	1,690	1,132	1,334	679	800
PAD District 3 Total	**4,557**	**5,015**	**4,964**	**6,986**	**73,410**	**99,968**
Alabama	2,077	2,804	1,021	1,071	1,257	1,478
Arkansas	682	450	136	699	17	26
Louisiana	398	405	262	3,255	63,213	84,693
Mississippi	479	646	1,846	382	836	2,280
New Mexico	154	226	238	139	52	29
Texas	768	484	1,461	1,442	8,034	11,461
PAD District 4 Total	**1,944**	**2,327**	**779**	**1,140**	**248**	**296**
Colorado	1,482	1,893	434	495	55	71
Idaho	156	277	31	177	2	33
Montana	164	49	103	121	64	85
Utah	94	78	196	330	121	91
Wyoming	48	30	16	18	7	16
PAD District 5 Total	**16,819**	**20,076**	**4,280**	**6,308**	**1,722**	**2,559**
Alaska	632	828	14	25	1	2
Arizona	99	44	51	86	36	117
California	8,217	11,605	1,987	3,016	1,062	1,288
Hawaii	–	–	2	2	4	4
Nevada	473	773	65	67	7	10
Oregon	3,173	3,917	953	1,869	486	731
Washington	4,224	2,909	1,208	1,244	126	408

See footnotes at end of table.

Table 6. Sales of Kerosene by Energy Use, 2003 and 2004 (Continued)

(Thousand Gallons)

Destination	Farm		All Other		Total	
	2003	2004	2003	2004	2003	2004
U.S. Total	**11,674**	**14,757**	**2,572**	**1,683**	**837,480**	**988,680**
PAD District 1 Total	**4,079**	**4,952**	**1,842**	**884**	**624,816**	**720,223**
Subdistrict 1A Total	**1,122**	**1,717**	**852**	**403**	**143,435**	**181,193**
Connecticut	7	3	605	196	25,943	32,242
Maine	484	841	18	31	66,014	85,215
Massachusetts	12	13	7	–	13,618	15,998
New Hampshire	281	312	126	61	20,204	24,696
Rhode Island	–	–	5	–	2,177	2,374
Vermont	338	549	90	116	15,479	20,668
Subdistrict 1B Total	**1,945**	**2,478**	**774**	**435**	**286,012**	**318,483**
Delaware	133	246	–	–	4,132	6,004
District of Columbia	–	–	–	–	24	34
Maryland	281	647	59	90	26,273	29,992
New Jersey	14	5	1	232	34,627	46,762
New York	1,118	1,190	338	38	134,153	133,666
Pennsylvania	400	390	376	75	86,805	102,026
Subdistrict 1C Total	**1,012**	**757**	**216**	**46**	**195,369**	**220,547**
Florida	29	3	116	–	5,274	6,401
Georgia	9	21	14	9	6,650	9,234
North Carolina	222	96	1	2	86,825	88,179
South Carolina	70	111	15	–	19,862	28,259
Virginia	648	418	59	35	63,231	73,654
West Virginia	33	107	10	–	13,526	14,819
PAD District 2 Total	**5,535**	**7,138**	**370**	**430**	**101,521**	**120,747**
Illinois	426	627	9	53	8,329	9,035
Indiana	555	692	39	67	11,574	15,052
Iowa	504	599	12	2	1,538	2,024
Kansas	114	80	–	4	823	916
Kentucky	272	356	64	81	10,773	11,959
Michigan	207	231	4	4	12,786	11,565
Minnesota	361	426	48	4	1,894	2,186
Missouri	155	140	17	–	4,261	5,522
Nebraska	199	236	89	125	661	906
North Dakota	29	46	–	–	224	367
Ohio	1,721	2,719	47	36	30,473	39,212
Oklahoma	121	92	–	–	1,198	1,380
South Dakota	86	27	–	–	273	214
Tennessee	426	336	39	52	13,393	16,052
Wisconsin	359	532	–	–	3,322	4,357
PAD District 3 Total	**522**	**424**	**18**	**2**	**83,470**	**112,394**
Alabama	13	19	1	–	4,368	5,372
Arkansas	65	15	–	–	900	1,190
Louisiana	48	11	–	–	63,921	88,364
Mississippi	176	157	–	–	3,337	3,464
New Mexico	26	19	17	1	486	414
Texas	194	203	–	–	10,458	13,590
PAD District 4 Total	**120**	**204**	**9**	**4**	**3,100**	**3,972**
Colorado	65	134	4	1	2,040	2,593
Idaho	19	32	1	–	208	519
Montana	–	2	–	3	331	259
Utah	33	33	4	–	448	533
Wyoming	3	3	–	–	74	68
PAD District 5 Total	**1,418**	**2,039**	**334**	**362**	**24,573**	**31,344**
Alaska	–	–	–	–	648	855
Arizona	1	1	–	–	187	247
California	351	486	306	15	11,923	16,410
Hawaii	–	–	–	–	7	6
Nevada	3	2	–	1	548	853
Oregon	682	1,126	16	14	5,310	7,657
Washington	380	423	13	332	5,951	5,316

Dashed (-) = No data reported.
Notes: • Totals may not equal sum of components due to independent rounding.
Sources: • Kerosene data are based on data from the Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2003-2004 and "Petroleum Supply Annual," Volume 1, 2003-2004, (DOE/EIA-0340(03)/1 - (04)/1).

Table 7. Sales for Residential Use: Distillate Fuel Oil and Kerosene, 2004
(Thousand Gallons)

Destination	Distillate Fuel Oil No. 1	Distillate Fuel Oil No. 2	Distillate Fuel Oil Total	Kerosene
U.S. Total	**108,237**	**6,536,702**	**6,644,939**	**627,842**
PAD District 1 Total	**4,641**	**5,843,099**	**5,847,740**	**525,481**
Subdistrict 1A Total	**2,620**	**2,434,375**	**2,436,995**	**140,330**
Connecticut	1	713,160	713,161	14,660
Maine	1,152	412,843	413,995	73,100
Massachusetts	578	809,630	810,208	11,730
New Hampshire	689	222,880	223,569	21,972
Rhode Island	62	163,030	163,092	2,086
Vermont	138	112,831	112,969	16,781
Subdistrict 1B Total	**1,145**	**3,017,651**	**3,018,796**	**203,213**
Delaware	–	40,435	40,435	5,338
District of Columbia	–	16,211	16,211	3
Maryland	120	171,566	171,686	23,101
New Jersey	–	415,197	415,197	6,516
New York	382	1,435,213	1,435,595	86,750
Pennsylvania	643	939,029	939,672	81,506
Subdistrict 1C Total	**876**	**391,073**	**391,949**	**181,939**
Florida	44	5,289	5,333	3,973
Georgia	–	1,687	1,687	3,902
North Carolina	–	120,172	120,172	79,445
South Carolina	42	12,010	12,052	22,841
Virginia	124	234,578	234,702	61,068
West Virginia	665	17,337	18,002	10,710
PAD District 2 Total	**56,997**	**529,373**	**586,370**	**74,942**
Illinois	1,275	11,458	12,733	4,208
Indiana	4,782	37,804	42,586	10,771
Iowa	2,482	10,996	13,478	1,157
Kansas	58	480	538	441
Kentucky	522	17,912	18,434	8,690
Michigan	8,577	76,895	85,472	9,298
Minnesota	16,725	81,775	98,500	1,162
Missouri	1,959	6,106	8,065	3,675
Nebraska	1,795	2,239	4,034	231
North Dakota	3,718	20,650	24,368	204
Ohio	4,298	135,984	140,282	20,349
Oklahoma	8	30	38	704
South Dakota	2,275	8,044	10,319	107
Tennessee	118	5,117	5,235	12,255
Wisconsin	8,405	113,882	122,287	1,690
PAD District 3 Total	**144**	**7,270**	**7,414**	**5,015**
Alabama	–	555	555	2,804
Arkansas	130	102	232	450
Louisiana	–	171	171	405
Mississippi	–	213	213	646
New Mexico	14	149	163	226
Texas	–	6,081	6,081	484
PAD District 4 Total	**5,979**	**24,860**	**30,839**	**2,327**
Colorado	70	617	687	1,893
Idaho	3,049	14,308	17,357	277
Montana	2,571	5,249	7,820	49
Utah	179	3,367	3,546	78
Wyoming	111	1,320	1,431	30
PAD District 5 Total	**40,476**	**132,100**	**172,576**	**20,076**
Alaska	35,453	35,215	70,668	828
Arizona	11	197	208	44
California	402	5,568	5,970	11,605
Hawaii	–	13	13	–
Nevada	221	6,924	7,145	773
Oregon	1,956	29,883	31,839	3,917
Washington	2,434	54,300	56,734	2,909

Dashed (-) = No data reported.
Notes: • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2004. • Kerosene data are also based on data from Energy Information Administration's "Petroleum Supply Annual," Volume 1, 2004, (DOE/EIA-0340(04)/1).

Table 8. Sales for Commercial Use: Distillate Fuel Oil, Residual Fuel Oil, and Kerosene, 2004
(Thousand Gallons)

Destination	Distillate Fuel Oil							Residual Fuel Oil	Kerosene
	No. 1 Distillate	No. 2 Distillate				No. 4 Fuel	Total Distillate		
		No. 2 Fuel Oil	Low Sulfur Diesel	High Sulfur Diesel	No. 2 Total				
U.S. Total	**57,938**	**1,701,613**	**875,066**	**535,568**	**3,112,247**	**212,875**	**3,383,061**	**781,944**	**151,811**
PAD District 1 Total	**5,349**	**1,550,700**	**349,882**	**282,985**	**2,183,566**	**211,447**	**2,400,362**	**731,691**	**114,457**
Subdistrict 1A Total	**950**	**509,693**	**56,514**	**38,269**	**604,476**	**25,867**	**631,293**	**192,682**	**25,195**
Connecticut	211	120,779	20,900	1,602	143,281	5,108	148,599	13,212	7,227
Maine	535	119,228	14,977	10,234	144,439	759	145,733	13,977	10,540
Massachusetts	119	139,511	7,447	19,746	166,705	13,833	180,658	111,228	3,802
New Hampshire	58	66,317	7,070	570	73,957	2,881	76,897	32,509	1,926
Rhode Island	8	31,509	1,547	1,125	34,182	1,803	35,993	15,871	288
Vermont	19	32,348	4,572	4,992	41,912	1,483	43,414	5,885	1,413
Subdistrict 1B Total	**4,178**	**943,572**	**131,237**	**62,767**	**1,137,576**	**185,186**	**1,326,940**	**508,662**	**65,779**
Delaware	47	8,215	542	3,401	12,159	384	12,589	7,666	405
District of Columbia	3	14,172	2,792	120	17,083	2,082	19,168	–	31
Maryland	867	65,780	11,250	9,135	86,165	1,302	88,334	3,479	5,293
New Jersey	108	102,685	4,503	917	108,105	4,075	112,288	13,928	11,586
New York	1,096	554,454	83,170	23,112	660,736	172,271	834,103	459,167	31,280
Pennsylvania	2,057	198,266	28,980	26,082	253,328	5,072	260,457	24,422	17,184
Subdistrict 1C Total	**221**	**97,434**	**162,131**	**181,949**	**441,514**	**394**	**442,130**	**30,347**	**23,482**
Florida	–	2,849	103,583	60,315	166,747	–	166,747	4,712	857
Georgia	–	2,151	16,529	26,461	45,141	–	45,141	–	893
North Carolina	–	30,156	16,683	23,361	70,200	191	70,391	11,076	7,067
South Carolina	–	5,617	6,367	11,171	23,155	–	23,155	1,867	1,095
Virginia	59	51,992	14,927	59,653	126,572	203	126,833	12,692	10,171
West Virginia	163	4,668	4,042	989	9,700	–	9,862	–	3,399
PAD District 2 Total	**20,577**	**118,129**	**254,880**	**118,881**	**491,890**	**1,428**	**513,895**	**45,067**	**22,919**
Illinois	2,112	2,662	19,756	9,365	31,783	1,174	35,069	1,976	1,883
Indiana	2,494	24,752	27,839	15,750	68,341	–	70,834	4,582	1,830
Iowa	1,206	7,226	8,979	2,119	18,324	–	19,530	–	225
Kansas	889	1,007	20,124	2,116	23,248	–	24,137	–	345
Kentucky	36	1,688	18,022	13,930	33,641	–	33,677	–	1,342
Michigan	927	10,602	26,003	6,991	43,596	–	44,523	1,980	910
Minnesota	3,757	19,633	8,884	1,408	29,925	6	33,688	18,038	437
Missouri	965	2,026	25,777	6,876	34,679	–	35,644	656	1,283
Nebraska	1,631	1,714	3,576	693	5,983	–	7,613	1,963	275
North Dakota	1,122	2,416	3,016	985	6,417	–	7,539	735	83
Ohio	1,095	17,491	25,982	36,369	79,841	–	80,936	4,043	10,822
Oklahoma	27	–	10,028	2,237	12,265	–	12,292	39	277
South Dakota	792	1,819	4,425	1,081	7,326	–	8,118	511	76
Tennessee	227	577	31,109	12,961	44,647	–	44,874	525	1,799
Wisconsin	3,298	24,516	21,358	6,001	51,874	249	55,421	10,019	1,334
PAD District 3 Total	**983**	**3,831**	**95,424**	**80,749**	**180,005**	**–**	**180,988**	**2,826**	**6,986**
Alabama	10	3,092	22,536	20,649	46,277	–	46,287	–	1,071
Arkansas	–	8	4,036	17,552	21,597	–	21,597	14	699
Louisiana	841	363	5,252	5,814	11,429	–	12,270	2,459	3,255
Mississippi	–	–	5,048	3,621	8,670	–	8,670	352	382
New Mexico	132	247	13,352	3,161	16,759	–	16,892	–	139
Texas	–	122	45,200	29,952	75,273	–	75,273	–	1,442
PAD District 4 Total	**4,418**	**7,335**	**46,415**	**9,288**	**63,039**	**–**	**67,457**	**–**	**1,140**
Colorado	473	669	12,239	157	13,065	–	13,538	–	495
Idaho	487	1,936	11,409	2,958	16,303	–	16,790	–	177
Montana	553	4,134	7,546	104	11,784	–	12,337	–	121
Utah	929	557	13,111	5,922	19,591	–	20,520	–	330
Wyoming	1,976	39	2,110	147	2,296	–	4,272	–	18
PAD District 5 Total	**26,611**	**21,617**	**128,465**	**43,665**	**193,748**	**–**	**220,359**	**2,361**	**6,308**
Alaska	23,681	8,048	3,446	13,339	24,833	–	48,515	–	25
Arizona	59	133	13,613	697	14,443	–	14,502	–	86
California	8	366	60,468	8,844	69,678	–	69,686	–	3,016
Hawaii	–	21	7,922	8,042	15,985	–	15,985	169	2
Nevada	388	1,374	13,569	261	15,204	–	15,592	–	67
Oregon	887	6,620	11,904	5,407	23,932	–	24,819	2,192	1,869
Washington	1,588	5,054	17,543	7,075	29,672	–	31,260	–	1,244

Dashed (-) = No data reported.

Notes: • Totals may not equal sum of components due to independent rounding.

Sources: • Energy Information Administration Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2004. • Kerosene data are also based on data from Energy Information Administration's "Petroleum Supply Annual," Volume 1, 2004, (DOE/EIA-0340(04)/1).

Table 9. Sales for Industrial Use: Distillate Fuel Oil, Residual Fuel Oil, and Kerosene, 2004
(Thousand Gallons)

Destination	Distillate Fuel Oil							Residual Fuel Oil	Kerosene
	No. 1 Distillate	No. 2 Distillate				No. 4 Fuel	Total Distillate		
		No. 2 Fuel Oil	Low Sulfur Diesel	High Sulfur Diesel	No. 2 Total				
U.S. Total	**39,755**	**406,270**	**804,472**	**1,033,041**	**2,243,783**	**43,066**	**2,326,604**	**1,539,830**	**192,588**
PAD District 1 Total	**1,801**	**243,547**	**103,504**	**433,200**	**780,251**	**37,618**	**819,670**	**1,119,427**	**74,448**
Subdistrict 1A Total	**616**	**60,926**	**11,216**	**8,371**	**80,513**	**11,742**	**92,871**	**233,570**	**13,548**
Connecticut	–	13,272	2,494	32	15,797	7,098	22,895	43,729	10,157
Maine	274	19,976	2,103	1,338	23,417	1,119	24,810	126,450	704
Massachusetts	–	9,387	3,250	3,601	16,238	594	16,832	28,913	453
New Hampshire	338	7,676	860	1,441	9,977	859	11,174	17,369	425
Rhode Island	–	5,409	55	1,045	6,508	1,095	7,603	11,065	–
Vermont	5	5,206	2,455	915	8,575	976	9,556	6,044	1,809
Subdistrict 1B Total	**659**	**113,355**	**23,723**	**73,111**	**210,189**	**24,070**	**234,918**	**189,255**	**46,579**
Delaware	–	1,304	1,011	423	2,738	722	3,460	31,091	14
District of Columbia	–	84	–	115	200	164	364	–	–
Maryland	659	15,753	3,722	6,003	25,478	1,005	27,141	28,187	862
New Jersey	–	25,085	973	974	27,032	13,392	40,424	19,774	28,423
New York	–	34,492	6,493	16,193	57,178	5,236	62,413	58,721	14,408
Pennsylvania	–	36,638	11,523	49,403	97,565	3,552	101,116	51,482	2,871
Subdistrict 1C Total	**526**	**69,266**	**68,566**	**351,718**	**489,549**	**1,806**	**491,881**	**696,601**	**14,322**
Florida	46	2,997	29,563	50,798	83,358	–	83,403	123,045	1,568
Georgia	–	14,144	15,586	43,394	73,123	–	73,123	114,521	4,409
North Carolina	–	13,874	10,777	36,805	61,457	607	62,064	209,614	1,570
South Carolina	5	5,482	2,531	18,296	26,310	290	26,605	137,657	4,212
Virginia	149	24,137	7,982	93,333	125,453	901	126,503	97,974	1,960
West Virginia	327	8,631	2,127	109,091	119,849	8	120,184	13,791	603
PAD District 2 Total	**16,981**	**152,683**	**195,876**	**260,583**	**609,142**	**4,466**	**630,589**	**242,955**	**15,317**
Illinois	3,523	9,711	17,850	20,880	48,442	55	52,020	13,439	2,264
Indiana	1,861	32,607	45,578	13,815	92,000	2,429	96,290	21,366	1,693
Iowa	1,313	1,044	7,009	1,873	9,927	–	11,240	11,305	39
Kansas	215	178	8,010	3,018	11,206	5	11,426	26,755	47
Kentucky	8	5,925	14,726	75,738	96,389	429	96,827	2,344	1,490
Michigan	484	6,144	4,946	16,052	27,142	5	27,631	27,553	1,122
Minnesota	2,501	40,382	16,750	1,147	58,280	27	60,808	25,062	157
Missouri	2,588	2,883	18,421	15,857	37,161	13	39,762	5,072	424
Nebraska	128	503	1,402	5,461	7,366	–	7,495	7,242	39
North Dakota	1,590	1,602	2,992	7,532	12,126	–	13,716	1,787	34
Ohio	466	27,748	8,997	49,770	86,514	1,067	88,047	25,610	5,286
Oklahoma	–	2,401	2,673	5,915	10,989	–	10,989	24,536	308
South Dakota	58	229	2,179	2,699	5,107	8	5,172	3,223	4
Tennessee	–	323	21,656	22,615	44,594	129	44,723	11,504	1,610
Wisconsin	2,245	21,003	22,685	18,212	61,900	299	64,445	36,157	800
PAD District 3 Total	**431**	**2,280**	**172,428**	**200,249**	**374,957**	**–**	**375,388**	**149,972**	**99,968**
Alabama	–	1,283	23,626	98,512	123,420	–	123,420	17,284	1,478
Arkansas	–	153	3,775	11,797	15,724	–	15,724	17,887	26
Louisiana	–	653	9,613	19,753	30,019	–	30,019	54,961	84,693
Mississippi	–	118	2,585	18,508	21,211	–	21,211	12,431	2,280
New Mexico	431	1	25,211	4,987	30,199	–	30,631	4,179	29
Texas	–	72	107,619	46,692	154,383	–	154,383	43,229	11,461
PAD District 4 Total	**5,531**	**6,667**	**185,117**	**17,377**	**209,161**	**–**	**214,693**	**12,830**	**296**
Colorado	1,607	2,611	22,817	1,310	26,737	–	28,345	–	71
Idaho	560	351	10,011	9,072	19,434	–	19,993	–	33
Montana	1,463	2,841	32,286	37	35,164	–	36,627	1,694	85
Utah	488	815	24,277	6,629	31,721	–	32,209	6,849	91
Wyoming	1,413	49	95,726	330	96,105	–	97,518	4,287	16
PAD District 5 Total	**15,010**	**1,093**	**147,547**	**121,632**	**270,272**	**982**	**286,264**	**14,646**	**2,559**
Alaska	14,044	503	8,273	21,607	30,383	–	44,427	–	2
Arizona	542	–	46,122	13,546	59,668	–	60,210	1,314	117
California	–	35	43,962	11,589	55,585	–	55,585	560	1,288
Hawaii	–	377	1,402	988	2,767	–	2,767	–	4
Nevada	316	1	29,942	52,161	82,104	982	83,402	10	10
Oregon	56	4	9,238	12,919	22,162	–	22,218	12,119	731
Washington	52	173	8,608	8,822	17,604	–	17,656	643	408

Dashed (-) = No data reported.

Notes: • Totals may not equal sum of components due to independent rounding.

Sources: • Energy Information Administration Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2004. • Kerosene data are also based on data from Energy Information Administration's "Petroleum Supply Annual," Volume 1, 2004, (DOE/EIA-0340(04)/1).

Table 10. Sales for Farm Use: Distillate Fuel Oil and Kerosene; Sales for Electric Power and Oil Company Uses: Distillate Fuel Oil and Residual Fuel Oil, 2004
(Thousand Gallons)

Destination	Farm				Electric Power		Oil Company Use	
	Diesel	Other Distillate	Total Distillate	Kerosene	Distillate Fuel Oil	Residual Fuel Oil	Distillate Fuel Oil	Residual Fuel Oil
U.S. Total	**3,116,917**	**72,097**	**3,189,014**	**14,757**	**823,380**	**4,704,027**	**472,920**	**46,818**
PAD District 1 Total	**360,508**	**50,205**	**410,712**	**4,952**	**420,016**	**4,061,320**	**19,682**	**29,438**
Subdistrict 1A Total	**21,680**	**15,462**	**37,141**	**1,717**	**22,998**	**808,988**	**126**	**231**
Connecticut	3,622	2,952	6,574	3	6,306	130,411	38	231
Maine	4,105	8,103	12,208	841	552	54,729	–	–
Massachusetts	5,122	312	5,434	13	13,407	532,774	45	–
New Hampshire	2,687	2,762	5,449	312	958	89,094	17	–
Rhode Island	87	92	180	–	1,575	1,981	12	–
Vermont	6,056	1,241	7,297	549	199	–	14	–
Subdistrict 1B Total	**91,502**	**28,094**	**119,597**	**2,478**	**172,061**	**1,121,164**	**9,664**	**28,801**
Delaware	6,547	11	6,557	246	4,165	28,365	5,348	–
District of Columbia	–	–	–	–	4,888	–	–	–
Maryland	18,448	62	18,511	647	30,524	69,657	2	676
New Jersey	3,794	354	4,148	5	29,952	154,660	497	1,849
New York	27,065	20,335	47,399	1,190	37,736	699,915	11	785
Pennsylvania	35,649	7,332	42,981	390	64,797	168,567	3,807	25,491
Subdistrict 1C Total	**247,326**	**6,648**	**253,974**	**757**	**224,956**	**2,131,168**	**9,892**	**406**
Florida	86,513	–	86,513	3	97,653	1,871,445	16	–
Georgia	69,856	37	69,893	21	16,154	2,949	1,451	–
North Carolina	34,985	5,301	40,286	96	22,681	–	–	115
South Carolina	19,874	846	20,720	111	13,257	251	–	110
Virginia	34,478	443	34,922	418	38,742	256,522	1,707	181
West Virginia	1,618	21	1,639	107	36,468	–	6,718	–
PAD District 2 Total	**1,559,532**	**20,572**	**1,580,103**	**7,138**	**163,258**	**86,724**	**80,051**	**1,532**
Illinois	156,007	1,659	157,666	627	12,062	11,936	81	–
Indiana	117,370	1,624	118,994	692	10,615	–	20	–
Iowa	156,346	726	157,072	599	9,444	–	–	–
Kansas	181,613	164	181,777	80	5,870	38,782	11,343	–
Kentucky	30,002	–	30,002	356	7,698	–	1,754	–
Michigan	46,479	1,300	47,780	231	20,083	32,937	1,189	–
Minnesota	110,574	1,503	112,077	426	8,727	3,068	–	1,157
Missouri	114,708	73	114,780	140	6,042	–	64	–
Nebraska	207,949	922	208,871	236	1,548	–	2	–
North Dakota	103,793	2,702	106,496	46	2,817	–	8,651	–
Ohio	95,571	6,176	101,747	2,719	49,124	–	3,732	375
Oklahoma	49,793	–	49,793	92	2,309	–	52,609	–
South Dakota	56,204	1,619	57,823	27	1,371	–	368	–
Tennessee	33,338	481	33,819	336	13,100	–	238	–
Wisconsin	99,786	1,622	101,408	532	12,448	–	–	–
PAD District 3 Total	**595,937**	**121**	**596,059**	**424**	**27,743**	**360,694**	**271,798**	**8**
Alabama	30,667	–	30,667	19	9,864	–	6,030	–
Arkansas	189,671	105	189,776	15	5,765	31,887	2,137	–
Louisiana	45,121	–	45,121	11	2,460	141,180	36,576	–
Mississippi	52,716	17	52,733	157	3,745	186,401	1,401	8
New Mexico	27,952	–	27,952	19	2,492	–	30,590	–
Texas	249,810	–	249,810	203	3,417	1,226	195,064	–
PAD District 4 Total	**169,361**	**1,080**	**170,441**	**204**	**6,900**	**215**	**61,434**	**–**
Colorado	39,611	19	39,630	134	1,359	215	13,449	–
Idaho	55,185	100	55,285	32	21	–	–	–
Montana	55,126	920	56,046	2	–	–	16,743	–
Utah	9,406	4	9,410	33	1,331	–	12,035	–
Wyoming	10,033	36	10,070	3	4,189	–	19,207	–
PAD District 5 Total	**431,579**	**119**	**431,698**	**2,039**	**205,464**	**195,075**	**39,955**	**15,839**
Alaska	60	–	60	–	58,662	–	25,400	–
Arizona	16,557	–	16,557	1	5,020	–	309	–
California	337,603	–	337,603	486	6,359	–	12,649	–
Hawaii	5,913	–	5,913	–	128,272	195,075	5	15,839
Nevada	4,845	21	4,866	2	914	–	1,043	–
Oregon	31,104	29	31,133	1,126	5,060	–	–	–
Washington	35,498	69	35,567	423	1,177	–	549	–

Dashed (-) = No data reported.
Notes: • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2004. • Kerosene data are also based on data from Energy Information Administration's "Petroleum Supply Annual," Volume 1, 2004, (DOE/EIA-0340(04)/1).

Table 11. Sales for Transportation Use: Distillate Fuel Oil and Residual Fuel Oil, 2004
(Thousand Gallons)

Destination	Railroad Use	Vessel Bunkering		On-Highway Diesel	Total Transportation Use	
	Distillate Fuel Oil	Distillate Fuel Oil	Residual Fuel Oil	Distillate Fuel Oil	Distillate Fuel Oil	Residual Fuel Oil
U.S. Total	**3,047,491**	**2,139,643**	**4,690,454**	**37,125,239**	**42,312,373**	**4,690,454**
PAD District 1 Total	**556,672**	**489,921**	**1,788,718**	**11,731,295**	**12,777,888**	**1,788,718**
Subdistrict 1A Total	**53,814**	**46,375**	**2,078**	**1,114,427**	**1,214,616**	**2,078**
Connecticut	3,656	7,306	888	284,212	295,174	888
Maine	74	14,031	1,096	174,373	188,478	1,096
Massachusetts	49,830	16,094	95	424,503	490,427	95
New Hampshire	185	3,820	–	111,503	115,507	–
Rhode Island	–	4,497	–	57,962	62,459	–
Vermont	69	627	–	61,874	62,570	–
Subdistrict 1B Total	**166,292**	**134,683**	**968,460**	**4,385,713**	**4,686,688**	**968,460**
Delaware	836	680	39,650	65,202	66,718	39,650
District of Columbia	11,315	39	–	24,276	35,629	–
Maryland	2,673	14,398	42,027	538,061	555,132	42,027
New Jersey	19,523	83,306	494,761	896,454	999,284	494,761
New York	76,068	13,296	233,710	1,410,982	1,500,346	233,710
Pennsylvania	55,877	22,964	158,311	1,450,738	1,529,578	158,311
Subdistrict 1C Total	**336,566**	**308,863**	**818,180**	**6,231,155**	**6,876,584**	**818,180**
Florida	72,790	148,556	511,224	1,567,480	1,788,826	511,224
Georgia	121,454	25,364	152,998	1,449,793	1,596,611	152,998
North Carolina	60,844	8,384	16,104	1,095,092	1,164,320	16,104
South Carolina	13,651	34,151	80,005	709,044	756,846	80,005
Virginia	54,029	22,204	57,849	1,115,628	1,191,861	57,849
West Virginia	13,799	70,203	–	294,118	378,120	–
PAD District 2 Total	**1,022,009**	**423,339**	**31,850**	**11,799,020**	**13,244,367**	**31,850**
Illinois	59,292	107,110	635	1,397,874	1,564,276	635
Indiana	85,757	7,289	6,460	1,242,988	1,336,034	6,460
Iowa	44,488	6,649	–	571,883	623,019	–
Kansas	49,475	–	–	413,594	463,069	–
Kentucky	85,954	89,374	244	856,232	1,031,560	244
Michigan	20,607	8,792	10,056	974,893	1,004,292	10,056
Minnesota	59,387	5,367	11,866	660,745	725,499	11,866
Missouri	47,388	65,819	722	1,013,808	1,127,015	722
Nebraska	40,805	–	–	402,763	443,568	–
North Dakota	54,422	–	–	156,154	210,576	–
Ohio	223,369	3,104	45	1,580,121	1,806,595	45
Oklahoma	148,118	6	–	636,979	785,103	–
South Dakota	4,843	–	–	175,679	180,522	–
Tennessee	65,590	127,881	1,690	990,608	1,184,078	1,690
Wisconsin	32,513	1,949	132	724,699	759,161	132
PAD District 3 Total	**757,761**	**849,224**	**1,366,153**	**6,574,471**	**8,181,456**	**1,366,153**
Alabama	56,889	116,401	50,059	786,306	959,596	50,059
Arkansas	78,238	40,574	–	600,997	719,809	–
Louisiana	37,267	419,196	436,468	658,561	1,115,023	436,468
Mississippi	29,989	70,417	67,465	598,448	698,854	67,465
New Mexico	11,690	–	–	465,748	477,438	–
Texas	543,688	202,637	812,161	3,464,411	4,210,737	812,161
PAD District 4 Total	**234,232**	**4**	**–**	**1,669,421**	**1,903,657**	**–**
Colorado	37,131	–	–	505,771	542,902	–
Idaho	21,083	4	–	238,093	259,180	–
Montana	38,900	–	–	222,384	261,284	–
Utah	33,904	–	–	365,585	399,489	–
Wyoming	103,214	–	–	337,588	440,802	–
PAD District 5 Total	**476,818**	**377,155**	**1,503,732**	**5,351,032**	**6,205,005**	**1,503,732**
Alaska	6,938	133,122	–	208,558	348,619	–
Arizona	16,354	–	–	776,419	792,773	–
California	310,156	46,117	1,114,585	2,844,083	3,200,356	1,114,585
Hawaii	–	115,769	58,945	42,788	158,557	58,945
Nevada	6,221	9	–	330,258	336,488	–
Oregon	58,830	11,606	68,711	521,796	592,232	68,711
Washington	78,319	70,532	261,492	627,130	775,982	261,492

Dashed (-) = No data reported.
Notes: • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2004. • On-Highway Diesel data are Federal Highway Administration statistics of highway special fuels use.

Table 12. Sales for Military, Off-Highway, and All Other Uses: Distillate Fuel Oil, Residual Fuel Oil, and Kerosene, 2004
(Thousand Gallons)

Destination	Military				Off-Highway Distillate Fuel Oil			All Other	
	Diesel	Other Distillate	Total Distillate	Residual Fuel Oil	Construction	Other	Total	Residual Fuel Oil	Kerosene
U.S. Total	**320,907**	**37,775**	**358,682**	**30,286**	**2,179,345**	**567,615**	**2,746,960**	**1,004**	**1,683**
PAD District 1 Total	**47,749**	**33,247**	**80,996**	**26,382**	**741,282**	**178,940**	**920,223**	**795**	**884**
Subdistrict 1A Total	**2,887**	**3,900**	**6,788**	**–**	**102,766**	**24,156**	**126,922**	**494**	**403**
Connecticut	47	1,391	1,438	–	16,055	169	16,223	316	196
Maine	1,420	1,398	2,818	–	12,093	13,088	25,181	179	31
Massachusetts	667	2	669	–	53,518	5,750	59,268	–	–
New Hampshire	698	977	1,674	–	12,349	3,491	15,840	–	61
Rhode Island	11	–	11	–	2,703	2	2,706	–	–
Vermont	44	133	177	–	6,048	1,657	7,704	–	116
Subdistrict 1B Total	**9,305**	**17,119**	**26,425**	**10,262**	**230,564**	**18,437**	**249,001**	**–**	**435**
Delaware	28	98	126	–	4,177	77	4,254	–	–
District of Columbia	2,198	1,494	3,692	–	1,612	–	1,612	–	–
Maryland	1,513	6,068	7,581	7,936	39,489	1,055	40,544	–	90
New Jersey	996	1,250	2,246	–	80,712	5,575	86,286	–	232
New York	2,313	1,957	4,270	–	35,759	272	36,031	–	38
Pennsylvania	2,258	6,252	8,510	2,327	68,816	11,458	80,274	–	75
Subdistrict 1C Total	**35,556**	**12,228**	**47,784**	**16,120**	**407,953**	**136,347**	**544,300**	**300**	**46**
Florida	3,283	–	3,283	551	155,380	26,698	182,078	–	–
Georgia	2,807	1,058	3,866	–	66,601	47,345	113,946	–	9
North Carolina	2,013	5,372	7,385	–	35,393	8,207	43,600	300	2
South Carolina	8,565	118	8,683	–	38,699	23,406	62,105	–	–
Virginia	18,812	5,533	24,344	15,569	94,324	25,696	120,020	–	35
West Virginia	75	147	223	–	17,556	4,995	22,551	–	–
PAD District 2 Total	**10,000**	**2,292**	**12,291**	**306**	**706,968**	**97,983**	**804,952**	**56**	**430**
Illinois	246	18	264	–	123,220	4,543	127,763	–	53
Indiana	171	66	237	–	43,269	4,607	47,876	–	67
Iowa	61	–	61	–	20,445	2,785	23,230	–	2
Kansas	310	–	310	306	21,059	736	21,795	–	4
Kentucky	355	258	613	–	36,591	8,860	45,451	–	81
Michigan	1,003	3	1,006	–	67,174	9,204	76,377	9	4
Minnesota	112	37	149	–	58,181	14,212	72,393	11	4
Missouri	2,605	1,037	3,642	–	79,104	8,203	87,307	–	–
Nebraska	102	–	102	–	12,642	2,415	15,057	–	125
North Dakota	487	–	487	–	18,262	880	19,142	–	–
Ohio	1,398	404	1,801	–	78,478	3,533	82,011	36	36
Oklahoma	2,058	–	2,058	–	36,624	2,704	39,329	–	–
South Dakota	114	–	114	–	8,990	899	9,889	–	–
Tennessee	213	37	250	–	50,987	18,461	69,448	–	52
Wisconsin	766	431	1,197	–	51,942	15,942	67,884	–	–
PAD District 3 Total	**87,272**	**872**	**88,144**	**2,614**	**287,713**	**187,574**	**475,287**	**32**	**2**
Alabama	9,489	420	9,909	832	76,981	48,790	125,771	–	–
Arkansas	283	136	419	–	9,934	16,373	26,307	–	–
Louisiana	33,872	–	33,872	–	63,208	46,350	109,558	–	–
Mississippi	565	316	881	–	48,579	51,006	99,586	–	–
New Mexico	694	–	694	–	5,154	1,208	6,361	32	1
Texas	42,369	1	42,369	1,782	83,858	23,847	107,704	–	–
PAD District 4 Total	**851**	**160**	**1,012**	**–**	**120,564**	**40,542**	**161,106**	**–**	**4**
Colorado	565	144	709	–	54,886	716	55,602	–	1
Idaho	55	–	55	–	12,962	18,193	31,155	–	–
Montana	24	16	40	–	12,346	13,883	26,229	–	3
Utah	45	–	45	–	28,610	5,502	34,113	–	–
Wyoming	163	–	163	–	11,760	2,248	14,008	–	–
PAD District 5 Total	**175,035**	**1,203**	**176,239**	**984**	**322,817**	**62,575**	**385,392**	**120**	**362**
Alaska	10,393	1,144	11,537	–	13,080	4,582	17,662	–	–
Arizona	511	60	571	–	51,527	3,010	54,536	–	–
California	58,066	–	58,066	–	179,542	10,366	189,909	–	15
Hawaii	65,999	–	65,999	984	7,294	1,067	8,361	–	–
Nevada	549	–	549	–	26,075	1,084	27,159	–	1
Oregon	2,022	–	2,022	–	16,824	22,718	39,541	–	14
Washington	37,493	–	37,493	–	28,474	19,749	48,223	120	332

Dashed (-) = No data reported.

Notes: • Totals may not equal sum of components due to independent rounding.

Sources: • Energy Information Administration Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2004. • Kerosene data are also based on data from Energy Information Administration's "Petroleum Supply Annual," Volume 1, 2004, (DOE/EIA-0340(04)/1).

Adjusted Sales of Fuel Oil and Kerosene in 2004

Tables 13 through 24 contain estimates of distillate fuel oil that have been adjusted at the PAD district level to equal published EIA volume estimates of petroleum products supplied in the U.S. marketplace. The kerosene and residual fuel oil sales estimates have been adjusted at the national level. The products supplied estimates can be found in the 2000 through 2004 issues of the *Petroleum Supply Annual, Volume 1* (*PSA*). In addition, electric power generation data and on-highway diesel data are used in lieu of adjusted survey results. See “Technical Note 3" in Appendix A for further explanation of data adjustments.

Total domestic adjusted sales of fuel oil and kerosene increased 5.2 percent from 72.8 billion gallons in 2003 to 76.6 billion gallons in 2004. Adjusted sales of distillate and residual fuel oils and kerosene all increased by 3.6, 12.3 and 18.1 percent, respectively in 2004.

NOTE: The 2003 adjusted numbers have been revised since they were first published in the *Fuel Oil and Kerosene Sales 2003*. The revisions to the data were made to include new distillate and residual volumes for “Electric Power”. When we originally published the *Fuel Oil and Kerosene Sales 2003*, the “Electric Power” information was still being collected and verified

Table 13. Adjusted Sales of Distillate Fuel Oil by Energy Use in the United States: 2000-2004
(Thousand Gallons)

Energy Use	Distillate Fuel Oil				
	2000	2001	2002	2003	2004
U.S. Total	**57,217,230**	**58,971,486**	**57,884,652**	**60,201,666**	**62,383,608**
Residential	6,123,946	6,275,678	5,885,280	R6,095,568	5,997,355
Commercial	3,324,687	3,512,488	3,043,558	R3,184,539	3,197,274
Industrial	2,117,531	2,329,029	2,223,793	R2,032,835	2,417,821
Oil Company	671,170	822,797	821,883	R466,425	554,196
Farm	3,122,416	3,434,936	3,158,072	R2,696,987	3,507,731
Electric Power	1,139,740	1,455,075	789,751	R1,233,615	735,002
Railroad	3,026,147	2,958,815	3,061,280	R3,086,390	3,310,588
Vessel Bunkering	2,041,433	2,099,011	2,056,465	R1,863,150	2,319,308
On-Highway Diesel	33,129,664	33,215,320	34,308,885	37,103,563	37,125,239
Military	227,998	347,220	327,145	R273,754	358,519
Off-Highway Diesel	2,292,498	2,521,118	2,208,540	R2,164,839	2,860,575

R = Revised.

Notes: • See Technical Note 3 for further explanations on 2004 revised data and adjustments. • Distillate fuel oil data in the Adjusted Sales tables (13-24) are adjusted at the PAD District level. • Totals may not equal sum of components due to independent rounding.

Sources: • Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2000-2004 and "Petroleum Supply Annual," Volume 1, 2000-2004, (DOE/EIA-0340(00)/1 - (04)/1). • See Technical Note 3 for further explanation of Electric Power. • On-Highway Diesel data are Federal Highway Administration statistics of highway special fuels use.

Table 14. Adjusted Sales of Residual Fuel Oil by Energy Use in the United States: 2000-2004
(Thousand Gallons)

Energy Use	Residual Fuel Oil				
	2000	2001	2002	2003	2004
U.S. Total	**13,966,134**	**13,508,460**	**10,724,994**	**11,836,776**	**13,292,286**
Commercial	641,810	520,335	564,516	R741,823	812,627
Industrial	1,531,336	1,403,638	1,234,188	R1,387,615	1,600,251
Oil Company	148,311	106,176	107,244	R82,527	48,655
Electric Power	5,418,215	7,112,731	4,027,869	R5,811,820	5,923,734
Vessel Bunkering	6,192,294	4,345,284	4,783,956	R3,801,425	4,874,502
Military	27,462	16,160	3,831	R10,057	31,475
All Other	6,706	4,136	3,389	R1,509	1,043

R = Revised.

Notes: • See "Technical Note 3" for further explanations on 2003 and 2004 revised data and adjustments. • Residual fuel oil data in the Adjusted Sales tables (13-24) are adjusted at the national level. • Totals may not equal sum of components due to independent rounding.

Sources: • Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2000-2004 and "Petroleum Supply Annual," Volume 1, 2000-2004, (DOE/EIA-0340(00)/1 - (04)/1). • See Technical Note 3 for further explanation of Electric Power.

Table 15. Adjusted Sales of Kerosene by Energy Use in the United States: 2000-2004
(Thousand Gallons)

Energy Use	Kerosene				
	2000	2001	2002	2003	2004
U.S. Total	**1,036,014**	**1,108,926**	**664,314**	**837,480**	**988,680**
Residential	700,532	704,305	443,919	520,799	627,842
Commercial	219,633	232,608	118,125	138,049	151,811
Industrial	86,844	141,317	77,508	164,386	192,588
Farm	23,084	27,162	19,390	11,674	14,757
All Other	5,921	3,535	5,372	2,572	1,683

Notes: • See Technical Note 3 for further explanation on adjustments. • Kerosene data in the Adjusted Sales tables (13-24) are adjusted at the national level. • Totals may not equal sum of components due to independent rounding.

Sources: • Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2000-2004 and "Petroleum Supply Annual," Volume 1, 2000-2004, (DOE/EIA-0340(00)/1 - (04)/1).

Table 16. Adjusted Sales of Distillate Fuel Oil by Energy Use, 2003 and 2004

(Thousand Gallons)

Destination	Residential		Commercial		Industrial	
	R2003	2004	R2003	2004	R2003	2004
U.S. Total	**6,095,568**	**5,997,355**	**3,184,539**	**3,197,274**	**2,032,835**	**2,417,821**
PAD District 1 Total	**5,456,353**	**5,120,586**	**2,307,584**	**2,101,882**	**754,669**	**717,746**
Subdistrict 1A Total	**2,212,242**	**2,133,959**	**664,293**	**552,793**	**105,191**	**81,323**
Connecticut	612,023	624,481	139,819	130,121	46,903	20,048
Maine	353,264	362,516	146,814	127,612	15,218	21,725
Massachusetts	808,186	709,461	222,777	158,193	19,103	14,739
New Hampshire	198,496	195,769	77,965	67,335	10,428	9,784
Rhode Island	148,226	142,812	39,217	31,517	6,064	6,658
Vermont	92,047	98,922	37,701	38,015	7,474	8,368
Subdistrict 1B Total	**2,877,500**	**2,643,415**	**1,256,786**	**1,161,937**	**178,982**	**205,706**
Delaware	42,278	35,407	11,727	11,024	2,638	3,030
District of Columbia	14,067	14,195	14,857	16,785	215	319
Maryland	164,780	150,337	89,292	77,350	23,240	23,766
New Jersey	412,140	363,568	122,095	98,325	37,479	35,397
New York	1,354,077	1,257,082	768,040	730,384	41,122	54,652
Pennsylvania	890,158	822,826	250,776	228,070	74,288	88,543
Subdistrict 1C Total	**366,611**	**343,211**	**386,505**	**387,152**	**470,496**	**430,717**
Florida	4,449	4,670	106,469	146,012	90,451	73,032
Georgia	1,501	1,478	36,546	39,528	92,271	64,030
North Carolina	118,698	105,229	85,022	61,638	52,914	54,346
South Carolina	17,284	10,554	23,436	20,276	25,060	23,296
Virginia	205,794	205,517	126,001	111,062	101,342	110,772
West Virginia	18,885	15,764	9,031	8,636	108,457	105,239
PAD District 2 Total	**566,216**	**673,015**	**505,379**	**589,830**	**579,670**	**723,768**
Illinois	9,794	14,615	55,303	40,250	53,868	59,706
Indiana	45,404	48,879	66,962	81,301	93,672	110,519
Iowa	15,030	15,469	26,940	22,416	7,198	12,900
Kansas	713	617	25,316	27,704	21,466	13,114
Kentucky	19,325	21,158	30,490	38,653	91,956	111,134
Michigan	88,229	98,101	45,766	51,101	21,470	31,714
Minnesota	93,274	113,055	29,375	38,666	43,566	69,793
Missouri	7,966	9,256	32,476	40,911	31,792	45,637
Nebraska	3,457	4,630	8,171	8,738	6,310	8,602
North Dakota	19,983	27,969	7,090	8,653	13,323	15,743
Ohio	129,110	161,012	69,803	92,896	72,954	101,058
Oklahoma	37	44	3,779	14,109	15,898	12,613
South Dakota	12,143	11,844	5,054	9,317	5,557	5,937
Tennessee	4,671	6,009	42,465	51,505	42,781	51,331
Wisconsin	117,081	140,357	56,389	63,610	57,858	73,967
PAD District 3 Total	**879**	**9,221**	**253,791**	**225,104**	**441,410**	**466,889**
Alabama	335	690	48,247	57,569	143,192	153,504
Arkansas	163	288	32,878	26,861	22,031	19,557
Louisiana	189	212	15,701	15,261	23,068	37,336
Mississippi	45	266	19,672	10,783	26,582	26,381
New Mexico	138	202	17,717	21,009	31,934	38,097
Texas	10	7,563	119,575	93,621	194,603	192,014
PAD District 4 Total	**22,622**	**35,213**	**53,610**	**77,024**	**190,952**	**245,141**
Colorado	411	784	11,236	15,458	26,169	32,365
Idaho	11,618	19,818	11,000	19,171	14,339	22,829
Montana	7,036	8,928	6,206	14,086	26,044	41,822
Utah	2,501	4,049	19,532	23,430	35,057	36,777
Wyoming	1,056	1,633	5,637	4,878	89,343	111,349
PAD District 5 Total	**49,497**	**159,320**	**64,174**	**203,433**	**66,135**	**264,276**
Alaska	17,460	65,239	11,055	44,788	12,382	41,015
Arizona	111	192	5,823	13,388	15,558	55,585
California	1,431	5,512	21,306	64,333	13,542	51,316
Hawaii	4	12	3,350	14,758	1,334	2,554
Nevada	2,017	6,596	3,325	14,395	11,643	76,995
Oregon	10,682	29,393	6,277	22,913	5,468	20,511
Washington	17,792	52,377	13,038	28,859	6,207	16,300

See footnotes at end of table.

Table 16. Adjusted Sales of Distillate Fuel Oil by Energy Use, 2003 and 2004 (Continued)

(Thousand Gallons)

Destination	Oil Company		Farm		Electric Power	
	R2003	2004	R2003	2004	R2003	2004
U.S. Total	**466,425**	**554,196**	**2,696,987**	**3,507,731**	**1,233,615**	**735,002**
PAD District 1 Total	**23,857**	**17,235**	**444,199**	**359,641**	**610,073**	**374,933**
Subdistrict 1A Total	**664**	**110**	**33,136**	**32,523**	**24,907**	**20,530**
Connecticut	7	33	7,022	5,757	4,707	5,629
Maine	196	–	10,795	10,690	577	493
Massachusetts	–	39	4,678	4,758	14,969	11,968
New Hampshire	–	15	5,260	4,771	1,910	855
Rhode Island	462	10	81	157	1,479	1,406
Vermont	–	13	5,300	6,390	1,264	178
Subdistrict 1B Total	**13,154**	**8,462**	**105,945**	**104,725**	**212,920**	**153,593**
Delaware	7,482	4,683	6,479	5,742	8,159	3,718
District of Columbia	–	–	–	–	9,013	4,363
Maryland	–	2	18,368	16,209	46,352	27,248
New Jersey	1,506	435	5,184	3,632	29,859	26,737
New York	2	10	42,455	41,505	33,352	33,685
Pennsylvania	4,164	3,333	33,459	37,637	86,185	57,842
Subdistrict 1C Total	**10,039**	**8,662**	**305,118**	**222,393**	**372,247**	**200,810**
Florida	31	14	146,068	75,755	99,845	87,171
Georgia	257	1,271	71,799	61,202	21,335	14,420
North Carolina	1,153	–	37,066	35,277	51,467	20,247
South Carolina	1,229	–	17,214	18,144	21,966	11,834
Virginia	3,745	1,495	31,800	30,579	138,569	34,584
West Virginia	3,624	5,882	1,171	1,435	39,065	32,554
PAD District 2 Total	**64,746**	**91,880**	**1,378,182**	**1,813,588**	**206,272**	**145,734**
Illinois	58	93	146,048	180,963	9,961	10,767
Indiana	–	23	116,000	136,577	17,492	9,475
Iowa	–	–	155,117	180,282	7,110	8,430
Kansas	8,503	13,019	143,722	208,637	7,429	5,240
Kentucky	1,270	2,014	27,143	34,435	8,930	6,872
Michigan	697	1,364	42,245	54,840	20,355	17,927
Minnesota	–	–	105,119	128,638	9,662	7,790
Missouri	114	73	82,474	131,741	6,532	5,393
Nebraska	–	2	182,807	239,735	3,057	1,382
North Dakota	5,364	9,929	86,293	122,232	2,168	2,515
Ohio	3,179	4,284	86,647	116,781	63,850	43,852
Oklahoma	45,305	60,383	39,679	57,150	4,854	2,061
South Dakota	–	423	54,412	66,367	1,649	1,224
Tennessee	37	273	26,866	38,816	32,247	11,694
Wisconsin	217	–	83,609	116,392	10,976	11,112
PAD District 3 Total	**329,362**	**338,049**	**622,951**	**741,349**	**178,734**	**24,765**
Alabama	921	7,500	28,388	38,142	16,469	8,805
Arkansas	2,792	2,658	176,420	236,034	8,050	5,146
Louisiana	75,717	45,491	56,131	56,119	10,494	2,196
Mississippi	2,102	1,742	51,518	65,586	2,492	3,343
New Mexico	26,373	38,047	35,926	34,765	3,304	2,225
Texas	221,456	242,611	274,568	310,702	137,924	3,050
PAD District 4 Total	**34,800**	**70,147**	**150,056**	**194,614**	**12,349**	**6,160**
Colorado	4,227	15,357	42,601	45,251	1,848	1,213
Idaho	–	–	44,020	63,126	9	19
Montana	10,537	19,117	40,067	63,995	–	–
Utah	7,425	13,741	17,344	10,744	3,536	1,188
Wyoming	12,611	21,931	6,025	11,498	3,471	3,739
PAD District 5 Total	**13,661**	**36,886**	**101,599**	**398,540**	**226,187**	**183,411**
Alaska	10,292	23,449	13	55	77,290	52,365
Arizona	39	286	5,457	15,285	5,210	4,481
California	2,891	11,677	77,709	311,672	7,539	5,676
Hawaii	2	5	1,739	5,458	134,182	114,504
Nevada	305	963	949	4,492	1,216	816
Oregon	–	–	6,824	28,741	231	4,517
Washington	132	507	8,907	32,835	519	1,051

See footnotes at end of table.

Table 16. Adjusted Sales of Distillate Fuel Oil by Energy Use, 2003 and 2004 (Continued)

(Thousand Gallons)

Destination	Railroad		Vessel Bunkering		On-Highway	
	R2003	2004	R2003	2004	2003	2004
U.S. Total	**3,086,390**	**3,310,588**	**1,863,150**	**2,319,308**	**37,103,563**	**37,125,239**
PAD District 1 Total	**517,109**	**487,451**	**449,619**	**429,000**	**10,900,154**	**11,731,295**
Subdistrict 1A Total	**22,470**	**47,122**	**43,827**	**40,608**	**1,060,291**	**1,114,427**
Connecticut	3,358	3,201	5,559	6,398	221,316	284,212
Maine	1,016	65	15,464	12,286	201,804	174,373
Massachusetts	17,882	43,634	15,222	14,093	409,242	424,503
New Hampshire	188	162	2,893	3,345	101,598	111,503
Rhode Island	–	–	4,117	3,938	59,616	57,962
Vermont	26	61	572	549	66,715	61,874
Subdistrict 1B Total	**190,092**	**145,614**	**114,442**	**117,935**	**4,038,926**	**4,385,713**
Delaware	1,141	732	647	596	63,366	65,202
District of Columbia	8,617	9,908	4	34	25,579	24,276
Maryland	16,749	2,341	10,909	12,607	509,305	538,061
New Jersey	18,779	17,096	74,739	72,947	867,588	896,454
New York	80,032	66,609	9,334	11,642	1,258,604	1,410,982
Pennsylvania	64,773	48,928	18,810	20,108	1,314,484	1,450,738
Subdistrict 1C Total	**304,547**	**294,715**	**291,350**	**270,457**	**5,800,937**	**6,231,155**
Florida	81,481	63,739	141,909	130,083	1,425,356	1,567,480
Georgia	100,718	106,351	16,003	22,210	1,425,552	1,449,793
North Carolina	59,429	53,279	3,410	7,341	1,034,884	1,095,092
South Carolina	5,267	11,953	35,777	29,905	629,129	709,044
Virginia	48,328	47,310	27,893	19,443	1,015,930	1,115,628
West Virginia	9,325	12,083	66,360	61,474	270,086	294,118
PAD District 2 Total	**1,255,425**	**1,173,026**	**405,996**	**485,893**	**11,804,120**	**11,799,020**
Illinois	201,714	68,053	53,887	122,937	1,402,713	1,397,874
Indiana	94,519	98,429	7,735	8,366	1,474,547	1,242,988
Iowa	37,415	51,061	6,251	7,631	509,625	571,883
Kansas	76,553	56,786	–	–	403,967	413,594
Kentucky	88,669	98,655	76,528	102,580	712,342	856,232
Michigan	13,806	23,652	8,438	10,091	977,042	974,893
Minnesota	54,540	68,162	3,496	6,160	642,015	660,745
Missouri	49,063	54,391	84,815	75,545	968,144	1,013,808
Nebraska	37,965	46,835	–	–	377,378	402,763
North Dakota	45,564	62,464	–	–	158,901	156,154
Ohio	184,296	256,375	7,534	3,563	1,512,124	1,580,121
Oklahoma	263,653	170,005	7	7	855,483	636,979
South Dakota	4,059	5,559	–	–	169,583	175,679
Tennessee	70,242	75,282	155,954	146,777	967,596	990,608
Wisconsin	33,368	37,317	1,351	2,237	672,660	724,699
PAD District 3 Total	**983,759**	**942,466**	**904,599**	**1,056,224**	**5,991,419**	**6,574,471**
Alabama	53,081	70,756	73,207	144,774	706,097	786,306
Arkansas	120,526	97,309	9,323	50,464	589,387	600,997
Louisiana	53,903	46,350	480,229	521,375	673,766	658,561
Mississippi	41,679	37,299	73,624	87,581	591,531	598,448
New Mexico	15,769	14,539	–	–	439,259	465,748
Texas	698,802	676,213	268,215	252,031	2,991,379	3,464,411
PAD District 4 Total	**202,250**	**267,451**	**431**	**5**	**1,730,771**	**1,669,421**
Colorado	48,733	42,398	429	–	577,265	505,771
Idaho	17,507	24,073	2	5	228,873	238,093
Montana	20,972	44,417	–	–	193,427	222,384
Utah	30,154	38,712	–	–	350,491	365,585
Wyoming	84,885	117,852	–	–	380,715	337,588
PAD District 5 Total	**127,847**	**440,194**	**102,505**	**348,186**	**6,677,099**	**5,351,032**
Alaska	1,720	6,405	28,744	122,897	89,126	208,558
Arizona	4,687	15,098	–	–	730,271	776,419
California	74,218	286,333	16,968	42,575	4,478,284	2,844,083
Hawaii	–	–	36,637	106,877	36,631	42,788
Nevada	1,465	5,743	3	8	301,013	330,258
Oregon	21,234	54,311	3,558	10,714	448,164	521,796
Washington	24,523	72,304	16,594	65,115	593,610	627,130

See footnotes at end of table.

Table 16. Adjusted Sales of Distillate Fuel Oil by Energy Use, 2003 and 2004 (Continued)

(Thousand Gallons)

Destination	Military		Off-Highway		Total	
	R2003	2004	R2003	2004	R2003	2004
U.S. Total	**273,754**	**358,519**	**2,164,839**	**2,860,575**	**60,201,666**	**62,383,608**
PAD District 1 Total	**96,035**	**70,925**	**776,369**	**805,795**	**22,336,020**	**22,216,488**
Subdistrict 1A Total	**7,798**	**5,944**	**111,264**	**111,139**	**4,286,083**	**4,140,479**
Connecticut	1,139	1,260	14,179	14,206	1,056,031	1,095,345
Maine	3,447	2,468	24,132	22,050	772,729	734,278
Massachusetts	1,061	586	52,343	51,898	1,565,462	1,433,872
New Hampshire	1,794	1,466	13,271	13,870	413,805	408,875
Rhode Island	18	10	2,838	2,369	262,119	246,839
Vermont	338	155	4,500	6,746	215,937	221,270
Subdistrict 1B Total	**37,619**	**23,139**	**196,587**	**218,038**	**9,222,954**	**9,168,279**
Delaware	114	110	3,326	3,725	147,357	133,968
District of Columbia	2,518	3,233	3,536	1,411	78,406	74,524
Maryland	9,086	6,639	37,850	35,503	925,931	890,063
New Jersey	16,103	1,966	39,371	75,557	1,624,843	1,592,115
New York	2,225	3,739	34,830	31,550	3,624,073	3,641,841
Pennsylvania	7,572	7,452	77,673	70,292	2,822,344	2,835,768
Subdistrict 1C Total	**50,617**	**41,842**	**468,517**	**476,617**	**8,826,983**	**8,907,731**
Florida	3,899	2,875	171,302	159,437	2,271,259	2,310,269
Georgia	4,646	3,385	88,994	99,777	1,859,621	1,863,446
North Carolina	12,040	6,466	46,212	38,179	1,502,294	1,477,094
South Carolina	2,052	7,603	49,297	54,382	827,711	896,992
Virginia	27,806	21,317	95,036	105,096	1,822,244	1,802,803
West Virginia	174	195	17,676	19,747	543,854	557,127
PAD District 2 Total	**10,960**	**14,108**	**676,763**	**923,895**	**17,453,730**	**18,433,758**
Illinois	407	303	77,442	146,642	2,011,196	2,042,204
Indiana	519	272	43,111	54,950	1,959,961	1,791,779
Iowa	321	70	20,168	26,663	785,176	896,806
Kansas	799	356	17,504	25,016	705,974	764,082
Kentucky	650	703	48,458	52,167	1,105,760	1,324,603
Michigan	727	1,155	60,398	87,663	1,279,172	1,352,502
Minnesota	576	171	68,365	83,090	1,049,989	1,176,270
Missouri	2,713	4,180	74,898	100,208	1,340,987	1,481,143
Nebraska	58	117	15,813	17,282	635,018	730,085
North Dakota	814	559	6,375	21,970	345,875	428,189
Ohio	809	2,068	84,154	94,129	2,214,458	2,456,138
Oklahoma	–	2,362	44,756	45,140	1,274,752	1,000,853
South Dakota	200	131	7,760	11,350	260,418	287,832
Tennessee	107	287	48,658	79,710	1,391,623	1,452,292
Wisconsin	960	1,373	58,904	77,915	1,093,372	1,248,980
PAD District 3 Total	**112,443**	**109,630**	**509,418**	**591,139**	**10,328,766**	**11,079,306**
Alabama	9,462	12,325	137,951	156,428	1,217,349	1,436,799
Arkansas	484	521	34,331	32,719	996,386	1,072,554
Louisiana	662	42,129	82,977	136,263	1,472,838	1,561,294
Mississippi	4,718	1,096	67,606	123,860	881,569	956,385
New Mexico	614	863	11,525	7,912	582,559	623,405
Texas	96,504	52,697	175,029	133,957	5,178,065	5,428,869
PAD District 4 Total	**4,929**	**1,155**	**110,091**	**183,955**	**2,512,860**	**2,750,286**
Colorado	1,115	810	37,530	63,487	751,562	722,894
Idaho	3,625	62	18,624	35,574	349,618	422,770
Montana	38	46	13,529	29,949	321,338	444,744
Utah	152	51	29,139	38,951	495,330	533,229
Wyoming	–	186	11,270	15,995	595,013	626,649
PAD District 5 Total	**49,388**	**162,702**	**92,199**	**355,790**	**7,570,290**	**7,903,770**
Alaska	3,181	10,650	3,347	16,306	254,609	591,728
Arizona	188	527	15,085	50,347	782,429	931,608
California	12,880	53,606	33,354	175,322	4,740,122	3,852,105
Hawaii	14,841	60,930	2,137	7,719	230,857	355,605
Nevada	213	507	6,784	25,073	328,933	465,846
Oregon	475	1,867	11,470	36,504	514,384	731,269
Washington	17,609	34,614	20,024	44,519	718,956	975,609

Dashed (-) = No data reported. R = Revised.

Notes: • See "Technical Note 3" for further explanations on 2003 revised data. • Totals may not equal sum of components due to independent rounding.

Sources: • Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2003-2004 and "Petroleum Supply Annual," Volume 1, 2003-2004, (DOE/EIA-0340(03)/1 - (04)/1). • See "Technical Note 3" in for further explanation of Electric Power. • On-Highway Diesel data are Federal Highway Administration statistics of highway special fuels use.

Table 17. Adjusted Sales of Residual Fuel Oil by Energy Use, 2003 and 2004

(Thousand Gallons)

Destination	Commercial		Industrial		Oil Company		Electric Power	
	R2003	2004	R2003	2004	R2003	2004	R2003	2004
U.S. Total	**741,823**	**812,627**	**1,387,615**	**1,600,251**	**82,527**	**48,655**	**5,811,820**	**5,923,734**
PAD District 1 Total	**693,047**	**760,402**	**959,483**	**1,163,352**	**51,584**	**30,593**	**4,908,241**	**5,114,379**
Subdistrict 1A Total	**147,401**	**200,242**	**220,462**	**242,735**	**678**	**241**	**1,117,493**	**1,018,751**
Connecticut	29,575	13,730	31,603	45,445	231	241	74,555	164,225
Maine	13,378	14,526	113,542	131,412	38	–	118,398	68,919
Massachusetts	76,007	115,592	40,660	30,047	–	–	761,434	670,916
New Hampshire	6,436	33,785	16,129	18,051	–	–	162,953	112,196
Rhode Island	15,656	16,494	12,620	11,499	409	–	153	2,494
Vermont	6,349	6,116	5,908	6,281	–	–	–	–
Subdistrict 1B Total	**517,972**	**528,622**	**177,894**	**196,681**	**50,470**	**29,931**	**1,390,650**	**1,411,870**
Delaware	11,423	7,966	15,759	32,311	11,410	–	80,532	35,720
Maryland	11,747	3,616	24,243	29,293	639	703	69,941	87,719
New Jersey	18,534	14,475	19,460	20,550	1,762	1,922	144,509	194,762
New York	452,616	477,185	65,790	61,025	682	815	890,940	881,395
Pennsylvania	23,653	25,381	52,642	53,502	35,976	26,491	204,728	212,274
Subdistrict 1C Total	**27,674**	**31,538**	**561,127**	**723,935**	**435**	**422**	**2,400,098**	**2,683,758**
Florida	701	4,897	78,063	127,873	–	–	2,026,924	2,356,692
Georgia	456	–	96,412	119,015	–	–	4,075	3,714
North Carolina	8,740	11,510	164,164	217,839	105	120	–	–
South Carolina	759	1,941	132,825	143,058	110	114	–	317
Virginia	17,019	13,190	87,568	101,818	220	188	369,099	323,035
West Virginia	–	–	2,095	14,332	–	–	–	–
PAD District 2 Total	**43,398**	**46,835**	**188,866**	**252,488**	**11,357**	**1,592**	**175,406**	**109,211**
Illinois	292	2,053	5,541	13,966	–	–	47,709	15,031
Indiana	2,661	4,762	13,099	22,205	–	–	–	–
Iowa	–	–	6,279	11,748	–	–	–	–
Kansas	–	–	26,195	27,805	–	–	66,272	48,838
Kentucky	–	–	2,451	2,436	2,588	–	–	–
Michigan	3,790	2,058	26,694	28,634	3,225	–	52,493	41,477
Minnesota	14,341	18,745	23,112	26,046	2,476	1,203	4,020	3,864
Missouri	920	681	3,506	5,271	–	–	–	–
Nebraska	604	2,041	5,309	7,526	–	–	–	–
North Dakota	4,204	764	1,795	1,858	–	–	–	–
Ohio	89	4,202	20,280	26,615	2,886	390	2,641	–
Oklahoma	–	40	20,054	25,499	–	–	2,270	–
South Dakota	–	531	1,795	3,349	128	–	–	–
Tennessee	–	546	10,365	11,955	–	–	–	–
Wisconsin	16,498	10,412	22,390	37,576	54	–	–	–
PAD District 3 Total	**3,087**	**2,936**	**211,639**	**155,856**	**8**	**9**	**254,444**	**454,218**
Alabama	–	–	11,499	17,962	–	–	–	–
Arkansas	–	15	7,889	18,589	–	–	13,033	40,155
Louisiana	2,991	2,556	119,788	57,118	–	–	94,676	177,787
Mississippi	96	366	6,793	12,919	8	9	124,683	234,733
New Mexico	–	–	6,573	4,343	–	–	–	–
Texas	–	–	59,097	44,925	–	–	22,051	1,543
PAD District 4 Total	**22**	**–**	**8,412**	**13,334**	**2,476**	**–**	**231**	**271**
Colorado	–	–	–	–	–	–	–	271
Idaho	–	–	16	–	–	–	–	–
Montana	22	–	–	1,761	238	–	–	–
Utah	–	–	2,851	7,118	1,805	–	231	–
Wyoming	–	–	5,544	4,455	433	–	–	–
PAD District 5 Total	**2,268**	**2,454**	**19,216**	**15,221**	**17,103**	**16,461**	**473,498**	**245,655**
Alaska	–	–	–	–	–	–	–	–
Arizona	–	–	–	1,366	–	–	–	–
California	–	–	1,508	582	701	–	148	–
Hawaii	–	176	60	–	15,206	16,461	472,494	245,655
Nevada	–	–	–	10	36	–	–	–
Oregon	2,220	2,278	14,738	12,594	606	–	750	–
Washington	48	–	2,910	669	555	–	106	–

See footnotes at end of table.

Table 17. Adjusted Sales of Residual Fuel Oil by Energy Use, 2003 and 2004 (Continued)

(Thousand Gallons)

Destination	Vessel Bunkering		Military		All Other		Total	
	R2003	2004	R2003	2004	R2003	2004	R2003	2004
U.S. Total	**3,801,425**	**4,874,502**	**10,057**	**31,475**	**1,509**	**1,043**	**11,836,776**	**13,292,286**
PAD District 1 Total	**1,269,876**	**1,858,905**	**4,019**	**27,417**	**1,152**	**826**	**7,887,401**	**8,955,874**
Subdistrict 1A Total	**511**	**2,160**	**–**	**–**	**245**	**514**	**1,486,790**	**1,464,643**
Connecticut	92	923	–	–	245	328	136,301	224,892
Maine	105	1,139	–	–	–	186	245,460	216,182
Massachusetts	314	98	–	–	–	–	878,416	816,654
New Hampshire	–	–	–	–	–	–	185,518	164,031
Rhode Island	–	–	–	–	–	–	28,838	30,487
Vermont	–	–	–	–	–	–	12,257	12,397
Subdistrict 1B Total	**875,379**	**1,006,461**	**1,101**	**10,665**	**–**	**–**	**3,013,466**	**3,184,230**
Delaware	41,749	41,206	–	–	–	–	160,874	117,203
Maryland	16,970	43,676	–	8,247	–	–	123,539	173,254
New Jersey	500,862	514,175	334	–	–	–	685,462	745,882
New York	192,376	242,881	–	–	–	–	1,602,403	1,663,301
Pennsylvania	123,422	164,523	767	2,418	–	–	441,189	484,590
Subdistrict 1C Total	**393,986**	**850,284**	**2,917**	**16,752**	**907**	**312**	**3,387,145**	**4,307,002**
Florida	189,905	531,284	–	572	907	–	2,296,500	3,021,319
Georgia	83,571	159,002	–	–	–	–	184,514	281,731
North Carolina	32,806	16,736	–	–	–	312	205,815	246,517
South Carolina	24,913	83,144	–	–	–	–	158,607	228,574
Virginia	62,791	60,119	2,917	16,180	–	–	539,613	514,530
West Virginia	–	–	–	–	–	–	2,095	14,332
PAD District 2 Total	**16,745**	**33,100**	**4,875**	**318**	**45**	**59**	**440,692**	**443,603**
Illinois	468	660	4,555	–	–	–	58,567	31,710
Indiana	3,229	6,714	–	–	–	–	18,989	33,680
Iowa	–	–	–	–	2	–	6,281	11,748
Kansas	–	–	320	318	–	–	92,787	76,961
Kentucky	131	253	–	–	–	–	5,170	2,689
Michigan	8,296	10,450	–	–	–	10	94,497	82,629
Minnesota	2,947	12,332	–	–	–	12	46,896	62,201
Missouri	538	750	–	–	–	–	4,963	6,703
Nebraska	–	–	–	–	15	–	5,928	9,567
North Dakota	–	–	–	–	–	–	5,999	2,622
Ohio	687	47	–	–	28	37	26,612	31,290
Oklahoma	–	–	–	–	–	–	22,324	25,539
South Dakota	–	–	–	–	–	–	1,923	3,880
Tennessee	345	1,756	–	–	–	–	10,709	14,257
Wisconsin	104	137	–	–	–	–	39,046	48,125
PAD District 3 Total	**1,181,473**	**1,419,759**	**–**	**2,717**	**295**	**33**	**1,650,946**	**2,035,529**
Alabama	42,407	52,023	–	865	–	–	53,906	70,850
Arkansas	–	–	–	–	–	–	20,922	58,758
Louisiana	405,845	453,595	–	–	6	–	623,307	691,055
Mississippi	34,459	70,112	–	–	273	–	166,312	318,139
New Mexico	–	–	–	–	15	33	6,589	4,377
Texas	698,761	844,029	–	1,852	–	–	779,910	892,349
PAD District 4 Total	**–**	**–**	**–**	**–**	**17**	**–**	**11,158**	**13,605**
Colorado	–	–	–	–	–	–	–	271
Idaho	–	–	–	–	–	–	16	–
Montana	–	–	–	–	–	–	260	1,761
Utah	–	–	–	–	–	–	4,888	7,118
Wyoming	–	–	–	–	17	–	5,994	4,455
PAD District 5 Total	**1,333,331**	**1,562,737**	**1,163**	**1,023**	**–**	**125**	**1,846,580**	**1,843,675**
Alaska	525	–	–	–	–	–	525	–
Arizona	–	–	–	–	–	–	–	1,366
California	979,213	1,158,320	1,162	–	–	–	982,731	1,158,902
Hawaii	38,351	61,258	–	1,023	–	–	526,111	324,572
Nevada	–	–	–	–	–	–	36	10
Oregon	63,956	71,407	–	–	–	–	82,270	86,279
Washington	251,286	271,752	1	–	–	125	254,907	272,546

Dashed (-) = No data reported. R = Revised.

Notes: • See Technical Note 3 for further explanations on 2003 revised data. • Totals may not equal sum of components due to independent rounding.

Sources: • Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2003-2004 and "Petroleum Supply Annual," Volume 1, 2003-2004, (DOE/EIA-0340(03)/1 - (04)/1). • See Technical Note 3 for further explanation of Electric Power.

Table 18. Adjusted Sales of Kerosene by Energy Use, 2003 and 2004

(Thousand Gallons)

Destination	Residential		Commercial		Industrial	
	2003	2004	2003	2004	2003	2004
U.S. Total	**520,799**	**627,842**	**138,049**	**151,811**	**164,386**	**192,588**
PAD District 1 Total	**433,208**	**525,481**	**108,402**	**114,457**	**77,285**	**74,448**
Subdistrict 1A Total	**111,030**	**140,330**	**17,916**	**25,195**	**12,515**	**13,548**
Connecticut	11,336	14,660	5,241	7,227	8,755	10,157
Maine	58,456	73,100	6,751	10,540	305	704
Massachusetts	10,235	11,730	3,008	3,802	356	453
New Hampshire	17,450	21,972	1,806	1,926	540	425
Rhode Island	1,952	2,086	216	288	4	–
Vermont	11,602	16,781	894	1,413	2,555	1,809
Subdistrict 1B Total	**162,343**	**203,213**	**63,389**	**65,779**	**57,561**	**46,579**
Delaware	3,675	5,338	313	405	11	14
District of Columbia	1	3	23	31	–	–
Maryland	16,978	23,101	8,207	5,293	748	862
New Jersey	5,806	6,516	10,362	11,586	18,444	28,423
New York	68,826	86,750	27,923	31,280	35,947	14,408
Pennsylvania	67,057	81,506	16,561	17,184	2,412	2,871
Subdistrict 1C Total	**159,835**	**181,939**	**27,096**	**23,482**	**7,210**	**14,322**
Florida	4,055	3,973	802	857	272	1,568
Georgia	2,791	3,902	1,999	893	1,837	4,409
North Carolina	75,027	79,445	11,310	7,067	265	1,570
South Carolina	15,817	22,841	920	1,095	3,039	4,212
Virginia	52,954	61,068	8,190	10,171	1,380	1,960
West Virginia	9,191	10,710	3,874	3,399	417	603
PAD District 2 Total	**64,271**	**74,942**	**19,624**	**22,919**	**11,720**	**15,317**
Illinois	4,449	4,208	1,536	1,883	1,909	2,264
Indiana	8,660	10,771	1,372	1,830	948	1,693
Iowa	827	1,157	170	225	25	39
Kansas	460	441	207	345	41	47
Kentucky	7,658	8,690	1,641	1,342	1,138	1,490
Michigan	11,096	9,298	796	910	683	1,122
Minnesota	763	1,162	603	437	120	157
Missouri	3,021	3,675	889	1,283	180	424
Nebraska	183	231	146	275	45	39
North Dakota	115	204	43	83	36	34
Ohio	15,504	20,349	8,532	10,822	4,669	5,286
Oklahoma	596	704	203	277	278	308
South Dakota	95	107	87	76	5	4
Tennessee	9,693	12,255	2,268	1,799	967	1,610
Wisconsin	1,152	1,690	1,132	1,334	679	800
PAD District 3 Total	**4,557**	**5,015**	**4,964**	**6,986**	**73,410**	**99,968**
Alabama	2,077	2,804	1,021	1,071	1,257	1,478
Arkansas	682	450	136	699	17	26
Louisiana	398	405	262	3,255	63,213	84,693
Mississippi	479	646	1,846	382	836	2,280
New Mexico	154	226	238	139	52	29
Texas	768	484	1,461	1,442	8,034	11,461
PAD District 4 Total	**1,944**	**2,327**	**779**	**1,140**	**248**	**296**
Colorado	1,482	1,893	434	495	55	71
Idaho	156	277	31	177	2	33
Montana	164	49	103	121	64	85
Utah	94	78	196	330	121	91
Wyoming	48	30	16	18	7	16
PAD District 5 Total	**16,819**	**20,076**	**4,280**	**6,308**	**1,722**	**2,559**
Alaska	632	828	14	25	1	2
Arizona	99	44	51	86	36	117
California	8,217	11,605	1,987	3,016	1,062	1,288
Hawaii	–	–	2	2	4	4
Nevada	473	773	65	67	7	10
Oregon	3,173	3,917	953	1,869	486	731
Washington	4,224	2,909	1,208	1,244	126	408

See footnotes at end of table.

Table 18. Adjusted Sales of Kerosene by Energy Use, 2003 and 2004 (Continued)

(Thousand Gallons)

Destination	Farm		All Other		Total	
	2003	2004	2003	2004	2003	2004
U.S. Total	**11,674**	**14,757**	**2,572**	**1,683**	**837,480**	**988,680**
PAD District 1 Total	**4,079**	**4,952**	**1,842**	**884**	**624,816**	**720,223**
Subdistrict 1A Total	**1,122**	**1,717**	**852**	**403**	**143,435**	**181,193**
Connecticut	7	3	605	196	25,943	32,242
Maine	484	841	18	31	66,014	85,215
Massachusetts	12	13	7	–	13,618	15,998
New Hampshire	281	312	126	61	20,204	24,696
Rhode Island	–	–	5	–	2,177	2,374
Vermont	338	549	90	116	15,479	20,668
Subdistrict 1B Total	**1,945**	**2,478**	**774**	**435**	**286,012**	**318,483**
Delaware	133	246	–	–	4,132	6,004
District of Columbia	–	–	–	–	24	34
Maryland	281	647	59	90	26,273	29,992
New Jersey	14	5	1	232	34,627	46,762
New York	1,118	1,190	338	38	134,153	133,666
Pennsylvania	400	390	376	75	86,805	102,026
Subdistrict 1C Total	**1,012**	**757**	**216**	**46**	**195,369**	**220,547**
Florida	29	3	116	–	5,274	6,401
Georgia	9	21	14	9	6,650	9,234
North Carolina	222	96	1	2	86,825	88,179
South Carolina	70	111	15	–	19,862	28,259
Virginia	648	418	59	35	63,231	73,654
West Virginia	33	107	10	–	13,526	14,819
PAD District 2 Total	**5,535**	**7,138**	**370**	**430**	**101,521**	**120,747**
Illinois	426	627	9	53	8,329	9,035
Indiana	555	692	39	67	11,574	15,052
Iowa	504	599	12	2	1,538	2,024
Kansas	114	80	–	4	823	916
Kentucky	272	356	64	81	10,773	11,959
Michigan	207	231	4	4	12,786	11,565
Minnesota	361	426	48	4	1,894	2,186
Missouri	155	140	17	–	4,261	5,522
Nebraska	199	236	89	125	661	906
North Dakota	29	46	–	–	224	367
Ohio	1,721	2,719	47	36	30,473	39,212
Oklahoma	121	92	–	–	1,198	1,380
South Dakota	86	27	–	–	273	214
Tennessee	426	336	39	52	13,393	16,052
Wisconsin	359	532	–	–	3,322	4,357
PAD District 3 Total	**522**	**424**	**18**	**2**	**83,470**	**112,394**
Alabama	13	19	1	–	4,368	5,372
Arkansas	65	15	–	–	900	1,190
Louisiana	48	11	–	–	63,921	88,364
Mississippi	176	157	–	–	3,337	3,464
New Mexico	26	19	17	1	486	414
Texas	194	203	–	–	10,458	13,590
PAD District 4 Total	**120**	**204**	**9**	**4**	**3,100**	**3,972**
Colorado	65	134	4	1	2,040	2,593
Idaho	19	32	1	–	208	519
Montana	–	2	–	3	331	259
Utah	33	33	4	–	448	533
Wyoming	3	3	–	–	74	68
PAD District 5 Total	**1,418**	**2,039**	**334**	**362**	**24,573**	**31,344**
Alaska	–	–	–	–	648	855
Arizona	1	1	–	–	187	247
California	351	486	306	15	11,923	16,410
Hawaii	–	–	–	–	7	6
Nevada	3	2	–	1	548	853
Oregon	682	1,126	16	14	5,310	7,657
Washington	380	423	13	332	5,951	5,316

Dashed (-) = No data reported.
Notes: • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2003-2004 and "Petroleum Supply Annual," Volume 1, 2003-2004, (DOE/EIA-0340(03)/1 - (04)/1).

Table 19. Adjusted Sales for Residential Use: Distillate Fuel Oil and Kerosene, 2004
(Thousand Gallons)

Destination	Distillate Fuel Oil			Kerosene
	No. 1	No. 2	Total	
U.S. Total	**113,856**	**5,883,499**	**5,997,355**	**627,842**
PAD District 1 Total	**4,064**	**5,116,521**	**5,120,585**	**525,481**
Subdistrict 1A Total	**2,294**	**2,131,665**	**2,133,959**	**140,330**
Connecticut	1	624,480	624,481	14,660
Maine	1,009	361,507	362,516	73,100
Massachusetts	506	708,954	709,460	11,730
New Hampshire	603	195,165	195,768	21,972
Rhode Island	54	142,758	142,812	2,086
Vermont	121	98,800	98,921	16,781
Subdistrict 1B Total	**1,003**	**2,642,412**	**2,643,415**	**203,213**
Delaware	–	35,407	35,407	5,338
District of Columbia	–	14,195	14,195	3
Maryland	105	150,232	150,337	23,101
New Jersey	–	363,568	363,568	6,516
New York	335	1,256,748	1,257,083	86,750
Pennsylvania	563	822,263	822,826	81,506
Subdistrict 1C Total	**767**	**342,444**	**343,211**	**181,939**
Florida	39	4,631	4,670	3,973
Georgia	–	1,478	1,478	3,902
North Carolina	–	105,229	105,229	79,445
South Carolina	37	10,517	10,554	22,841
Virginia	109	205,408	205,517	61,068
West Virginia	583	15,181	15,764	10,710
PAD District 2 Total	**65,419**	**607,595**	**673,014**	**74,942**
Illinois	1,464	13,152	14,616	4,208
Indiana	5,489	43,390	48,879	10,771
Iowa	2,848	12,621	15,469	1,157
Kansas	66	551	617	441
Kentucky	599	20,559	21,158	8,690
Michigan	9,845	88,257	98,102	9,298
Minnesota	19,196	93,859	113,055	1,162
Missouri	2,248	7,008	9,256	3,675
Nebraska	2,060	2,569	4,629	231
North Dakota	4,268	23,701	27,969	204
Ohio	4,934	156,078	161,012	20,349
Oklahoma	9	34	43	704
South Dakota	2,611	9,233	11,844	107
Tennessee	136	5,873	6,009	12,255
Wisconsin	9,647	130,710	140,357	1,690
PAD District 3 Total	**179**	**9,042**	**9,221**	**5,015**
Alabama	–	690	690	2,804
Arkansas	161	127	288	450
Louisiana	–	212	212	405
Mississippi	–	265	265	646
New Mexico	17	185	202	226
Texas	–	7,563	7,563	484
PAD District 4 Total	**6,827**	**28,386**	**35,213**	**2,327**
Colorado	80	704	784	1,893
Idaho	3,481	16,337	19,818	277
Montana	2,935	5,993	8,928	49
Utah	204	3,845	4,049	78
Wyoming	126	1,507	1,633	30
PAD District 5 Total	**37,367**	**121,953**	**159,320**	**20,076**
Alaska	32,730	32,510	65,240	828
Arizona	10	182	192	44
California	371	5,141	5,512	11,605
Hawaii	–	12	12	–
Nevada	204	6,392	6,596	773
Oregon	1,805	27,587	29,392	3,917
Washington	2,247	50,130	52,377	2,909

Dashed (-) = No data reported.
Notes: • See Technical Note 3 for further explanations. • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2004 and "Petroleum Supply Annual," Volume 1, 2004, (DOE/EIA-0340(04)/1).

Table 20. Adjusted Sales for Commercial Use: Distillate Fuel Oil, Residual Fuel Oil, and Kerosene, 2004
(Thousand Gallons)

Destination	Distillate Fuel Oil							Residual Fuel Oil	Kerosene
	No. 1 Distillate	No. 2 Distillate				No. 4 Fuel	Total Distillate		
		No. 2 Fuel Oil	Low Sulfur Diesel	High Sulfur Diesel	No. 2 Total				
U.S. Total	**59,136**	**1,526,556**	**889,196**	**535,592**	**2,951,345**	**186,793**	**3,197,274**	**812,627**	**151,811**
PAD District 1 Total	**4,684**	**1,357,873**	**306,375**	**247,796**	**1,912,044**	**185,154**	**2,101,882**	**760,402**	**114,457**
Subdistrict 1A Total	**832**	**446,314**	**49,487**	**33,510**	**529,311**	**22,651**	**552,793**	**200,242**	**25,195**
Connecticut	184	105,760	18,301	1,402	125,464	4,473	130,121	13,730	7,227
Maine	468	104,402	13,115	8,961	126,479	665	127,612	14,526	10,540
Massachusetts	104	122,164	6,521	17,291	145,976	12,113	158,193	115,592	3,802
New Hampshire	51	58,071	6,191	499	64,761	2,523	67,335	33,785	1,926
Rhode Island	7	27,591	1,355	985	29,931	1,579	31,517	16,494	288
Vermont	16	28,326	4,004	4,371	36,701	1,298	38,015	6,116	1,413
Subdistrict 1B Total	**3,659**	**826,241**	**114,918**	**54,962**	**996,121**	**162,158**	**1,161,937**	**528,622**	**65,779**
Delaware	41	7,194	475	2,978	10,647	336	11,024	7,966	405
District of Columbia	2	12,409	2,444	105	14,959	1,823	16,785	–	31
Maryland	760	57,601	9,851	7,999	75,451	1,140	77,350	3,616	5,293
New Jersey	95	89,916	3,943	803	94,662	3,568	98,325	14,475	11,586
New York	960	485,509	72,828	20,238	578,575	150,849	730,384	477,185	31,280
Pennsylvania	1,801	173,612	25,377	22,839	221,827	4,441	228,070	25,381	17,184
Subdistrict 1C Total	**194**	**85,318**	**141,970**	**159,324**	**386,613**	**345**	**387,152**	**31,538**	**23,482**
Florida	–	2,495	90,703	52,815	146,012	–	146,012	4,897	857
Georgia	–	1,883	14,474	23,171	39,528	–	39,528	–	893
North Carolina	–	26,407	14,609	20,456	61,471	167	61,638	11,510	7,067
South Carolina	–	4,919	5,576	9,782	20,276	–	20,276	1,941	1,095
Virginia	51	45,527	13,071	52,235	110,833	178	111,062	13,190	10,171
West Virginia	142	4,088	3,539	866	8,493	–	8,636	–	3,399
PAD District 2 Total	**23,618**	**135,584**	**292,542**	**136,447**	**564,574**	**1,639**	**589,830**	**46,835**	**22,919**
Illinois	2,424	3,056	22,675	10,748	36,479	1,347	40,250	2,053	1,883
Indiana	2,862	28,410	31,952	18,077	78,439	–	81,301	4,762	1,830
Iowa	1,385	8,294	10,306	2,432	21,031	–	22,416	–	225
Kansas	1,021	1,156	23,098	2,429	26,683	–	27,704	–	345
Kentucky	41	1,938	20,686	15,989	38,612	–	38,653	–	1,342
Michigan	1,063	12,168	29,845	8,024	50,038	–	51,101	2,058	910
Minnesota	4,312	22,534	10,197	1,616	34,347	7	38,666	18,745	437
Missouri	1,108	2,325	29,586	7,892	39,803	–	40,911	681	1,283
Nebraska	1,872	1,967	4,105	795	6,867	–	8,738	2,041	275
North Dakota	1,287	2,773	3,462	1,131	7,366	–	8,653	764	83
Ohio	1,257	20,075	29,821	41,743	91,639	–	92,896	4,202	10,822
Oklahoma	31	–	11,510	2,567	14,077	–	14,109	40	277
South Dakota	909	2,088	5,079	1,241	8,408	–	9,317	531	76
Tennessee	261	662	35,706	14,876	51,244	–	51,505	546	1,799
Wisconsin	3,785	28,138	24,514	6,888	59,540	285	63,610	10,412	1,334
PAD District 3 Total	**1,223**	**4,765**	**118,684**	**100,432**	**223,881**	**–**	**225,104**	**2,936**	**6,986**
Alabama	12	3,846	28,029	25,683	57,557	–	57,569	–	1,071
Arkansas	–	10	5,020	21,831	26,861	–	26,861	15	699
Louisiana	1,046	452	6,532	7,231	14,215	–	15,261	2,556	3,255
Mississippi	–	–	6,279	4,504	10,783	–	10,783	366	382
New Mexico	165	307	16,606	3,931	20,844	–	21,009	–	139
Texas	–	151	56,217	37,252	93,621	–	93,621	–	1,442
PAD District 4 Total	**5,045**	**8,376**	**52,998**	**10,605**	**71,979**	**–**	**77,024**	**–**	**1,140**
Colorado	540	764	13,975	180	14,918	–	15,458	–	495
Idaho	556	2,211	13,027	3,377	18,615	–	19,171	–	177
Montana	631	4,720	8,616	119	13,455	–	14,086	–	121
Utah	1,061	636	14,971	6,762	22,369	–	23,430	–	330
Wyoming	2,256	45	2,410	167	2,622	–	4,878	–	18
PAD District 5 Total	**24,567**	**19,957**	**118,598**	**40,311**	**178,866**	**–**	**203,433**	**2,454**	**6,308**
Alaska	21,862	7,430	3,182	12,314	22,926	–	44,788	–	25
Arizona	54	123	12,567	643	13,334	–	13,388	–	86
California	7	338	55,824	8,165	64,326	–	64,333	–	3,016
Hawaii	–	20	7,314	7,424	14,758	–	14,758	176	2
Nevada	359	1,268	12,526	241	14,036	–	14,395	–	67
Oregon	819	6,112	10,990	4,992	22,094	–	22,913	2,278	1,869
Washington	1,466	4,666	16,196	6,531	27,393	–	28,859	–	1,244

Dashed (-) = No data reported.
Notes: • See Technical Note 3 for further explanations. • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2004 and "Petroleum Supply Annual," Volume 1, 2004, (DOE/EIA-0340(04)/1).

Table 21. Adjusted Sales for Industrial Use: Distillate Fuel Oil, Residual Fuel Oil, and Kerosene, 2004
(Thousand Gallons)

Destination	Distillate Fuel Oil							Residual Fuel Oil	Kerosene
	No. 1 Distillate	No. 2 Distillate				No. 4 Fuel	Total Distillate		
		No. 2 Fuel Oil	Low Sulfur Diesel	High Sulfur Diesel	No. 2 Total				
U.S. Total	**41,777**	**399,964**	**877,496**	**1,059,612**	**2,337,071**	**38,973**	**2,417,821**	**1,600,251**	**192,588**
PAD District 1 Total	**1,577**	**213,263**	**90,634**	**379,332**	**683,229**	**32,940**	**717,746**	**1,163,352**	**74,448**
Subdistrict 1A Total	**540**	**53,350**	**9,821**	**7,330**	**70,501**	**10,282**	**81,323**	**242,735**	**13,548**
Connecticut	–	11,621	2,184	28	13,833	6,215	20,048	45,445	10,157
Maine	240	17,492	1,842	1,172	20,505	980	21,725	131,412	704
Massachusetts	–	8,220	2,846	3,153	14,219	520	14,739	30,047	453
New Hampshire	296	6,721	753	1,262	8,736	752	9,784	18,051	425
Rhode Island	–	4,736	48	915	5,699	959	6,658	11,499	–
Vermont	4	4,559	2,149	801	7,509	855	8,368	6,281	1,809
Subdistrict 1B Total	**577**	**99,260**	**20,773**	**64,020**	**184,053**	**21,077**	**205,706**	**196,681**	**46,579**
Delaware	–	1,142	885	370	2,397	632	3,030	32,311	14
District of Columbia	–	74	–	101	175	144	319	–	–
Maryland	577	13,794	3,259	5,257	22,310	880	23,766	29,293	862
New Jersey	–	21,965	852	853	23,671	11,727	35,397	20,550	28,423
New York	–	30,203	5,686	14,179	50,068	4,585	54,652	61,025	14,408
Pennsylvania	–	32,082	10,091	43,260	85,433	3,110	88,543	53,502	2,871
Subdistrict 1C Total	**461**	**60,653**	**60,040**	**307,982**	**428,675**	**1,582**	**430,717**	**723,935**	**14,322**
Florida	40	2,624	25,887	44,481	72,993	–	73,032	127,873	1,568
Georgia	–	12,385	13,647	37,998	64,030	–	64,030	119,015	4,409
North Carolina	–	12,149	9,437	32,228	53,815	532	54,346	217,839	1,570
South Carolina	4	4,801	2,216	16,021	23,038	254	23,296	143,058	4,212
Virginia	130	21,136	6,990	81,728	109,853	789	110,772	101,818	1,960
West Virginia	286	7,558	1,862	95,526	104,946	7	105,239	14,332	603
PAD District 2 Total	**19,491**	**175,244**	**224,819**	**299,088**	**699,152**	**5,126**	**723,768**	**252,488**	**15,317**
Illinois	4,043	11,146	20,488	23,966	55,600	64	59,706	13,966	2,264
Indiana	2,136	37,425	52,313	15,856	105,595	2,787	110,519	22,205	1,693
Iowa	1,507	1,199	8,045	2,150	11,393	–	12,900	11,748	39
Kansas	246	204	9,194	3,464	12,862	6	13,114	27,805	47
Kentucky	10	6,801	16,902	86,929	110,632	493	111,134	2,436	1,490
Michigan	556	7,051	5,677	18,424	31,152	6	31,714	28,634	1,122
Minnesota	2,871	46,349	19,225	1,317	66,891	31	69,793	26,046	157
Missouri	2,970	3,309	21,143	18,200	42,652	15	45,637	5,271	424
Nebraska	147	577	1,610	6,268	8,455	–	8,602	7,526	39
North Dakota	1,825	1,838	3,434	8,645	13,917	–	15,743	1,858	34
Ohio	535	31,848	10,326	57,124	99,298	1,224	101,058	26,615	5,286
Oklahoma	–	2,756	3,068	6,789	12,613	–	12,613	25,499	308
South Dakota	66	262	2,501	3,097	5,861	9	5,937	3,349	4
Tennessee	–	371	24,856	25,956	51,183	148	51,331	11,955	1,610
Wisconsin	2,577	24,106	26,038	20,903	71,047	343	73,967	37,576	800
PAD District 3 Total	**537**	**2,835**	**214,457**	**249,060**	**466,353**	**–**	**466,889**	**155,856**	**99,968**
Alabama	–	1,595	29,385	122,524	153,504	–	153,504	17,962	1,478
Arkansas	–	190	4,695	14,672	19,557	–	19,557	18,589	26
Louisiana	–	812	11,956	24,568	37,336	–	37,336	57,118	84,693
Mississippi	–	147	3,215	23,020	26,381	–	26,381	12,919	2,280
New Mexico	537	2	31,356	6,203	37,560	–	38,097	4,343	29
Texas	–	90	133,851	58,073	192,014	–	192,014	44,925	11,461
PAD District 4 Total	**6,316**	**7,612**	**211,372**	**19,842**	**238,826**	**–**	**245,141**	**13,334**	**296**
Colorado	1,835	2,981	26,053	1,495	30,530	–	32,365	–	71
Idaho	639	401	11,431	10,359	22,190	–	22,829	–	33
Montana	1,670	3,244	36,865	42	40,151	–	41,822	1,761	85
Utah	557	930	27,720	7,569	36,220	–	36,777	7,118	91
Wyoming	1,614	56	109,302	377	109,735	–	111,349	4,455	16
PAD District 5 Total	**13,857**	**1,009**	**136,214**	**112,289**	**249,513**	**907**	**264,276**	**15,221**	**2,559**
Alaska	12,965	465	7,637	19,947	28,049	–	41,015	–	2
Arizona	500	–	42,579	12,506	55,085	–	55,585	1,366	117
California	–	33	40,585	10,699	51,316	–	51,316	582	1,288
Hawaii	–	348	1,294	912	2,554	–	2,554	–	4
Nevada	292	1	27,642	48,154	75,797	907	76,995	10	10
Oregon	52	4	8,529	11,927	20,460	–	20,511	12,594	731
Washington	48	159	7,947	8,145	16,251	–	16,300	669	408

Dashed (-) = No data reported.
Notes: • See Technical Note 3 for further explanations. • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration’s Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2004 and "Petroleum Supply Annual," Volume 1, 2004, (DOE/EIA-0340(04)/1).

Table 22. Adjusted Sales for Farm Use: Distillate Fuel Oil and Kerosene; Sales for Electric Power and Oil Company Uses: Distillate Fuel Oil and Residual Fuel Oil, 2004
(Thousand Gallons)

Destination	Farm				Electric Power		Oil Company Use	
	Diesel	Other Distillate	Total Distillate	Kerosene	Distillate Fuel Oil	Residual Fuel Oil	Distillate Fuel Oil	Residual Fuel Oil
U.S. Total	**3,438,664**	**69,067**	**3,507,731**	**14,757**	**735,002**	**5,923,734**	**554,196**	**48,655**
PAD District 1 Total	**315,679**	**43,962**	**359,641**	**4,952**	**374,933**	**5,114,379**	**17,235**	**30,593**
Subdistrict 1A Total	**18,984**	**13,539**	**32,523**	**1,717**	**20,530**	**1,018,751**	**110**	**241**
Connecticut	3,172	2,585	5,757	3	5,629	164,225	33	241
Maine	3,595	7,095	10,690	841	493	68,919	–	–
Massachusetts	4,485	273	4,758	13	11,968	670,916	39	–
New Hampshire	2,353	2,418	4,771	312	855	112,196	15	–
Rhode Island	76	81	157	–	1,406	2,494	10	–
Vermont	5,303	1,087	6,390	549	178	–	13	–
Subdistrict 1B Total	**80,124**	**24,601**	**104,725**	**2,478**	**153,593**	**1,411,870**	**8,462**	**29,931**
Delaware	5,733	10	5,742	246	3,718	35,720	4,683	–
District of Columbia	–	–	–	–	4,363	–	–	–
Maryland	16,154	55	16,209	647	27,248	87,719	2	703
New Jersey	3,322	310	3,632	5	26,737	194,762	435	1,922
New York	23,699	17,806	41,505	1,190	33,685	881,395	10	815
Pennsylvania	31,216	6,420	37,637	390	57,842	212,274	3,333	26,491
Subdistrict 1C Total	**216,571**	**5,822**	**222,393**	**757**	**200,810**	**2,683,758**	**8,662**	**422**
Florida	75,755	–	75,755	3	87,171	2,356,692	14	–
Georgia	61,170	33	61,202	21	14,420	3,714	1,271	–
North Carolina	30,635	4,642	35,277	96	20,247	–	–	120
South Carolina	17,403	741	18,144	111	11,834	317	–	114
Virginia	30,191	388	30,579	418	34,584	323,035	1,495	188
West Virginia	1,417	18	1,435	107	32,554	–	5,882	–
PAD District 2 Total	**1,789,976**	**23,612**	**1,813,588**	**7,138**	**145,734**	**109,211**	**91,880**	**1,592**
Illinois	179,059	1,904	180,963	627	10,767	15,031	93	–
Indiana	134,713	1,864	136,577	692	9,475	–	23	–
Iowa	179,448	833	180,282	599	8,430	–	–	–
Kansas	208,449	188	208,637	80	5,240	48,838	13,019	–
Kentucky	34,435	–	34,435	356	6,872	–	2,014	–
Michigan	53,347	1,492	54,840	231	17,927	41,477	1,364	–
Minnesota	126,913	1,725	128,638	426	7,790	3,864	–	1,203
Missouri	131,657	84	131,741	140	5,393	–	73	–
Nebraska	238,677	1,058	239,735	236	1,382	–	2	–
North Dakota	119,131	3,102	122,232	46	2,515	–	9,929	–
Ohio	109,693	7,088	116,781	2,719	43,852	–	4,284	390
Oklahoma	57,150	–	57,150	92	2,061	–	60,383	–
South Dakota	64,509	1,859	66,367	27	1,224	–	423	–
Tennessee	38,264	552	38,816	336	11,694	–	273	–
Wisconsin	114,531	1,861	116,392	532	11,112	–	–	–
PAD District 3 Total	**741,198**	**151**	**741,349**	**424**	**24,765**	**454,218**	**338,049**	**9**
Alabama	38,142	–	38,142	19	8,805	–	7,500	–
Arkansas	235,904	130	236,034	15	5,146	40,155	2,658	–
Louisiana	56,119	–	56,119	11	2,196	177,787	45,491	–
Mississippi	65,566	21	65,586	157	3,343	234,733	1,742	9
New Mexico	34,765	–	34,765	19	2,225	–	38,047	–
Texas	310,702	–	310,702	203	3,050	1,543	242,611	–
PAD District 4 Total	**193,381**	**1,233**	**194,614**	**204**	**6,160**	**271**	**70,147**	**–**
Colorado	45,229	22	45,251	134	1,213	271	15,357	–
Idaho	63,012	114	63,126	32	19	–	–	–
Montana	62,944	1,051	63,995	2	–	–	19,117	–
Utah	10,740	4	10,744	33	1,188	–	13,741	–
Wyoming	11,456	42	11,498	3	3,739	–	21,931	–
PAD District 5 Total	**398,430**	**110**	**398,540**	**2,039**	**183,411**	**245,655**	**36,886**	**16,461**
Alaska	55	–	55	–	52,365	–	23,449	–
Arizona	15,285	–	15,285	1	4,481	–	286	–
California	311,672	–	311,672	486	5,676	–	11,677	–
Hawaii	5,458	–	5,458	–	114,504	245,655	5	16,461
Nevada	4,473	20	4,492	2	816	–	963	–
Oregon	28,715	26	28,741	1,126	4,517	–	–	–
Washington	32,771	64	32,835	423	1,051	–	507	–

Dashed (-) = No data reported.
Notes: • See Technical Note 3 for further explanations. • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2004 and "Petroleum Supply Annual," Volume 1, 2004, (DOE/EIA-0340(04)/1). • See Technical Note 3 for further explanation of Electric Power.

Table 23. Adjusted Sales for Transportation Use: Distillate Fuel Oil and Residual Fuel Oil, 2004
(Thousand Gallons)

Destination	Railroad Use	Vessel Bunkering		On-Highway Diesel	Total Transportation Use	
	Distillate Fuel Oil	Distillate Fuel Oil	Residual Fuel Oil	Distillate Fuel Oil	Distillate Fuel Oil	Residual Fuel Oil
U.S. Total	**3,310,588**	**2,319,308**	**4,874,502**	**37,125,239**	**42,755,135**	**4,874,502**
PAD District 1 Total	**487,451**	**429,000**	**1,858,905**	**11,731,295**	**12,647,746**	**1,858,905**
Subdistrict 1A Total	**47,122**	**40,608**	**2,160**	**1,114,427**	**1,202,158**	**2,160**
Connecticut	3,201	6,398	923	284,212	293,811	923
Maine	65	12,286	1,139	174,373	186,724	1,139
Massachusetts	43,634	14,093	98	424,503	482,229	98
New Hampshire	162	3,345	–	111,503	115,009	–
Rhode Island	–	3,938	–	57,962	61,900	–
Vermont	61	549	–	61,874	62,484	–
Subdistrict 1B Total	**145,614**	**117,935**	**1,006,461**	**4,385,713**	**4,649,262**	**1,006,461**
Delaware	732	596	41,206	65,202	66,530	41,206
District of Columbia	9,908	34	–	24,276	34,218	–
Maryland	2,341	12,607	43,676	538,061	553,009	43,676
New Jersey	17,096	72,947	514,175	896,454	986,497	514,175
New York	66,609	11,642	242,881	1,410,982	1,489,234	242,881
Pennsylvania	48,928	20,108	164,523	1,450,738	1,519,775	164,523
Subdistrict 1C Total	**294,715**	**270,457**	**850,284**	**6,231,155**	**6,796,326**	**850,284**
Florida	63,739	130,083	531,284	1,567,480	1,761,302	531,284
Georgia	106,351	22,210	159,002	1,449,793	1,578,354	159,002
North Carolina	53,279	7,341	16,736	1,095,092	1,155,712	16,736
South Carolina	11,953	29,905	83,144	709,044	750,902	83,144
Virginia	47,310	19,443	60,119	1,115,628	1,182,381	60,119
West Virginia	12,083	61,474	–	294,118	367,674	–
PAD District 2 Total	**1,173,026**	**485,893**	**33,100**	**11,799,020**	**13,457,939**	**33,100**
Illinois	68,053	122,937	660	1,397,874	1,588,864	660
Indiana	98,429	8,366	6,714	1,242,988	1,349,782	6,714
Iowa	51,061	7,631	–	571,883	630,576	–
Kansas	56,786	–	–	413,594	470,380	–
Kentucky	98,655	102,580	253	856,232	1,057,467	253
Michigan	23,652	10,091	10,450	974,893	1,008,636	10,450
Minnesota	68,162	6,160	12,332	660,745	735,067	12,332
Missouri	54,391	75,545	750	1,013,808	1,143,743	750
Nebraska	46,835	–	–	402,763	449,598	–
North Dakota	62,464	–	–	156,154	218,618	–
Ohio	256,375	3,563	47	1,580,121	1,840,059	47
Oklahoma	170,005	7	–	636,979	806,991	–
South Dakota	5,559	–	–	175,679	181,238	–
Tennessee	75,282	146,777	1,756	990,608	1,212,666	1,756
Wisconsin	37,317	2,237	137	724,699	764,253	137
PAD District 3 Total	**942,466**	**1,056,224**	**1,419,759**	**6,574,471**	**8,573,161**	**1,419,759**
Alabama	70,756	144,774	52,023	786,306	1,001,836	52,023
Arkansas	97,309	50,464	–	600,997	748,769	–
Louisiana	46,350	521,375	453,595	658,561	1,226,286	453,595
Mississippi	37,299	87,581	70,112	598,448	723,328	70,112
New Mexico	14,539	–	–	465,748	480,287	–
Texas	676,213	252,031	844,029	3,464,411	4,392,655	844,029
PAD District 4 Total	**267,451**	**5**	**–**	**1,669,421**	**1,936,877**	**–**
Colorado	42,398	–	–	505,771	548,169	–
Idaho	24,073	5	–	238,093	262,171	–
Montana	44,417	–	–	222,384	266,801	–
Utah	38,712	–	–	365,585	404,297	–
Wyoming	117,852	–	–	337,588	455,440	–
PAD District 5 Total	**440,194**	**348,186**	**1,562,737**	**5,351,032**	**6,139,412**	**1,562,737**
Alaska	6,405	122,897	–	208,558	337,861	–
Arizona	15,098	–	–	776,419	791,517	–
California	286,333	42,575	1,158,320	2,844,083	3,172,991	1,158,320
Hawaii	–	106,877	61,258	42,788	149,665	61,258
Nevada	5,743	8	–	330,258	336,009	–
Oregon	54,311	10,714	71,407	521,796	586,821	71,407
Washington	72,304	65,115	271,752	627,130	764,549	271,752

Dashed (-) = No data reported.
Notes: • See Technical Note 3 for further explanations. • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2004 and "Petroleum Supply Annual," Volume 1, 2004, (DOE/EIA-0340(04)/1). • On-Highway Diesel data are Federal Highway Administration statistics of highway special fuels use.

Table 24. Adjusted Sales for Military, Off-Highway, and All Other Uses: Distillate Fuel Oil, Residual Fuel Oil, and Kerosene, 2004
(Thousand Gallons)

Destination	Military				Off-Highway Distillate Fuel Oil			All Other	
	Diesel	Other Distillate	Total Distillate	Residual Fuel Oil	Construction	Other	Total	Residual Fuel Oil	Kerosene
U.S. Total	**324,396**	**34,123**	**358,519**	**31,475**	**2,254,068**	**606,507**	**2,860,575**	**1,043**	**1,683**
PAD District 1 Total	**41,812**	**29,113**	**70,925**	**27,417**	**649,105**	**156,689**	**805,795**	**826**	**884**
Subdistrict 1A Total	**2,528**	**3,415**	**5,944**	**–**	**89,987**	**21,153**	**111,139**	**514**	**403**
Connecticut	41	1,218	1,260	–	14,058	148	14,206	328	196
Maine	1,244	1,224	2,468	–	10,589	11,461	22,050	186	31
Massachusetts	584	2	586	–	46,863	5,035	51,898	–	–
New Hampshire	611	855	1,466	–	10,813	3,057	13,870	–	61
Rhode Island	10	–	10	–	2,367	2	2,369	–	–
Vermont	39	116	155	–	5,296	1,451	6,746	–	116
Subdistrict 1B Total	**8,148**	**14,991**	**23,139**	**10,665**	**201,894**	**16,144**	**218,038**	**–**	**435**
Delaware	25	85	110	–	3,657	68	3,725	–	–
District of Columbia	1,925	1,308	3,233	–	1,411	–	1,411	–	–
Maryland	1,325	5,314	6,639	8,247	34,579	924	35,503	–	90
New Jersey	872	1,094	1,966	–	70,675	4,881	75,557	–	232
New York	2,025	1,714	3,739	–	31,312	238	31,550	–	38
Pennsylvania	1,977	5,475	7,452	2,418	60,259	10,033	70,292	–	75
Subdistrict 1C Total	**31,135**	**10,707**	**41,842**	**16,752**	**357,225**	**119,393**	**476,617**	**312**	**46**
Florida	2,875	–	2,875	572	136,058	23,378	159,437	–	–
Georgia	2,458	927	3,385	–	58,319	41,458	99,777	–	9
North Carolina	1,763	4,704	6,466	–	30,992	7,187	38,179	312	2
South Carolina	7,500	103	7,603	–	33,887	20,495	54,382	–	–
Virginia	16,472	4,845	21,317	16,180	82,595	22,500	105,096	–	35
West Virginia	66	129	195	–	15,373	4,374	19,747	–	–
PAD District 2 Total	**11,478**	**2,630**	**14,108**	**318**	**811,433**	**112,462**	**923,895**	**59**	**430**
Illinois	283	20	303	–	141,427	5,215	146,642	–	53
Indiana	196	76	272	–	49,663	5,288	54,950	–	67
Iowa	70	–	70	–	23,466	3,197	26,663	–	2
Kansas	356	–	356	318	24,171	845	25,016	–	4
Kentucky	408	296	703	–	41,998	10,169	52,167	–	81
Michigan	1,151	3	1,155	–	77,100	10,564	87,663	10	4
Minnesota	129	43	171	–	66,778	16,312	83,090	12	4
Missouri	2,990	1,191	4,180	–	90,793	9,415	100,208	–	–
Nebraska	117	–	117	–	14,509	2,772	17,282	–	125
North Dakota	559	–	559	–	20,961	1,010	21,970	–	–
Ohio	1,604	463	2,068	–	90,074	4,054	94,129	37	36
Oklahoma	2,362	–	2,362	–	42,036	3,104	45,140	–	–
South Dakota	131	–	131	–	10,318	1,032	11,350	–	–
Tennessee	244	43	287	–	58,522	21,189	79,710	–	52
Wisconsin	879	495	1,373	–	59,618	18,298	77,915	–	–
PAD District 3 Total	**108,545**	**1,085**	**109,630**	**2,717**	**357,844**	**233,295**	**591,139**	**33**	**2**
Alabama	11,802	523	12,325	865	95,745	60,683	156,428	–	–
Arkansas	352	169	521	–	12,355	20,364	32,719	–	–
Louisiana	42,129	–	42,129	–	78,615	57,648	136,263	–	–
Mississippi	703	392	1,096	–	60,421	63,439	123,860	–	–
New Mexico	863	–	863	–	6,410	1,502	7,912	33	1
Texas	52,696	1	52,697	1,852	104,298	29,659	133,957	–	–
PAD District 4 Total	**972**	**183**	**1,155**	**–**	**137,663**	**46,292**	**183,955**	**–**	**4**
Colorado	645	165	810	–	62,670	817	63,487	–	1
Idaho	62	–	62	–	14,800	20,773	35,574	–	–
Montana	28	18	46	–	14,097	15,852	29,949	–	3
Utah	51	–	51	–	32,668	6,283	38,951	–	–
Wyoming	186	–	186	–	13,428	2,567	15,995	–	–
PAD District 5 Total	**161,591**	**1,111**	**162,702**	**1,023**	**298,022**	**57,769**	**355,790**	**125**	**362**
Alaska	9,594	1,056	10,650	–	12,076	4,230	16,306	–	–
Arizona	472	55	527	–	47,569	2,778	50,347	–	–
California	53,606	–	53,606	–	165,752	9,570	175,322	–	15
Hawaii	60,930	–	60,930	1,023	6,734	985	7,719	–	–
Nevada	507	–	507	–	24,072	1,001	25,073	–	1
Oregon	1,867	–	1,867	–	15,532	20,973	36,504	–	14
Washington	34,614	–	34,614	–	26,287	18,232	44,519	125	332

Dashed (-) = No data reported.
Notes: • See Technical Note 3 for further explanations. • Totals may not equal sum of components due to independent rounding.
Sources: • Energy Information Administration's Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2004 and "Petroleum Supply Annual," Volume 1, 2004, (DOE/EIA-0340(04)/1).

Appendix A

Technical Notes

Appendix A

Technical Notes

Note 1: EIA-821: Annual Fuel Oil And Kerosene Sales Report, 2004

Background

The EIA-821, "Annual Fuel Oil and Kerosene Sales Report" survey was implemented to meet Energy Information Administration (EIA) legislative mandates and data user needs. Form EIA-821 is used to gather data on the sales to energy users of distillate fuel oil, residual fuel oil, and kerosene. The data are used to determine the level of demand by energy use category and product at the State, regional, and national levels. This mandatory report is authorized by the Federal Energy Administration Act of 1974 (P. L. 93-275).

The predecessor survey to the EIA-821 was the EIA-172, "Sales Report of Fuel Oil and Kerosene" survey. The EIA-172 was conducted for reference years 1979 through 1982. Due to a serious deterioration in the sample of respondents during the 4-year period, the Form EIA-172 data were not collected for 1983. Instead, estimates for 1983 were published and a new sample of respondents was designed and selected from an improved sampling frame. The EIA-821 survey commenced with reference year 1984.

Discussion of Sampling Frame

The target population for the fuel oil and kerosene sales survey is the universe of companies that sell fuel oil and kerosene to energy users.

The EIA-863 database provided the sampling frame for the EIA-821 survey. The EIA-863, "Petroleum Product Sales Identification Survey," was mailed to approximately 25,000 companies in January 2003 to collect 2002 State-level sales volume data for No. 2 distillate, residual fuel, motor gasoline, and propane. Companies also indicated if they sold kerosene. The No. 2 distillate data were further identified by residential and nonresidential energy use, and nonenergy use sales; the residual data were identified by energy use and non-energy use; motor gasoline was identified by energy use and non-energy use and by conventional and oxygenated and/or reformulated; and propane was identified by residential, nonresidential, and non-energy use sales. The mailing list for the EIA-863 survey was constructed by merging and unduplicating the 1998 frame file and more than 50 State and commercial lists. In addition, company/State-level volumes for distillate fuel, residual fuel, motor gasoline, and propane from the 2002 EIA-821 survey were merged with the EIA-863 to yield a combined data file. The transformed and edited version of the frame was then used to design and select the 2004 EIA-821 sample.

It should be noted that truck stops selling No. 2 diesel fuel were not specifically included in the EIA-863 survey. Therefore, the EIA-821 survey does not include all sales of No. 2 distillate through retail truck stops. However, to compensate for this shortage in coverage, data from the Federal Highway Administration are presented in the tables for on-highway diesel sales.

The sampling frame also lacked full coverage of kerosene retailers, many of whom are hardware stores and service stations. To account for all kerosene volumes supplied to the marketplace, aggregate reported kerosene volumes are set equal to the products supplied volumes published in the *Petroleum Supply Annual*.

Discussion of the Sample Design

The purpose of the EIA-821 sample design was to produce State-level estimates of total sales for the following five target variables: (1) residential No. 2 distillate, (2) other retail No. 2 distillate, (3) wholesale No. 2 distillate, (4) retail residual, and (5) wholesale residual. A separate sample was initially designed for each target variable.

Companies were divided into two basic types of strata: certainty and noncertainty. Companies selected with certainty were:

- All refiners and gas plant operators.
- Companies doing business in four or more States.
- Companies accounting for 5 percent or more of the distillate or residual fuel oil volume for any target variable or particular energy use category sold in a State.

- Companies accounting for 5 percent or more of the kerosene volume sold in a State in an earlier EIA-821 survey.
- Augmented frame units, e.g., vessel bunkering, for which no attribute data were available.

Firms determined not to be selling distillate or residual fuel oil or kerosene were removed from the frame file. Volumes for nonrespondents to the EIA-863 who had reported in the previous frame survey or in a sample survey were imputed. The imputed nonrespondents and the noncertainty companies were stratified by sales volume for each target variable. Strata boundaries were determined using the Dalenius-Hodges procedures, allowing the number of strata and the strata boundaries to vary by State. Nonrespondents for whom no previous information was available were classified in a separate stratum and sampled with reduced probabilities of selection.

Neyman allocation was used to allocate the number of companies required for each strata to obtain the required levels of accuracy: a 2.5 percent coefficient of variation for residual fuel oil and a 5 percent coefficient of variation for distillate fuel oil. Sample selections were then performed simultaneously from the same random list for the five samples to produce a final linked sample of approximately 4,000 companies. This method reduced the total survey sample size while improving volume estimates. Selected companies were asked to report sales by end-use categories for distillate and residual fuel oil and kerosene.

Imputation and Estimation

Survey data gathered from the respondents may contain incomplete reporting, total nonresponse, or values that fail editing. Missing data are estimated, or implicitly imputed for, using the strata means and treated the same as reported data. The weighted estimate is defined as follows:

$$\hat{V} = \sum_h N_h \left(\sum_i W_{hi} V_{hi} \;\; / \;\; \sum_i W_{hi} \right)$$

where:

$\hat{V} =$ total estimated volume

$\sum_h =$ denotes summation over strata

$N_h =$ stratum population for stratum h

$\sum_i =$ denotes summation over units within stratum h

$V_{hi} =$ volume reported for unit i in stratum h

$W_{hi} =$ weight attached to unit i in stratum h

where: W_{hi} is inversely proportional to the probability of inclusion in the linked sample.

The degree of imputation by product and energy use at the U.S. total level ranged as follows for the 2004 EIA-821 data: distillate, 1.25 percent for railroad use to 19.89 percent for off-highway use; residual fuel oil, 0.00 percent for oil company use to 11.06 percent for all other uses; and kerosene, 2.21 percent for industrial use to 8.01 percent for residential use.

Collection Methods

The EIA-821 form was mailed in January 2005 to all companies selected for participation in the 2004 reference year survey. The completed form was due to EIA on March 4, 2005. A second request was mailed to nonrespondents approximately 1 month after the filing deadline. Follow-up telephone calls were made to collect outstanding data and to verify reported data. Late submissions and resubmissions were processed when received.

Data Processing

As EIA-821 forms were received, they were logged into an automated Survey Control File that maintains company identification and survey form status information for each company selected to participate in the survey. The data were reviewed manually, entered onto the computer files, and then processed through an automated edit program which detected missing data and outlying values. Data that failed the edits were resolved through telephone calls to the data reporters and corrections were entered onto the computer files. Preliminary estimates were generated and processed through a series of validation procedures to flag and rectify potential misreporting of data. Statistical reports, including publication tables, were produced using only acceptable and verified data.

Note 2: Reliability of the Data

Two types of errors are associated with data produced from a sample survey; sampling errors and nonsampling errors. Sampling errors occur because the estimates are based on a sample rather than on a census. The particular sample used for the EIA-821 survey is one of a large number of samples of equal size which could have been selected from the sampling frame using the same sample design. Each of these samples would produce a different estimate. If the estimates were averaged over all possible samples, the result would be the same as the estimate derived from a census of the sampling frame. The sampling error is a measure of variability among the estimates from all possible samples and, thus, is a measure of the precision with which an estimate from a particular sample approximates the results of a census.

Nonsampling errors and possibly biases can arise from a number of sources: (1) inability to obtain information about all cases in the sample, (2) response errors, (3) differences in the interpretation of questions or definitions, (4) mistakes in recording or coding of the data obtained, and (5) other errors of collection, response, coverage, and estimation for missing data. Bias is the difference between the average of the estimates over all possible samples of the same size and design, and the true value being estimated. It is not possible to estimate bias using the results of one sample.

Data obtained from alternate sources are not subject to sampling errors, but may be subject to nonsampling errors, the magnitudes of which are unknown. Nonsampling errors for survey estimates and estimates adjusted to alternate sources cannot be determined, but attempts are made throughout survey processing to minimize this type of error.

Data in Tables 1 through 12 are based on survey data which are subject to sampling errors. Coefficients of variation, which are estimates of sampling errors, are presented for the retail target variables in the following table for the 2004 survey. The coefficients of variation (CV) were estimated by:

$$CV(\hat{V}) = \frac{\sqrt{VAR(\hat{V})}}{\hat{V}}$$

where:

$$VAR(\hat{V}) = \sum_{h} n_h \left(1 - \frac{n_h}{N_h}\right) S_h^2$$

$$S_h^2 = \frac{\sum_{i=1}^{n_h} W_i^2 V_i^2 + \overline{V}_h^2 \sum_{i=1}^{n_h} W_i^2 - 2\overline{V}_h \sum_{i=1}^{n_h} W_i^2 V_i}{n_h - 1}$$

$$\overline{V}_h = \frac{\sum_{i=1}^{n_h} W_i V_i}{\sum_{i=1}^{n_h} W_i}$$

$\hat{V} =$ total estimated volume

$N_h =$ stratum population for stratum h

$n_h =$ number of sample units in stratum h

$V_i =$ volume for unit i

$W_i =$ weight for unit i

Response rates also offer some indication of the reliability and comprehensiveness of survey results. For the 2004 EIA-821 survey, the overall response rate (the number of submissions received, divided by the number of submissions solicited and expected, times 100) was 90.9 percent.

Note 3: Data Adjustments

Alternate Source Data

After all preliminary tabulations were verified, comparisons were made between the survey results and available alternate source data. The following energy use categories were replaced by alternate source data at the U.S., Petroleum Administration for Defense (PAD) district, or State level:

Tables 1 through 12:

On-Highway Diesel. Distillate fuel oil by State was calculated from the Federal Highway Administration data on highway use of special fuels. Of the 2000 through 2004 special fuels, more than 99 percent is diesel.

Tables 13 through 24:

The 2003 adjusted numbers have been revised since they were first published in the Fuel Oil and Kerosene Sales 2003. The revisions to the data were made to include new distillate and residual volumes for “Electric Power”. When we originally published the Fuel Oil and Kerosene Sales 2003, the “Electric Power” information was still being collected and verified. See Electric Power below for further explanation of how the data are calculated.

Coefficients of Variation for Sales of Fuel Oil, 2004

Geographic Area	Residential Distillate Fuel Oil	Non-Residential Retail Distillate Fuel Oil	Retail Residual Fuel Oil
U.S. Average	**1.6**	**0.8**	**0.1**
PAD District 1 Average	**1.8**	**1.1**	**0.1**
Subdistrict 1A Average	**2.4**	**1.9**	**0.1**
Connecticut	5.7	3.9	0.1
Maine	2.7	4.1	0.1
Massachusetts	4.8	4.0	0.0
New Hampshire	3.2	4.9	0.0
Rhode Island	3.6	3.3	0.0
Vermont	2.3	4.2	0.0
Subdistrict 1B Average	**2.9**	**1.7**	**0.1**
Delaware	4.7	2.5	0.0
District of Columbia	0.0	0.0	0.0
Maryland	3.8	2.2	0.4
New Jersey	5.8	4.4	0.0
New York	4.6	3.2	0.1
Pennsylvania	5.6	2.9	0.0
Subdistrict 1C Average	**3.7**	**1.6**	**0.1**
Florida	11.5	3.8	0.0
Georgia	9.6	3.4	1.6
North Carolina	6.0	3.8	0.0
South Carolina	10.4	3.3	0.1
Virginia	5.4	3.5	0.0
West Virginia	6.0	3.5	0.0
PAD District 2 Average	**2.7**	**1.3**	**0.8**
Illinois	16.7	5.0	0.0
Indiana	8.1	3.4	0.0
Iowa	7.9	4.3	0.1
Kansas	2.8	3.9	0.0
Kentucky	3.4	4.7	0.0
Michigan	4.6	5.1	4.5
Minnesota	5.3	4.4	0.2
Missouri	4.5	3.5	0.0
Nebraska	14.5	7.1	0.0
North Dakota	12.5	5.3	0.0
Ohio	6.5	5.3	0.0
Oklahoma	0.0	5.5	0.0
South Dakota	7.4	3.1	0.0
Tennessee	11.0	2.5	5.9
Wisconsin	7.9	3.4	0.0
PAD District 3 Average	**74.7**	**2.7**	**0.1**
Alabama	1.4	3.8	0.0
Arkansas	1.9	10.5	0.0
Louisiana	3.0	4.0	0.1
Mississippi	64.7	2.5	0.0
New Mexico	32.1	3.2	0.0
Texas	91.0	4.9	0.0
PAD District 4 Average	**12.3**	**2.2**	**0.0**
Colorado	3.1	5.0	0.0
Idaho	16.5	4.3	0.0
Montana	25.3	6.6	0.0
Utah	42.2	2.5	0.0
Wyoming	10.4	4.7	0.0
PAD District 5 Average	**3.2**	**2.6**	**0.3**
Alaska	7.1	1.0	0.0
Arizona	0.0	2.3	0.0
California	6.0	5.6	0.0
Hawaii	0.0	0.0	0.0
Nevada	0.0	3.5	0.0
Oregon	5.6	6.6	5.3
Washington	2.3	3.3	0.0

Note: Coefficients of variation that are less than 0.1 and greater than zero are displayed as 0.1.
Sources: • Energy Information Administration Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report," for 2004.

Electric Power. National-level distillate and residual fuel oil sales for electric power use were calculated from annual aggregations of data collected on the EIA-906, “Power Plant Report.” Form EIA-906 utility and non-utility, NAICS 22 companies, consumption data was added to the stock change of distillate and residual, respectively. Allocations at the State level were based on the EIA-821 survey.

On-Highway Diesel. Distillate fuel oil by State was calculated from the Federal Highway Administration data on highway use of special fuels. Of the 1998 through 2002 special fuels, more than 99 percent is diesel.

1999 through 2003 Adjustments

Kerosene volumes in Tables 1 through 24 are adjusted at the national level to equal products supplied volumes as published in the “Detailed Statistics” section of the Petroleum Supply Annual (PSA). The 2004 survey resulted in 584,456 thousand gallons of kerosene at the national level. The products supplied volume at the national level for kerosene was 988,680 thousand gallons. Hence, the adjustment factor at the national level for 2004 was 1.69.

Volumes of distillate fuel oil in Tables 13 through 24 were adjusted at the PAD district level to equal products supplied volumes. The adjustment factors at the PAD district level for 2004 are as follows:

Distillate Fuel Oil

PAD District 1:	.88
PAD District 2:	1.15
PAD District 3:	1.24
PAD District 4:	1.14
PAD District 5:	.92

For Tables 13 through 24, total sales at the PAD district level equal the products supplied volumes as reported in the PSA, 2000 through 2004. For example, the 2004 survey yielded a volume for distillate residential use in PAD District 2 of 586,370 thousand gallons. The total distillate volume for PAD District 2 was 5,653,599 from the survey, after subtracting the volume coming from alternate sources. The product supplied total distillate volume for PAD District 2 was 6,489,004 after removing alternate source volume. Hence, the adjusted 2003 estimate of distillate for residential use in PAD District 2 was (6,489,004/5,653,599) x 586,370 = 673,015. For distillate fuel oil in Tables 13 through 24, the PAD district adjustments were made to each State and product-use category except on-highway diesel use, and power use.

Volumes of residual fuel oil in Tables 13 through 24 were adjusted at the national level to equal the products supplied estimate. The 2004 survey yielded 11,794,362 gallons of residual fuel oil, while the products supplied volume at the national level was 13,292,286 thousand gallons. Thus, the adjustment factor at the national level for 2004 was 1.04, after subtracting the volumes coming from alternate sources. For residual fuel oil, the adjustments were made to each State and energy use category except electric power.

Note 4: Energy Use Descriptions and Petroleum Product Definitions

Energy Use Descriptions

Residential. An energy-consuming sector that consists of living quarters for private households. Common uses of energy associated with this sector include space heating, water heating, air conditioning, lighting, refrigeration, cooking, and running a variety of other appliances. Sales to farmhouses are reported under “Farm” and sales to apartment buildings are reported under “Commercial.”

Commercial. An energy-consuming sector that consists of service-providing facilities and equipment of nonmanufacturing businesses; Federal, State, and local governments; and other private and public organizations, such as religious, social, or fraternal groups. The commercial sector includes institutional living quarters. Common uses of energy associated with this sector include space heating, water heating, air conditioning, lighting, refrigeration, cooking and running a wide variety of other equipment.

Industrial. An energy-consuming sector that consists of all facilities and equipment used for producing, processing, or assembling goods. The industrial sector encompasses the following types of activity: manufacturing and mining. Overall energy use in this sector is largely for process heat and cooling and powering machinery, with lesser amounts used for facility heating, air conditioning, and lighting. Fossil fuels are also used as raw material inputs to manufactured products.

Oil Company. An energy-consuming sector that consists of drilling companies, pipelines or other related oil companies not engaged in the selling of petroleum products. Includes fuel oil that was purchased or produced and used by company facilities for operation of drilling equipment, other field or refinery operations, and space heating at petroleum refineries, pipeline companies, and oil-drilling companies. Sales to other oil companies for field use are included, but sales for use as refinery charging stocks are excluded.

Farm. An energy-consuming sector that consists of establishments where the primary activity is growing crops and/or raising animals. Energy use by all facilities and equipment at these establishments is included, whether or not it is directly associated with growing crops and/or raising animals. Common types of energy-using equipment include tractors, irrigation pumps, crop dryers, smudge pots, and milking machines. Facility energy use encompasses all structures at the establishment, including the farm house.

Electric Power. An energy-consuming sector that consists of electricity only and combined heat and power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public--i.e., NAICS 22 plants. Volumes directly imported and used by the electric power companies are included.

Railroad. An energy-consuming sector that consists of all railroads for any use, including that used for heating buildings operated by railroads.

Vessel Bunkering. An energy-consuming sector that consists of commercial or private boats such as pleasure craft, fishing boats, tugboats, an ocean-going vessels, including vessels operated by oil companies. Excluded are volumes sold to the U. S. Armed Forces.

On-Highway Diesel. An energy-consuming sector that consists of motor vehicles: automobiles, trucks, and buses. Vehicles used in the marketing an distribution of petroleum products is also included.

Military. An energy-consuming sector that consists of the U.S. Armed Forces, Defense Energy Support Center (DESC), and all branches of the Department of Defense (DOD).

Off-Highway. An energy-consuming sector that consist of:

1. **Construction.** An energy-consuming sub sector that consist of all facilities and equipment including earthmoving equipment, cranes, generators, air compressors, etc.

2. **Other.** An energy-consuming sub sector that consists of all off-highway uses other that construction. Includes logging, scrape and junk yards, and refrigeration units on trucks.

All Other Uses. Sales for all other energy-consuming sectors not included elsewhere.

Definitions of Petroleum Products and Other Related Terms

ASTM. The acronym for the American Society for Testing and Materials.

Distillate Fuel Oil. A general classification for one of the petroleum fractions produced in conventional distillation operations. It includes diesel fuels and fuel oils. Products known as No. 1, No. 2, and No. 4 diesel fuel are used in on-highway diesel engines, such as those in trucks and automobiles, as well as off-highway engines, such as those in railroad locomotives and agricultural machinery. Products known as No. 1, No. 2, and No. 4 fuel oils are used primarily for space heating and electric power generation.

1. **No. 1 Distillate.** A light petroleum distillate that can be used as either a diesel fuels or a fuel oil.

a. **No. 1 Diesel Fuel.** A light distillate fuel oil that has distillation temperatures of 550 degrees Fahrenheit at the 90-percent point and meets the specifications defined in ASTM specification D 975. It is used in high-speed diesel engines generally operated under frequent speed and load changes, such as those in city buses and similar vehicles.

b. **No. 1 Fuel Oil.** A light distillate fuel oil that has distillation temperatures of 400 degrees Fahrenheit at the 10-percent recovery point and 550 degrees Fahrenheit at the 90-percent point and meets the specifications defined in ASTM Specification D 396. It is used primarily as fuel for portable outdoor stoves and portable outdoor heaters.

2. **No. 2 Distillate.** A petroleum distillate that can be used as either a diesel fuel or a fuel oil.

a. **No. 2 Diesel Fuel.** A fuel that has distillation temperatures of 400 degrees Fahrenheit at the 10-percent recovery point and 640 degrees Fahrenheit at the 90-percent recovery point and meets the specifications defined in ASTM Specification D 975. It is used in high speed diesel engines that are generally operated under uniform speed and load conditions such as those in railroads locomotives, trucks, and automobiles.

(1) **Low Sulfur No. 2 Diesel Fuel.** No. 2 diesel fuel that has a sulfur level no higher than 0.05 percent by weight. It is used primarily in motor vehicle diesel engines for on-highway use.

(2) **High Sulfur No. 2 Diesel Fuel.** No. 2 diesel fuel that has a sulfur level above 0.05 percent by weight.

b. **No. 2 Fuel Oil (Heating Oil).** A distillate fuel oil that has distillation temperatures of 400 degrees Fahrenheit at the 10-percent recovery point and 640 degrees Fahrenheit at the 90-percent recovery point and meets the specification defined in ASTM specification D 396. It is used in atomizing type burners for domestic heating or for moderate capacity commercial/industrial burner units.

3. **No. 4 Fuel.** A distillate fuel oil made by blending distillate fuel oil and residual fuel oil stocks. It conforms with ASTM Specification D 396 or Federal Specification VV-F-815C and is used extensively in industrial plants and in commercial burner installations that are not equipped with preheating facilities. It also includes No. 4 diesel fuel used for low-and medium-speed diesel engines and conforms to ASTM Specification D 975.

NOTE: Respondents to the EIA-821 survey were instructed to report all volumes in accordance with what the product was sold as, regardless of the actual specifications of that product. For example, if a No. 2 distillate was sold as a heating oil or fuel oil, the volume would be reported in the category "No. 2 Fuel Oil" even if the product conformed to the higher specifications of a diesel fuel.

Kerosene. A light petroleum distillate that is used in space heater, cook stoves, an water heaters and is suitable for use as a light source when burned in wick-fed lamps. Kerosene has a maximum distillation temperature of 400 degrees Fahrenheit at the 10-percent recovery point, a final boiling point of 572 degrees Fahrenheit, and a minimum flash point of 100 degrees Fahrenheit. Included are No. 1-k and No. 2-k, the two grades of kerosene called range or stove oil, which have properties similar to those of No. 1 fuel oil.

PAD District. Petroleum Administration for Defense Districts

PAD District 1:

Subdistrict 1A. Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont
Subdistrict 1B. Delaware, District of Columbia, Maryland, New Jersey, New York, and Pennsylvania
Subdistrict 1C. Florida, Georgia, North Carolina, South Carolina, Virginia, and West Virginia

PAD District 2:

Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, Ohio, Oklahoma, Tennessee, and Wisconsin

PAD District 3:

Alabama, Arkansas, Louisiana, Mississippi, New Mexico, and Texas

PAD District 4:

Colorado, Idaho, Montana, Utah, and Wyoming

PAD District 5:

Alaska, Arizona, California, Hawaii, Nevada, Oregon, and Washington

Residual Fuel Oils. A general classification for the heavier oils, know as No. 5 and No. 6 fuel oils that remain after the distillate fuel oils an lighter hydrocarbons are distilled away in refinery operations. It conforms to ASTM Specification D 396 and D 975 and Federal Specification VV-F-815C. No. 5, a residual fuel oil of medium viscosity, is also know as Navy Special anis defined in Military Specification MIL-F859E, including Amendment 2 (NATO Symbol F-77). It is used in steam-powered vessels in government service and inshore power plants. No. 6 fuel oil includes Bunker C fuel oil and is used for the production of electric power, space heating, vessel bunkering, and various industrial purposes. The United States includes the 50 states and the District of Columbia.

Appendix B

Form EIA – 821: Annual Fuel Oil and Kerosene Sales Report

U.S. DEPARTMENT OF ENERGY
Energy Information Administration

Form Approved
OMB Number: 1905-0174
Form Expires: 11/30/06

EIA-821: ANNUAL FUEL OIL AND KEROSENE SALES REPORT

This report is mandatory under Public Law 93-275. Title 18 U.S.C. 1001 makes it a criminal offense for any person knowingly and willingly to make to any Agency or Department of the United States any false, fictitious, or fraudulent statements as to any matter within its jurisdiction. For the provisions concerning the confidentiality of information and sanctions, see Sections 8 and 9 of the instructions.

PART I. IDENTIFICATION DATA

For assistance in completing this form call 1-800-592-2299

Provide **Corrections** to Company Name, Address, and Contact information in Items 1-8

1. Company Name	7. Name of Contact Person
2. Street	8. Contact Information a. Telephone Number ___ - ___ - ___
3. P.O. Box / RFD	b. Fax Number ___ - ___ - ___
4. City / 5. State / 6. Zip Code	c. Email Address ______

9. Reference Year **2004**	10. Type of Report (*Check One*) (1) ☐ Original (2) ☐ Resubmission	11. The Number of States for Which You Are Reporting

12. Which of the following best describes this firm at the end of 2004?

a.	☐ In operation - Sales include petroleum products	Skip to and complete items 22-25 and Part II	13. Effective Date of Status Change (Month / Day / Year)
b.	(1) ☐ Sold or Merged (2) ☐ Leased	Complete items 13 to 25, and Part II for that portion of 2004 in which the firm was active under your ownership and control	14. Name of Company Sold to / Leased to / Merged into / Subsidiary of / Agent for:
c.	☐ Permanently ceased operation	Complete item 13, then skip to and complete items 22-25 and Part II for the portion of 2004 in which the firm was active under your ownership and control	15. Name of Contact Person 16. Contact's Telephone Number ___ - ___ - ___
d.	☐ Subsidiary of another	Complete items 13 to 25, and Part II for that portion of 2004 in which the firm was active under your ownership and control	17. Street
e.	☐ Commissioned Agent		18. PO Box / RFD
f.	☐ Not in petroleum business	Skip to and complete items 22-25	19. City / 20. State / 21. Zip Code

PREPARED BY: *Check appropriate box.* If preparer is different from contact person, complete lines 24 and 25.

22. ☐ Preparer same as contact person shown on label	23. Date
24. ☐ Preparer's Name	25. Preparer's Telephone number

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Name of Firm Reporting	DOE ID Number	Reference Year **2004**	Page________ of ________

PART II. TOTAL SALES DURING THE REFERENCE YEAR. (READ PAGES 2-4 OF INSTRUCTIONS CAREFULLY)

Line No.	Type of Fuel and Use	States of Destination (*Enter* STANDARD ABBREVIATIONS)		
	Sold directly to consumers for	**Kerosene** (*Report in Actual Gallons*)		
1	Residential Use (Non-Farm):			
2	Commercial Use:			
3	Industrial Use:			
4	Farm Use:			
5	All Other Uses (*Include own company*, please specify):____________________			
6	Sold to Dealers, Resellers, and Refiners:			
7	**Total Kerosene (Add Lines 1 thru 6)**			
	Sold directly to consumers for	**Distillate Fuel Oil** (*Report in Actual Gallons*)		
	Residential Use (Non-Farm):			
8	No. 1			
9	No. 2			
	Commercial Use (See Reference Guide):	*Report sales of Low Sulfur Diesel for automobiles, trucks, buses, and school buses on line 28 On-highway Diesel Use with the exception of government vehicles which should be reported on line 12.*		
10	No. 1			
11	No. 2 Fuel Oil			
12	No. 2 Diesel ≤ .05% Sulfur, Low			
13	No. 2 Diesel > .05% Sulfur, High			
14	No. 4			
	Industrial Use (Manufacturing and Mining):			
15	No. 1			
16	No. 2 Fuel Oil			
17	No. 2 Diesel ≤ .05% Sulfur, Low			
18	No. 2 Diesel > .05% Sulfur, High			
19	No. 4			
20	Oil Company Use (Drilling and Own Company Refining):			
21	Railroad Use:			
22	Vessel Bunkering (Shipping and Boating):			

EIA-821 (12-04)

Name of Firm Reporting	DOE ID Number	Reference Year 2004	Page_______ of_______

PART II. TOTAL SALES DURING THE REFERENCE YEAR. (READ PAGES 2-4 OF INSTRUCTIONS CAREFULLY)

Line No.	Type of Fuel and Use	States of Destination (*Enter* STANDARD ABBREVIATION)		
	Distillate Fuel Oil--Continued (*Report in Actual Gallons*)			
	Military Use:			
23	Diesel			
24	Other Distillate			
25	Electric Power Use (Electric utility and Nonutility power producers):			
	Farm Use:			
26	Diesel			
27	Other Distillate			
28	**On-highway Diesel Use:**			
	Off-highway Use:			
29	Construction			
30	Other (Specify e.g., Logging)____________			
31	All Other Uses (Specify):_______________			
32	Sold to Dealers, Resellers, and Refiners:			
33	**Total Distillate (Add Lines 8 thru 32)**			
	Residual Fuel Oil - Include No.5 and No. 6 (*Report in Actual Gallons*)			
	Sold directly to consumers for			
34	Commercial Use (Nonmanufacturing):			
35	Industrial Use (Manufacturing and Mining):			
36	Oil Company Use (Drilling and Own Company Refining):			
37	Railroad Use (Include Volumes on line 41):			
38	Vessel Bunkering:			
39	Military Use:			
40	Electric Power Use (Electric utility and Nonutility power producers):			
41	All Other Uses (Specify):_______________			
42	Sold to Dealers, Resellers, and Refiners:			
43	**Total Residual (Add Lines 34 thru 42)**			

Page 3

Send the completed form to:	**U.S. Department of Energy** **Energy Information Administration (EIA-821)** **P.O. Box 833** **Merrifield, VA. 22116-0833**
or telefax completed form by calling:	**1(703) 676-7514, Attn: EIA-821**

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