



Missouri
Department of
Natural Resources

2002 Base Year Emissions Inventory for the Missouri Portion of the St. Louis 8-Hour Ozone Nonattainment Area

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**Missouri Department of Natural Resources
Division of Environmental Quality
Air Pollution Control Program**

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I. INTRODUCTION

The St. Louis area is currently designated as a moderate nonattainment area for the 8-hour ozone standard. In Missouri, the nonattainment area encompasses the City of St. Louis and Franklin, Jefferson, St. Charles, and St. Louis Counties. The Clean Air Act Section 182(a)(1) requires the Missouri Department of Natural Resources' Air Pollution Control Program to submit a comprehensive, accurate, current inventory of actual emissions for all sources within the nonattainment area. The department is using 2002 as the baseline year for emissions inventory purposes, as per 40 CFR 51.910(d). The base year inventory was originally adopted by the Missouri Air Conservation Commission on May 25, 2006 and submitted to the U.S. Environmental Protection Agency (EPA) by the June 2006 deadline. Subsequent to the June 2006 submission, the inventory was revised. This document replaces the June 2006 base year inventory.

This inventory conforms to the EPA's *Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations* (August 2005). It is comprehensive and current for all 2002 actual emissions of the pollutants that contribute to ozone formation in the St. Louis nonattainment area: volatile organic compounds (VOC), oxides of nitrogen (NO_x), and carbon monoxide (CO). It includes emissions from stationary point and area sources, onroad and offroad mobile sources, and biogenic sources within the St. Louis ozone nonattainment area. Both annual and ozone season day (OSD) emissions are included. Ozone season day emissions are defined as emissions occurring during a typical weekday during the high ozone season, which is June through August.

The base year inventory is the foundation for the reasonable further progress (RFP) demonstration. RFP is a demonstration that incremental emission reductions will be achieved from 2002 through 2008 to provide steady progress toward attainment of the 8-hour ozone standard in the St. Louis area. The RFP inventory is developed from the base year inventory to calculate the emission reduction target(s) for the St. Louis area and provide the baseline for calculating emission reductions associated with implementation of any control measures that might be adopted in the State Implementation Plan (SIP). The RFP inventory accounts for economic growth and emissions controls expected to occur from the base year to 2008, the year for which emission reduction targets must be met.

This inventory is a subset of an inventory being developed in support of the St. Louis ozone and PM_{2.5} photochemical modeling effort and attainment demonstration that will be submitted to the EPA by June 2007. The modeling inventory is broader in scope in terms of pollutants included and geographic area covered. In addition to VOC, NO_x, and CO, the modeling inventory contains directly emitted PM_{2.5} and emissions of sulfur dioxide and ammonia, both of which contribute to PM_{2.5} formation. The modeling inventory spans the entire modeling domain consisting of the continental U.S. plus portions of Canada and Mexico.

While the base year inventory is consistent in many ways with the modeling inventory within the St. Louis nonattainment area, there are key differences. Whereas the base year inventory represents typical emissions, the modeling inventory includes episode-specific emissions. The

main differences are in the onroad mobile and biogenic emissions estimates: average temperature data are used in the base year inventory but episode-specific meteorology is used in the modeling inventory. Another difference is in the point source inventory. For large point sources, emissions in the base year inventory are based on typical operations, while day- and hour-specific Continuous Emissions Monitoring (CEM) data are used in the modeling inventory where available.

The department's Air Pollution Control Program prepared an inventory for the 2002 National Emissions Inventory (NEI) as required by the Consolidated Emissions Reporting Rule (CERR). However, subsequent to submitting the data to the 2002 NEI, substantial revisions and improvements were made to the point, area, and offroad mobile source emissions through the Central Regional Air Planning Association (CENRAP) workgroup process for regional haze planning and analysis. In addition, the department developed updated 2002 onroad mobile emissions estimates for the base year inventory using more current input data and a refined calculation methodology in comparison to the earlier work for the 2002 NEI. The base year inventory for St. Louis is a composite of inventory data prepared by the department's Air Pollution Control Program and data generated through the CENRAP process.

A number of agencies and stakeholders have been involved in the development and quality-assurance of the inventory data summarized in this document. As mentioned above, much of the inventory work completed through the CENRAP workgroup process has been incorporated. More information on the CENRAP process and participants can be found at <http://www.cenrap.org>. In addition, the department has been working closely with the Illinois Environmental Protection Agency (IEPA), EPA Region 7, and other stakeholders in the development of the modeling inventory in support of the 8-hour ozone and PM_{2.5} SIPs and attainment demonstrations. Information about the St. Louis SIP workgroup process can be found at <http://www.dnr.mo.gov/env/apcp/sipworkgrp/sipgrpmain.htm>.

This version of the base year inventory reflects the following changes since the version adopted by the Missouri Air Conservation Commission on May 25, 2006 and submitted to the EPA in June 2006:

- VOC emissions from portable fuel containers (gas cans) were added to the area source inventory;
- VOC emissions from aviation gasoline usage were revised in the area source inventory;
- Corrections were made to the vehicle miles traveled (VMT) and MOBILE6 inputs that resulted in minor changes to the onroad mobile source typical summer weekday emissions; and
- Typical ozone season weekday emissions for point, area, and offroad mobile sources were corrected.

These changes are consistent with the St. Louis Base 4 typical modeling emissions inventory used in the attainment demonstration. The biogenic emissions in this base year inventory submission have not changed from the June 2006 version.

Section II of this document discusses the emission statement requirement for the 8-hour ozone standard. Section III gives an overview of 2002 annual and ozone season day emissions of VOC, NO_x, and CO in the St. Louis nonattainment area by county and source type (i.e., point, area, offroad mobile, onroad mobile, biogenic). Sections IV through VII present the point, area, offroad mobile, and onroad mobile emissions by source category and briefly discuss the methods and data used to develop these individual elements of the inventory. In addition, Sections IV through VII discuss the changes made to the point, area, offroad mobile, and onroad mobile inventories since the base year inventory submission in June 2006. Finally, Section VIII provides information on the base year biogenic emissions estimates that were prepared by EPA.

II. EMISSION STATEMENT REQUIREMENT

Section 182(a)(3)(B) of the 1990 Clean Air Act Amendments requires all states with ozone nonattainment areas to require emission statements from sources of VOC and NO_x. In January 1994, the department submitted a revision to the Missouri SIP that demonstrated compliance with this requirement. The emission statement SIP was publicly heard on July 29, 1993 and August 26, 1993. It was voted on and approved by the Missouri Air Conservation Commission on September 30, 1993.

Shortly after this submission, the department modified the annual reporting forms that individual sources used to report their emissions. These reporting requirements are currently specified in 10 CSR 10-6.110. The 2002 Emission Inventory Questionnaires (EIQs) are provided in Appendix A. The forms provide the mechanism that the department uses to collect the information required by Section 182(a)(3)(B), including the name, location, address, geographical location, the industrial classification codes, and the operational activity and process rates related to the ozone season. The forms also require the identification of emission controls and control efficiencies, as well as the emission factors and emission calculation methods. The forms also provide the necessary certification from the sources that the data is accurate.

Section 182(a)(3)(B) also created the requirement for states to submit this data to EPA. This data submission is now conducted in compliance with the CERR.

State rule 10 CSR 10-6.110, Submission of Emission Data, Emission Fees, and Process Information, is adequate in addressing the emission statement requirement for the 8-hour ozone standard.

III. SUMMARY OF 2002 BASE YEAR EMISSIONS INVENTORY

A. Anthropogenic Emissions

Anthropogenic emissions are emissions resulting from human activities and are broadly classified into the point, area, offroad mobile, and onroad mobile source types. This section gives an overview of total anthropogenic emissions in the St. Louis nonattainment area. Sections IV through VII discuss point, area, offroad mobile, onroad mobile source emissions in greater detail.

Table 1 summarizes total 2002 annual and ozone season day anthropogenic emissions in the St. Louis nonattainment counties. Figures 1, 2, and 3 present the ozone season day emissions in pie chart format for VOC, NO_x, and CO, respectively. Table 2 summarizes the data by county and source type.

Table 1. 2002 Anthropogenic Emissions by Source Type

Source Type	VOC	VOC	NO _x	NO _x	CO	CO
	tons/year	tons/day	tons/year	tons/day	tons/year	tons/day
Point	10,868.3	32.7	44,018.2	127.2	9,206.9	26.7
Area	28,212.4	71.4	10,014.2	19.4	20,976.8	30.3
Offroad Mobile	13,881.3	46.9	19,329.0	60.8	188,365.9	668.6
Onroad Mobile	25,973.0	68.1	60,311.7	159.0	399,726.4	862.6
Totals	78,934.9	219.1	133,673.0	366.3	618,276.0	1,588.3

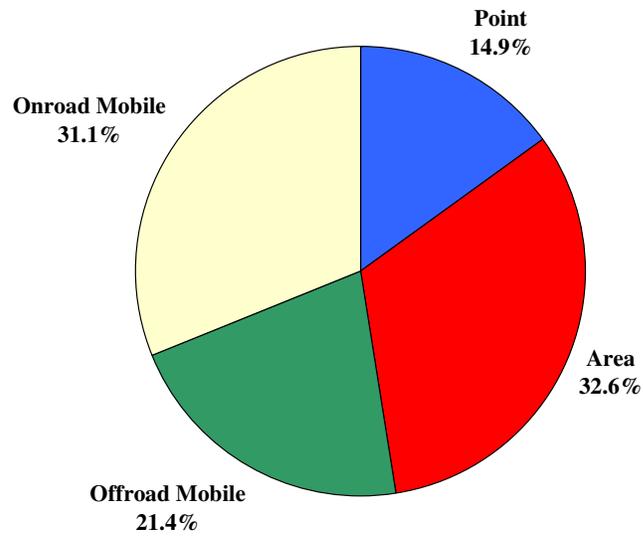


Figure 1. 2002 VOC Emissions for a Typical Summer Weekday in the St. Louis Nonattainment Area by Source Type -- Total 219.1 tons/day

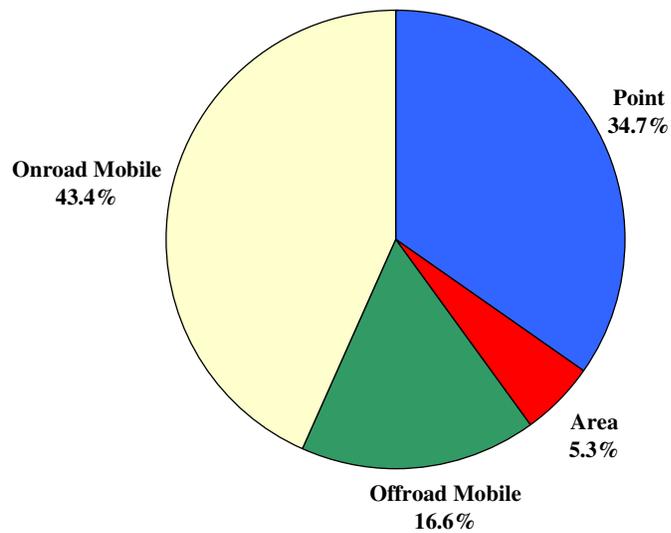


Figure 2. 2002 NOx Emissions for a Typical Summer Weekday in the St. Louis Nonattainment Area by Source Type -- Total 366.3 tons/day

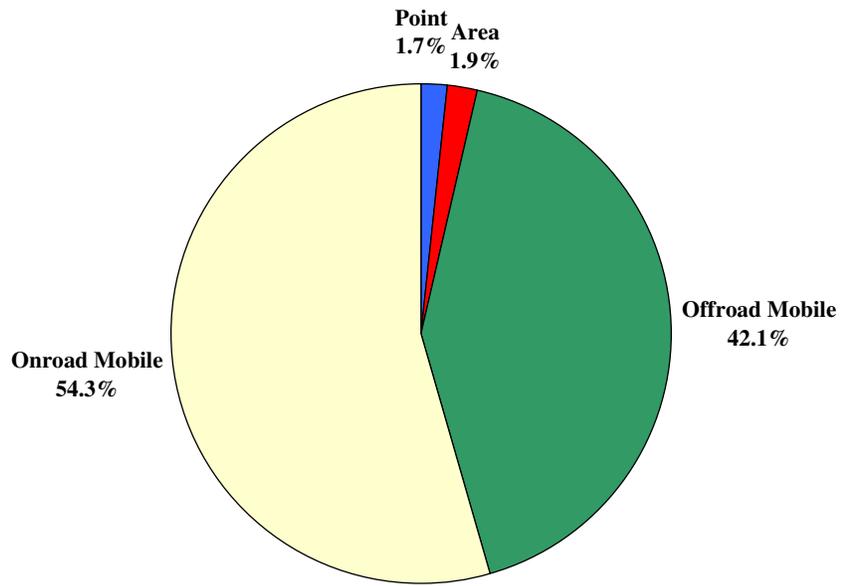


Figure 3. 2002 CO Emissions for a Typical Summer Weekday in the St. Louis Nonattainment Area by Source Type -- 1,588.3 tons/day

Table 2. 2002 Anthropogenic Emissions by County and Source Type

Source Type	VOC	VOC	NOx	NOx	CO	CO
	tons/year	tons/day	tons/year	tons/day	tons/year	tons/day
FRANKLIN COUNTY						
Point	814.0	2.7	7,850.9	24.3	2,119.2	6.6
Area	2,003.9	3.9	705.9	1.7	4,819.9	6.4
Offroad	790.8	2.7	1,584.3	4.8	6,233.5	22.8
Onroad	1,911.1	4.8	4,937.6	13.0	32,627.0	70.0
Franklin Co. Totals	5,519.8	14.1	15,078.6	43.8	45,799.7	105.8
JEFFERSON COUNTY						
Point	664.0	2.0	9,202.1	26.0	2,065.1	5.8
Area	3,703.0	8.7	660.4	1.4	7,697.6	15.6
Offroad	1,170.4	4.0	1,780.9	5.3	12,934.5	46.4
Onroad	2,523.5	6.4	5,807.4	14.9	38,500.1	80.7
Jefferson Co. Totals	8,060.9	21.2	17,450.9	47.6	61,197.4	148.4
ST. CHARLES COUNTY						
Point	1,450.6	3.6	14,553.7	46.1	1,081.8	3.5
Area	3,663.7	9.1	1,224.9	2.4	3,059.7	1.2
Offroad	2,241.9	7.2	2,139.8	7.1	22,910.1	79.9
Onroad	3,412.2	8.8	7,852.5	20.2	52,057.6	109.8
St. Charles Co. Totals	10,768.5	28.6	25,770.9	75.8	79,109.2	194.4
ST. LOUIS COUNTY						
Point	4,146.2	13.3	10,416.9	25.4	2,651.7	7.5
Area	13,781.3	36.2	5,320.9	9.9	4,123.2	5.3
Offroad	8,123.5	27.5	9,642.8	31.5	121,829.3	426.5
Onroad	14,194.1	37.4	32,665.2	86.2	216,552.0	468.2
St. Louis Co. Totals	40,245.0	114.5	58,045.7	152.9	345,156.1	907.4
CITY OF ST. LOUIS						
Point	3,793.4	11.1	1,994.6	5.4	1,289.1	3.4
Area	5,060.5	13.4	2,102.2	4.0	1,276.3	1.8
Offroad	1,554.7	5.6	4,181.2	12.0	24,458.5	93.0
Onroad	3,932.1	10.7	9,049.0	24.7	59,989.7	134.0
City of St. Louis Totals	14,340.7	40.8	17,326.9	46.1	87,013.6	232.3
Nonattainment Area Totals	78,934.9	219.1	133,673.0	366.3	618,276.0	1,588.3

B. Biogenic Emissions

Biogenic emissions sources are natural (i.e., non-anthropogenic) sources of emissions. Table 3 summarizes 2002 biogenic emissions by county. Section VIII discusses biogenic emissions in more detail.

Table 3. 2002 Biogenic Emissions by County

County/City	VOC tons/yr	VOC tons/day	VOC lbs/OSD	NOx tons/yr	NOx tons/day	NOx lbs/day	CO tons/yr	CO tons/day	CO lbs/day
Franklin	19,076.3	131.0	262,008.6	226.4	0.9	1,796.1	1,476.2	8.9	17,784.8
Jefferson	15,241.3	103.4	206,781.6	137.7	0.6	1,117.4	1,212.2	7.2	14,428.3
St. Charles	9,868.1	66.7	133,409.0	205.8	0.8	1,632.2	884.0	5.3	10,569.6
St. Louis	8,861.7	59.1	118,287.8	192.5	0.8	1,525.7	815.6	4.8	9,502.2
City of St. Louis	3,831.1	25.6	51,149.0	124.0	0.5	990.2	425.6	2.5	5,056.7
Totals	56,878.5	385.8	771,635.9	886.5	3.5	7,061.5	4,813.6	28.7	57,341.5

IV. POINT SOURCE EMISSIONS

Point sources are large, stationary, identifiable sources of emissions. The department defines point sources as sources with a Basic, Intermediate, or Part 70 operating permit that must report their actual emissions to the department on an annual basis.

A. Emissions Summary

Tables 4, 5, and 6 summarize total 2002 St. Louis nonattainment area point source emissions of VOC, NOx, and CO, respectively. The tables summarize the emissions by source category and are sorted from highest to lowest ozone season day emissions. The source category groupings are based on EPA's Source Classification Code (SCC) to Tier Category crosswalk available on the Clearinghouse for Inventories and Emissions Factors (CHIEF) website at <http://www.epa.gov/ttn/chief/codes/index.html>. Emissions for individual facilities located in the St. Louis nonattainment area are listed in Table A-1 in Appendix A.

Table 4. 2002 VOC Emissions from Point Sources by Source Category

Point Source Category	VOC	VOC	VOC
	tons/year	tons/day	lbs/day
Solvent Utilization - Surface Coating	3,956.2	12.3	24,643.3
Solvent Utilization - Other Industrial	2,233.6	6.1	12,223.8
Solvent Utilization - Graphic Arts	765.9	2.4	4,867.5
Solvent Utilization - Degreasing	704.7	2.0	4,064.2
Fuel Comb. Elec. Util. - Coal	642.4	1.9	3,734.2
Other Industrial Processes - Agriculture, Food, & Kindred Products	321.7	1.0	2,013.9
Other Industrial Processes - Mineral Products	244.3	0.7	1,432.2
Chemical & Allied Product Mfg - Other Chemical Mfg	246.6	0.7	1,355.8
Chemical & Allied Product Mfg - Paint, Varnish, Lacquer, Enamel Mfg	165.3	0.6	1,231.0
Other Industrial Processes - Miscellaneous Industrial Processes	202.8	0.5	1,055.3
Chemical & Allied Product Mfg - Polymer & Resin Mfg	121.0	0.4	885.4
Storage & Transport - Organic Chemical Storage	129.7	0.4	849.0
Other Industrial Processes - Rubber & Miscellaneous Plastic Products	120.4	0.4	830.8
Metals Processing - Non-Ferrous Metals Processing	138.9	0.4	773.5
Metals Processing - Ferrous Metals Processing	86.1	0.3	622.0
Waste Disposal & Recycling - Landfills	91.5	0.3	502.0
Chemical & Allied Product Mfg - Pharmaceutical Mfg	64.3	0.2	493.1
Chemical & Allied Product Mfg - Organic Chemical Mfg	82.1	0.2	481.6
Petroleum & Related Industries - Petroleum Refineries & Related Industries	59.9	0.2	459.4
Petroleum & Related Industries - Asphalt Manufacturing	35.9	0.2	400.4
Storage & Transport - Bulk Terminals & Plants	66.6	0.2	379.5
Waste Disposal & Recycling - Potw	48.7	0.1	290.1
Waste Disposal & Recycling - Incineration	55.1	0.1	240.7
Storage & Transport - Service Stations: Stage Ii	45.3	0.1	234.5
Chemical & Allied Product Mfg - Inorganic Chemical Mfg	39.7	0.1	201.0

Point Source Category	VOC	VOC	VOC
	tons/year	tons/day	lbs/day
Storage & Transport - Petroleum & Petroleum Product Storage	24.1	0.1	161.4
Fuel Comb. Industrial - Gas	34.1	0.1	158.1
Other Industrial Processes - Machinery Products	16.7	0.1	113.8
Storage & Transport - Petroleum & Petroleum Product Transport	20.4	0.1	111.8
Waste Disposal & Recycling - Industrial Waste Water	19.7	0.1	109.4
Fuel Comb. Industrial - Internal Combustion	13.0	0.1	102.1
Fuel Comb. Other - Commercial/Institutional Gas	19.0	0.0	94.5
Chemical & Allied Product Mfg - Agricultural Chemical Mfg	10.0	0.0	67.1
Storage & Transport - Organic Chemical Transport	7.8	0.0	55.8
Petroleum & Related Industries - Oil & Gas Production	7.1	0.0	40.9
Fuel Comb. Elec. Util. - Other	5.8	0.0	36.2
Fuel Comb. Industrial - Coal	6.3	0.0	31.4
Fuel Comb. Elec. Util. - Internal Combustion	4.2	0.0	30.4
Solvent Utilization - Dry Cleaning	3.2	0.0	20.4
Fuel Comb. Industrial - Other	1.7	0.0	10.3
Fuel Comb. Elec. Util. - Gas	2.4	0.0	9.6
Miscellaneous - Health Services	1.3	0.0	7.0
Storage & Transport - Service Stations: Stage I	0.5	0.0	3.8
Fuel Comb. Other - Misc. Fuel Comb. (Except Residential)	0.6	0.0	3.5
Other Industrial Processes - Textiles, Leather, & Apparel Products	0.3	0.0	1.9
Fuel Comb. Other - Commercial/Institutional Oil	0.4	0.0	1.7
Waste Disposal & Recycling - Tsd	0.2	0.0	1.3
Other Industrial Processes - Wood, Pulp & Paper, & Publishing Products	0.1	0.0	1.3
Fuel Comb. Elec. Util. - Oil	0.6	0.0	1.2
Other Industrial Processes - Electronic Equipment	0.1	0.0	1.0
Metals Processing - Metals Processing Nec	0.1	0.0	0.8
Fuel Comb. Industrial - Oil	0.1	0.0	0.2
Point Source VOC Totals in St. Louis Nonattainment Area	10,868.2	32.7	65,441.1

Table 5. 2002 NO_x Emissions from Point Sources by Source Category

Point Source Category	NO _x	NO _x	NO _x
	tons/year	tons/day	lbs/day
Fuel Comb. Elec. Util. - Coal	35,324.9	102.4	204,742.2
Other Industrial Processes - Mineral Products	5,227.2	15.4	30,825.8
Fuel Comb. Industrial - Coal	1,388.9	3.5	7,015.3
Fuel Comb. Industrial - Gas	687.1	1.6	3,188.3
Fuel Comb. Industrial - Internal Combustion	423.6	1.5	2,932.6
Fuel Comb. Other - Commercial/Institutional Gas	300.7	0.7	1,419.6
Fuel Comb. Elec. Util. - Internal Combustion	202.1	0.7	1,370.5
Waste Disposal & Recycling - Incineration	165.8	0.4	788.7
Petroleum & Related Industries - Asphalt Manufacturing	61.7	0.3	660.6
Waste Disposal & Recycling - Landfills	55.7	0.2	318.0
Other Industrial Processes - Miscellaneous Industrial Processes	41.6	0.1	234.1
Fuel Comb. Elec. Util. - Gas	31.4	0.1	122.1
Chemical & Allied Product Mfg - Polymer & Resin Mfg	12.5	0.0	89.0
Metals Processing - Non-Ferrous Metals Processing	11.5	0.0	78.8
Fuel Comb. Other - Misc. Fuel Comb. (Except Residential)	11.4	0.0	68.8
Other Industrial Processes - Machinery Products	8.9	0.0	52.5
Fuel Comb. Industrial - Other	7.9	0.0	45.8
Metals Processing - Ferrous Metals Processing	4.3	0.0	28.2
Fuel Comb. Other - Commercial/Institutional Oil	6.2	0.0	26.5
Fuel Comb. Industrial - Oil	6.4	0.0	24.4
Other Industrial Processes - Rubber & Miscellaneous Plastic Products	1.8	0.0	13.6
Chemical & Allied Product Mfg - Agricultural Chemical Mfg	2.1	0.0	11.5
Storage & Transport - Petroleum & Petroleum Product Transport	1.4	0.0	7.5
Fuel Comb. Other - Commercial/Institutional Coal	6.2	0.0	7.4
Other Industrial Processes - Agriculture, Food, & Kindred Products	0.0	0.0	0.3
Chemical & Allied Product Mfg - Organic Chemical Mfg	0.0	0.0	0.2
Solvent Utilization - Surface Coating	0.0	0.0	0.2
Fuel Comb. Elec. Util. - Oil	27.1	0.0	0.0
Point Source NO_x Totals in St. Louis Nonattainment Area	44,018.2	127.0	254,072.5

Table 6. 2002 CO Emissions from Point Sources by Source Category

Point Source Category	CO	CO	CO
	tons/year	tons/day	lbs/day
Fuel Comb. Elec. Util. - Coal	4,694.8	13.5	26,934.6
Other Industrial Processes - Mineral Products	911.6	2.8	5,525.9
Waste Disposal & Recycling - Landfills	839.7	2.3	4,614.7
Petroleum & Related Industries - Asphalt Manufacturing	407.6	2.2	4,352.8
Waste Disposal & Recycling - Incineration	785.8	2.0	3,906.8
Fuel Comb. Industrial - Internal Combustion	418.0	1.3	2,557.3
Fuel Comb. Industrial - Gas	482.3	1.1	2,234.6
Fuel Comb. Industrial - Coal	282.8	0.7	1,391.7
Fuel Comb. Other - Commercial/Institutional Gas	195.1	0.5	903.9
Fuel Comb. Elec. Util. - Other	51.1	0.2	316.9
Fuel Comb. Elec. Util. - Internal Combustion	28.3	0.1	196.1
Fuel Comb. Elec. Util. - Gas	38.5	0.1	163.7
Metals Processing - Ferrous Metals Processing	13.6	0.1	100.9
Chemical & Allied Product Mfg - Polymer & Resin Mfg	17.1	0.0	93.5
Fuel Comb. Industrial - Other	13.2	0.0	83.8
Fuel Comb. Elec. Util. - Oil	8.1	0.0	30.5
Other Industrial Processes - Rubber & Miscellaneous Plastic Products	3.1	0.0	23.8
Fuel Comb. Other - Misc. Fuel Comb. (Except Residential)	3.5	0.0	20.6
Storage & Transport - Petroleum & Petroleum Product Transport	3.4	0.0	18.6
Fuel Comb. Other - Commercial/Institutional Coal	5.0	0.0	5.9
Fuel Comb. Other - Commercial/Institutional Oil	2.7	0.0	5.8
Fuel Comb. Industrial - Oil	1.2	0.0	3.8
Other Industrial Processes - Machinery Products	0.5	0.0	2.7
Metals Processing - Non-Ferrous Metals Processing	0.1	0.0	0.5
Other Industrial Processes - Miscellaneous Industrial Processes	0.0	0.0	0.1
Point Source CO Totals in St. Louis Nonattainment Area	9,206.9	26.7	53,489.7

B. Overview of Point Source Inventory Development

The 2002 point source inventory is based on information reported by facilities on EIQs. The 2002 EIQ data collection process was conducted by the department's Air Pollution Control Program and the local air pollution agencies of St. Louis County and the City of St. Louis. As the coordinating agency for point source inventory development, the department's Air Pollution Control Program performed the overall quality-assurance procedures and submitted the data to the 2002 NEI to meet the requirements of the CERR. Appendix A contains the 2002 EIQ packet that was mailed to facilities in January 2003 and the Quality Assurance Project Plan for fiscal year 2002-2003 that describes the point source data collection and quality-assurance procedures in greater detail.

Following submission of the Missouri point source inventory to the 2002 NEI, additional quality assurance and revision of the data was completed through the CENRAP process. Pechan,

through a contract with CENRAP, obtained the Missouri point source inventory and worked with the department's Air Pollution Control Program to make corrections where needed. In particular, an error that resulted in the double-counting of emissions from a number of emission units was corrected. The problem affected VOC emissions only. For example, for the Chrysler-North facility (291890231), emission unit number 20949, which emitted a total of 112 tons/year (about 0.3 tons/day) VOC in 2002, was associated with stack numbers 44387 and 44388. Instead of being proportioned between the two stacks, the total amount of 112 tons/year was linked to each stack, which doubled the emissions. In all, this problem resulted in overstating VOC emissions in the St. Louis nonattainment area by a total of 751 tons/year (roughly 2 tons/day). Other revisions included corrections to facility coordinates and stack parameters. Pechan also converted the point source inventory to the Sparse Matrix Operator Kernel Emissions/Inventory Data Analyzer (SMOKE/IDA) format. Pechan's work is described in detail in the two documents included in Appendix B: *The Consolidation of Emissions Inventories* (April 28, 2005) and *Refinement of CENRAP's 2002 Emissions Inventories* (August 31, 2005).

The SMOKE/IDA-formatted file prepared by Pechan was considered to be the most accurate and current version of the 2002 Missouri point source inventory and therefore was used as the basis for the base year inventory summarized in this document. The file contains annual emissions for all point sources and ozone season day emissions where this information was provided in EIQs. Because ozone season day emissions information was not complete, the SMOKE model was used to calculate typical ozone day emissions for all point sources in the St. Louis nonattainment area in order to apply consistent procedures to all sources. Appendix C describes how the typical ozone season day emissions were calculated.

C. Changes to Point Emissions Since Previous Base Year Inventory

Compared to the base year inventory submitted to the EPA in June 2006, the only change to the point source emissions has been a revision to the ozone season weekday emissions; the annual point source emissions have not changed. The ozone season weekday emissions were revised to reflect a typical ozone season weekday rather than a specific weekday. For the previous base year inventory submission, the ozone season weekday emissions were based on SMOKE output reports for a Monday in June. Subsequent to the preparation of that inventory, it was discovered that the SMOKE model makes an adjustment for Monday emissions even though none of the day-of-week temporal profile weights vary from one weekday to the next. Although the specific mechanism could not be identified in time for this report, it appears that the adjustment is internal to the SMOKE model and is done after the day-of-week temporal profile weights are applied. For this version of the base year inventory, SMOKE output reports for a Wednesday in June were used in order to be more representative of a typical weekday. The result is slightly higher ozone season weekday emissions in this inventory. The facility-level summaries in Appendix A, Table A-2 were revised to reflect this change. None of the temporal information related to point sources in Appendix C changes as a result of this correction.

V. AREA SOURCE EMISSIONS

Area sources are stationary sources that do not qualify as point sources under the relevant emissions cutoffs. Area sources encompass more widespread sources that may be abundant but

individually release small amounts of a given pollutant. Examples of area sources include autobody painting, fires, and consumer solvent use.

A. Emissions Summary

Tables 7, 8, and 9 summarize the total 2002 VOC, NO_x, and CO area source emissions for the St. Louis nonattainment area by source category. The tables are sorted from highest to lowest ozone season day emissions. The source category groupings are based on EPA's SCC to Tier Category crosswalk available on the CHIEF website at <http://www.epa.gov/ttn/chief/codes/index.html>. The crosswalk was modified by adding the SCCs for portable fuel containers. Table D-2 in Appendix D presents the 2002 area source inventory at the more detailed SCC level.

Table 7. 2002 VOC Emissions from Area Sources by Source Category

Area Source Category	VOC	VOC	VOC
	tons/year	tons/day	lbs/day
Solvent Utilization - Surface Coating	8,968.9	24.9	49,873.0
Solvent Utilization - Nonindustrial	6,626.4	18.4	36,702.0
Solvent Utilization - Degreasing	3,688.2	10.2	20,392.2
Storage & Transport - Portable Fuel Containers (Gas Cans)	1,716.0	4.7	9,402.7
Solvent Utilization - Graphic Arts	1,543.4	4.3	8,533.1
Waste Disposal & Recycling - Open Burning	770.1	2.1	4,219.6
Storage & Transport - Petroleum & Petroleum Product Storage	744.1	2.0	4,081.2
Waste Disposal & Recycling - Landfills	560.7	1.5	3,072.5
Other Industrial Processes - Agriculture, Food, & Kindred Products	301.0	1.1	2,135.3
Solvent Utilization - Dry Cleaning	252.9	0.7	1,414.6
Fuel Comb. Other - Residential Wood	2,290.6	0.4	756.4
Fuel Comb. Industrial - Gas	72.0	0.2	406.2
Waste Disposal & Recycling - Incineration	71.8	0.2	393.3
Fuel Comb. Other - Commercial/Institutional Gas	73.7	0.1	250.4
Miscellaneous - Other Combustion	220.1	0.1	233.7
Fuel Comb. Industrial - Oil	38.8	0.1	219.0
Storage & Transport - Petroleum & Petroleum Product Transport	34.7	0.1	190.0
Fuel Comb. Other - Commercial/Institutional Coal	39.8	0.1	135.2
Fuel Comb. Industrial - Other	15.0	0.0	84.7
Fuel Comb. Other - Residential Other	158.1	0.0	82.7
Fuel Comb. Other - Commercial/Institutional Oil	9.3	0.0	31.7
Fuel Comb. Industrial - Coal	5.1	0.0	28.9
Fuel Comb. Other - Misc. Fuel Comb. (Except Residential)	4.6	0.0	25.9
Waste Disposal & Recycling - Other	3.7	0.0	20.5
Storage & Transport - Service Stations: Stage II	1.5	0.0	8.1
Storage & Transport - Service Stations: Breathing & Emptying	1.4	0.0	7.4
Storage & Transport - Service Stations: Stage I	0.6	0.0	3.2
Area Source VOC Totals in St. Louis Nonattainment Area	28,212.4	71.4	142,703.4

Table 8. 2002 NOx Emissions from Area Sources by Source Category

Area Source Category	NOx	NOx	NOx
	tons/year	tons/day	lbs/day
Fuel Comb. Industrial - Coal	1,878.0	5.3	10,599.2
Fuel Comb. Industrial - Gas	1,308.4	3.7	7,384.6
Fuel Comb. Other - Commercial/Institutional Gas	1,340.1	2.3	4,552.7
Fuel Comb. Industrial - Oil	680.9	1.9	3,842.8
Fuel Comb. Industrial - Other	570.2	1.6	3,218.0
Storage & Transport - Petroleum & Petroleum Product Transport	556.6	1.5	3,050.1
Fuel Comb. Other - Residential Other	2,602.1	0.9	1,713.2
Waste Disposal & Recycling - Open Burning	249.0	0.7	1,364.5
Fuel Comb. Other - Commercial/Institutional Coal	290.8	0.5	987.9
Fuel Comb. Other - Misc. Fuel Comb. (Except Residential)	128.5	0.4	725.3
Fuel Comb. Other - Commercial/Institutional Oil	192.9	0.3	655.2
Waste Disposal & Recycling - Incineration	108.7	0.3	595.9
Miscellaneous - Other Combustion	36.9	0.0	76.5
Fuel Comb. Other - Residential Wood	71.2	0.0	23.5
Area Source NOx Totals in St. Louis Nonattainment Area	10,014.2	19.4	38,789.5

Table 9. 2002 CO Emissions from Area Sources by Source Category

Area Source Category	CO	CO	CO
	tons/year	tons/day	lbs/day
Waste Disposal & Recycling - Open Burning	7,268.0	19.9	39,825.0
Fuel Comb. Industrial - Gas	1,099.1	3.1	6,203.1
Fuel Comb. Other - Commercial/Institutional Gas	1,125.7	1.9	3,824.3
Miscellaneous - Other Combustion	3,296.5	1.0	2,094.2
Waste Disposal & Recycling - Incineration	362.5	1.0	1,986.2
Fuel Comb. Other - Residential Wood	5,546.0	0.9	1,831.3
Other Industrial Processes - Agriculture, Food, & Kindred Products	225.3	0.6	1,234.8
Fuel Comb. Other - Commercial/Institutional Coal	336.7	0.6	1,143.9
Fuel Comb. Industrial - Oil	154.2	0.4	870.4
Fuel Comb. Other - Residential Other	1,359.8	0.3	564.9
Fuel Comb. Industrial - Other	96.0	0.3	542.0
Fuel Comb. Industrial - Coal	42.7	0.1	240.9
Fuel Comb. Other - Commercial/Institutional Oil	46.9	0.1	159.4
Fuel Comb. Other - Misc. Fuel Comb. (Except Residential)	17.4	0.0	98.4
Area Source CO Totals in St. Louis Nonattainment Area	20,976.8	30.3	60,618.8

B. Overview of Area Source Inventory Development

The 2002 area source inventory is a consolidation of the best available area source emissions data. It includes emissions estimates prepared by the department's Air Pollution Control Program and CENRAP, with remaining gaps filled in with data from the EPA's NEI. Table D-1 in Appendix D lists the source of the emissions estimates for each SCC in the base year area source inventory. For the categories developed by the department's Air Pollution Control Program, the data and methods used are described in the document *Missouri Statewide Estimates for the 2002 National Emissions Inventory (NEI): Area Sources* in Appendix D. The data and methods used to develop the prescribed burning inventory for CENRAP are discussed in Sonoma Technology's report *Research and Development of Planned Burning Emission Inventories for the Central States Regional Air Planning Association* (July 30, 2004) in Appendix D. Documentation of EPA's methods for the NEI may be found on EPA's Clearinghouse for Inventories and Emission Factors (CHIEF) website at <http://www.epa.gov/ttn/chief/net/2002inventory.html>.

In a contract with CENRAP, Pechan consolidated the area source data from the various sources, conducted additional quality assurance, and worked with the department's Air Pollution Control Program to make revisions where needed. In particular, corrections were made to a double-counting error of industrial surface coating VOC emissions. Pechan also converted the area source inventory to the SMOKE/IDA format. Pechan's work is described in detail in the two documents included in Appendix B: *The Consolidation of Emissions Inventories* (April 28, 2005) and *Refinement of CENRAP's 2002 Emissions Inventories* (August 31, 2005).

The SMOKE/IDA-formatted file prepared by Pechan was considered to be the most accurate and current version of the 2002 Missouri area source inventory and therefore was used as the basis for the base year inventory summarized in this document. The file contains annual emissions for all area sources and ozone season day emissions for some categories. Because ozone season day emissions information was not complete, the SMOKE model was used to calculate typical ozone day emissions for all area sources in the St. Louis nonattainment area in order to apply consistent procedures to all sources. Appendix C describes how the typical ozone season day emissions were calculated.

C. Changes to Area Emissions Since Previous Base Year Inventory

VOC emissions from portable fuel containers (gas cans) were missing from the previous version of the base year inventory submitted to the EPA in June 2006. Emissions from this category were estimated based on a methodology from the California Air Resources Board and added to the inventory. Portable fuel container emissions were estimated based on the California Environmental Protection Agency/Air Resources Board - *Public Meeting to Consider Approval of California's Portable Gasoline Container Emissions Inventory*, September 1999 Method. The California CARB Method is described along with more recent revisions in **Estimating Emissions Associated with Portable Fuel Containers (PFCs)**, EPA, February 2006 (<http://www.epa.gov/otaq/regs/toxics/420d06003.pdf>). Residential PFC usage was based on 2000 Census figures of the number of occupied households. Commercial PFC usage was obtained from the total number of businesses per NAICS sector in each county. Gas-can emission processes were estimated as a function of the emissions process (permeation; diurnal, and

transport/ spillage), can material (plastic or metal), and the storage conditions, either open or closed.

The other significant change made to the area source inventory relates to aviation gasoline (AvGas) usage in St. Louis County. The original emissions estimates for aviation gasoline usage were from EPA's 2002 National Emissions Inventory. The department's Air Pollution Control Program evaluated EPA's methodology and identified a number of problems (US EPA, *Documentation for the Final 2002 Nonpoint Sector (Feb 2006 version) National Emission Inventory for Criteria and Hazardous Air Pollutants*, pp. A-8 – A-15, July 2006). The EPA had allocated aviation gasoline to individual counties by multiplying the total gallons consumed in Petroleum Administration District (PAD) 2 by the ratio of the number of landings and takeoffs in the county to the total number of landings and takeoffs in the entire PAD. The number of landings and takeoffs in EPA's database could not be verified based on information obtained from the Federal Aviation Administration website or from the airports themselves. In addition, the EPA treated the aviation gasoline storage tanks as bulk terminals. There are no bulk terminals storing aviation gasoline in the St. Louis nonattainment counties. EPA's method resulted in substantial overestimation of VOC emissions for this category, particularly for the Spirit of St. Louis Airport in Chesterfield, MO, where nearly 10% of the nation's total aviation gasoline emissions were allocated.

The program revised the aviation gasoline emissions in the base year inventory by applying a 90% reduction factor, which was a conservative assumption. To justify this assumption, the program recently obtained aviation gasoline data and tank characteristics for all airports contained in EPA's database in the St. Louis nonattainment area. These included the St. Clair (K39) and Sullivan (UUV) airports in Franklin County; Smart Field (SET) and St. Charles (3SQ) airports in St. Charles County; and Creve Coeur (1H0), Lambert (STL), and Spirit of St. Louis (SUS) airports in St. Louis County. Data were not collected from smaller airports in the St. Louis nonattainment counties with insignificant aviation gasoline consumption. Note that these smaller airports were also not accounted for in EPA's emissions estimates.

For aviation gasoline Stage I emissions, EPA's VOC emission factors for unloading/tank filling (1,081 mg/L AvGas) and tank truck filling-composite (1,235 mg/L AvGas) were multiplied by the aviation gasoline throughput data provided by the airports. For storage tank working and breathing losses, the TANKS 4.0.9d software was run using the following assumptions: 1) above-ground tanks less than or equal to 4,000 gallons are horizontal tanks; 2) above-ground tanks greater than 4,000 gallons are vertical fixed roof tanks; 3) below-ground tanks are horizontal tanks; 4) each tank is filled to half of its capacity; 5) an airport's annual throughput is allocated among tanks by multiplying the throughput by the ratio of an individual tank's capacity to the airport's total tank capacity; and 5) the RVP of aviation gasoline is 7.0 psi (AvGas is required by ASTM specifications to fall in the range of 5.5 to 7.5 psi). Fugitive valve and pump emissions were not included because the aviation gasoline storage tanks are not bulk terminals. The total Stage I VOC emissions calculated based on actual throughput and tank characteristics are 9.0 tons/day for St. Louis County and 11.9 tons/day for the St. Louis nonattainment area.

For aviation gasoline Stage II emissions, EPA's VOC emission factor (1.36 E-2 lb/gal AvGas) was multiplied by the annual throughput data. Total Stage II VOC emissions based on actual

throughput data are 4.7 tons/day for St. Louis County and 6.1 tons/day for the St. Louis nonattainment area.

The total VOC emissions for aviation gasoline based on the data provided by the airports are 13.6 tons/year for St. Louis County and 18.0 tons/year for the entire St. Louis nonattainment area, which are an order of magnitude lower than the estimates resulting from applying a 90% reduction factor to EPA’s values. In order to be conservative for the calculation of RFP, the estimates based on applying the 90% reduction factor to EPA’s values were used in the base year inventory rather than the estimates based on actual data. It is important to note that aviation gasoline emissions do not have a significant impact on total area source emissions in the nonattainment area.

Table 10 summarizes the two most significant changes made to the area source portion of the base year inventory.

Table 10. Summary of the Most Significant Changes Made to the Area Source Emissions

“Previous Inventory” refers to the June 2006 version of the base year inventory; “Current Inventory” is the inventory summarized in this document.

County/City	Source Category	Annual VOC Emissions			Summer Weekday VOC Emissions		
		Previous Inventory	Current Inventory	Difference	Previous Inventory	Current Inventory	Difference
		tons/year	tons/year	tons/year	tons/day	tons/day	tons/day
Franklin	Portable Fuel Containers	0.0	86.2	86.2	0.0	0.2	0.2
Jefferson	Portable Fuel Containers	0.0	161.7	161.7	0.0	0.4	0.4
St. Charles	Portable Fuel Containers	0.0	242.7	242.7	0.0	0.7	0.7
St. Louis	Portable Fuel Containers	0.0	905.0	905.0	0.0	2.5	2.5
	Aircraft Refueling (Stage I and Stage II)	2,722.9	272.3	-2,450.6	7.5	0.7	-6.8
City of St. Louis City	Portable Fuel Containers	0.0	320.5	320.5	0.0	0.9	0.9
Totals		2,722.9	1,988.3	-734.6	7.5	5.4	-2.1

Another minor change was an adjustment to the ozone season weekday emissions for all area source categories. The ozone season weekday emissions were revised to reflect a typical ozone season weekday rather than a specific weekday. For the previous base year inventory submission, the ozone season weekday emissions were based on SMOKE output reports for a Monday in June. Subsequent to the preparation of that inventory, it was discovered that the SMOKE model makes an adjustment for Monday emissions even though none of the day-of-week temporal profile weights vary from one weekday to the next. Although the specific mechanism could not be identified in time for this report, it appears that the adjustment is internal to the SMOKE model and is done after the day-of-week temporal profile weights are applied. For this version of the base year inventory, SMOKE output reports for a Wednesday in

June were used as the basis of the ozone season weekday emissions. The result is slightly higher ozone season weekday emissions in this inventory. All the area source emissions summary tables in this base year inventory submissions were revised to reflect this change, including the SCC-level summary in Table D-2. None of the information related to the calculation of ozone season weekday emissions in Appendix C changes as a result of this correction, however the portable fuel container SCCs were added to Table C-2.

The final change involved revisions to the area source documentation in Appendix D, *Missouri Statewide Estimates for the 2002 National Emissions Inventory (NEI): Area Sources*. The revisions included adding methodologies for traffic markings and coal combustion and fixing the table of contents and section numbering based on comments received from EPA.

VI. OFFROAD MOBILE SOURCE EMISSIONS

Offroad mobile sources are mobile and portable internal-combustion powered equipment not generally licensed or certified for highway use. Offroad engines are classified according to distinct nonroad equipment categories, ranging from small lawn and garden equipment to heavy-duty construction equipment, large aircraft, and diesel locomotives.

A. Emissions Summary

Tables 10, 11, and 12 summarize the total 2002 offroad mobile source VOC, NO_x, and CO emissions for the St. Louis nonattainment area by source category. The tables are sorted from highest to lowest ozone season day emissions. The source category groupings are based on EPA's SCC to Tier Category crosswalk available on the Clearinghouse for Inventories and Emissions Factors (CHIEF) website at <http://www.epa.gov/ttn/chief/codes/index.html>. Table E-2 in Appendix E presents the 2002 offroad mobile inventory at the more detailed SCC level.

Table 11. 2002 VOC Emissions from Offroad Mobile Sources by Source Category

Offroad Mobile Source Category	VOC	VOC	VOC
	tons/year	tons/day	lbs/day
Non-Road Gasoline - lawn & garden	7,145.3	24.1	48,280.9
Non-Road Gasoline - light commercial	1,344.7	5.7	11,341.6
Non-Road Gasoline - recreational marine vessels	1,874.4	5.1	10,270.6
Non-Road Gasoline - recreational	1,031.9	3.9	7,771.1
Other - liquified petroleum gas	589.8	1.6	3,253.8
Non-Road Diesel - construction	429.7	1.6	3,245.7
Non-Road Gasoline - construction	258.4	1.0	1,945.7
Aircraft	340.7	1.0	1,943.1
Non-Road Gasoline - industrial	143.3	0.5	1,067.2
Railroads	184.3	0.5	1,009.8
Non-Road Diesel - light commercial	114.6	0.5	969.3
Marine Vessels - diesel	171.7	0.5	940.7
Non-Road Diesel - industrial	101.5	0.3	675.6
Non-Road Diesel - farm	64.3	0.3	541.7
Non-Road Diesel - lawn & garden	42.0	0.1	257.6
Non-Road Gasoline - farm	13.3	0.1	109.9
Non-Road Diesel - airport service	13.3	0.1	100.4
Non-Road Gasoline - airport service	4.5	0.0	33.6
Non-Road Diesel - railway maintenance	3.8	0.0	20.9
Other - compressed natural gas	3.7	0.0	20.8
Non-Road Diesel - recreational marine vessels	3.3	0.0	17.9
Non-Road Diesel - recreational	1.7	0.0	12.8
Non-Road Gasoline - railway maintenance	1.3	0.0	7.0
Offroad Mobile VOC Totals in St. Louis Nonattainment Area	13,881.3	46.9	93,837.9

Table 12. 2002 NO_x Emissions from Offroad Mobile Sources by Source Category

Offroad Mobile Source Category	NO _x	NO _x	NO _x
	tons/year	tons/day	lbs/day
Non-Road Diesel - construction	3,829.5	14.5	28,927.0
Marine Vessels - diesel	4,363.5	12.0	23,909.8
Railroads	3,116.7	8.5	17,077.8
Other - liquified petroleum gas	2,298.8	6.3	12,680.9
Aircraft	1,630.2	4.7	9,307.4
Non-Road Diesel - industrial	932.0	3.1	6,176.8
Non-Road Diesel - light commercial	603.0	2.6	5,101.1
Non-Road Diesel - farm	562.0	2.4	4,739.0
Non-Road Gasoline - lawn & garden	674.1	2.3	4,583.9
Non-Road Gasoline - light commercial	298.8	1.3	2,520.3
Non-Road Diesel - lawn & garden	267.4	0.8	1,640.9
Other - compressed natural gas	228.2	0.7	1,300.6
Non-Road Diesel - airport service	157.9	0.6	1,192.9
Non-Road Gasoline - industrial	106.7	0.4	788.4
Non-Road Diesel - recreational marine vessels	85.9	0.2	470.7
Non-Road Gasoline - recreational marine vessels	70.9	0.2	388.5
Non-Road Gasoline - recreational	37.3	0.1	281.2
Non-Road Gasoline - construction	32.2	0.1	242.8
Non-Road Diesel - railway maintenance	19.8	0.1	108.6
Non-Road Gasoline - farm	5.2	0.0	41.5
Non-Road Diesel - recreational	4.7	0.0	35.6
Non-Road Gasoline - airport service	3.7	0.0	27.5
Non-Road Gasoline - railway maintenance	0.4	0.0	2.2
Offroad Mobile NO_x Totals in St. Louis Nonattainment Area	19,329.0	60.8	121,545.5

Table 13. 2002 CO Emissions from Offroad Mobile Sources by Source Category

Offroad Mobile Source Category	CO	CO	CO
	tons/year	tons/day	lbs/day
Non-Road Gasoline - lawn & garden	111,670.7	380.6	761,247.5
Non-Road Gasoline - light commercial	39,105.6	164.9	329,838.2
Other - liquified petroleum gas	9,156.9	25.2	50,451.6
Non-Road Gasoline - recreational	7,715.9	29.1	58,107.7
Non-Road Gasoline - recreational marine vessels	4,358.6	11.9	23,882.7
Non-Road Gasoline - construction	3,710.2	14.0	27,941.1
Non-Road Gasoline - industrial	3,668.7	13.7	27,343.5
Aircraft	3,046.8	8.7	17,334.4
Non-Road Diesel - construction	2,073.2	7.8	15,660.5
Other - compressed natural gas	939.5	2.7	5,350.3
Marine Vessels - diesel	600.8	1.6	3,291.8
Railroads	432.6	1.2	2,370.4
Non-Road Diesel - industrial	418.4	1.4	2,792.3
Non-Road Diesel - light commercial	404.8	1.7	3,424.4
Non-Road Gasoline - farm	336.3	1.4	2,784.5
Non-Road Diesel - farm	317.7	1.3	2,681.5
Non-Road Diesel - lawn & garden	151.3	0.5	928.8
Non-Road Gasoline - airport service	105.6	0.4	795.5
Non-Road Diesel - airport service	72.9	0.3	550.7
Non-Road Gasoline - railway maintenance	41.3	0.1	226.1
Non-Road Diesel - railway maintenance	17.8	0.0	97.3
Non-Road Diesel - recreational marine vessels	13.8	0.0	75.4
Non-Road Diesel - recreational	6.6	0.0	49.9
Offroad Mobile CO Totals in St. Louis Nonattainment Area	188,365.9	668.6	1,337,226.0

B. Overview of Offroad Mobile Source Inventory Development

The 2002 offroad mobile source inventory is a consolidation of the best available offroad mobile source emissions data. It includes emissions estimates prepared by the department's Air Pollution Control Program and CENRAP, with remaining gaps filled in with EPA NEI data. Table E-1 in Appendix E lists the source of the emissions estimates for each SCC in the base year offroad mobile inventory. The majority of the offroad mobile inventory was developed by Sonoma Technology under a contract with CENRAP. The methods and data used by Sonoma are described in the report *Emissions Inventory Development for Mobile Sources and Agricultural Dust Sources for the Central States* (October 28, 2004) in Appendix E. The department's Air Pollution Control Program revised Sonoma's emissions estimates for recreational boat SCCs by running the EPA's draft NONROAD2004 model using default model inputs. Information on the NONROAD model is at <http://www.epa.gov/otaq/nonrdmdl.htm>. Documentation of EPA's methods used in the development of the 2002 NEI may be found on EPA's CHIEF website at <http://www.epa.gov/ttn/chief/net/2002inventory.html>.

Pechan, under a contract with CENRAP, consolidated the offroad mobile source inventories from the various data sources, quality-assured the data, worked with the department's Air Pollution Control Program to make corrections where needed, and created SMOKE/IDA-formatted files. In particular, Pechan made corrections to the fuel oxygenate content used in the NONROAD model. Pechan's work is described in detail in the two documents included in Appendix B: *The Consolidation of Emissions Inventories* (April 28, 2005) and *Refinement of CENRAP's 2002 Emissions Inventories* (August 31, 2005).

The SMOKE/IDA-formatted file prepared by Pechan was considered to be the most accurate and current version of the 2002 Missouri offroad mobile source inventory and therefore was used as the basis for the base year inventory summarized in this document. The file contains annual emissions for all offroad mobile sources. The SMOKE model was used to calculate typical ozone day emissions. Appendix C describes the how the typical ozone season day emissions were calculated.

C. Changes to Offroad Mobile Emissions Since Previous Base Year Inventory

Compared to the original base year inventory submitted to the EPA in June 2006, the only change to the offroad mobile source emissions has been a revision to the ozone season weekday emissions; the annual offroad mobile source emissions have not changed. The ozone season weekday emissions were revised to reflect a typical ozone season weekday rather than a specific weekday. For the previous base year inventory submission, the ozone season weekday emissions were based on SMOKE output reports for a Monday in June. Subsequent to the preparation of that inventory, it was discovered that the SMOKE model makes an adjustment for Monday emissions even though none of the day-of-week temporal profile weights vary from one weekday to the next. Although the specific mechanism could not be identified in time for this report, it appears that the adjustment is internal to the SMOKE model and is done after the day-of-week temporal profile weights are applied. For this version of the base year inventory, SMOKE output reports for a Wednesday in June were used. The result is slightly higher ozone season weekday emissions in this inventory. All the offroad mobile source emissions summary tables in this base year inventory submissions were revised to reflect this change, including the SCC-level summary in Table E-2. None of the information related to the calculation of ozone season weekday emissions in Appendix C changes as a result of this correction.

VII. ONROAD MOBILE SOURCE EMISSIONS

A. Overview of Onroad Mobile Source Inventory Development

Onroad mobile sources include motor vehicles such as cars, vans, trucks, buses, and motorcycles that are used for transportation of passengers and goods on public roads and streets.

Onroad mobile emissions were calculated by multiplying an emission rate (units of mass/mile) by vehicle miles traveled. The emission rates were generated using the EPA's MOBILE6.2 model, referred to as MOBILE6 (<http://www.epa.gov/otaq/m6.htm>).

2002 VMT Data

The 2002 VMT data for the St. Louis nonattainment area were obtained from the East-West Gateway Coordinating Council (EWGCC) in October 2005. The VMT data are based on actual demographic data, trip studies, and annual average daily traffic (AADT). EWGCC utilizes modeling software to generate average weekday VMT, which includes the geographical coordinates of each roadway link along with the corresponding VMT count and average congested speed.

The EWGCC VMT roadway links were broken down into the 11 functional classifications listed in Table 13. For the purposes of this study, VMT associated with classifications 7, 10, and 11, representing transit, metro link, and centroid connectors, respectively, were removed. Per guidance from EWGCC, modeled VMT associated with these three roadway classifications are not included in onroad vehicle emissions estimates for air quality analyses.

Table 14. Roadway Functional Classifications Included in 2002 VMT Dataset

Functional Class Code	Description
1	Interstate Highway
2	Expressway
3	Principal Arterial
4	Minor Arterial
5	Major Collector
6	Minor Collector
7	Transit Only
8	Ramp
9	Local Road
10	Metro Link
11	Centroid Connector

In the original dataset, VMT was grouped into four travel periods: morning peak (6:00 - 8:59 a.m.), mid-day (9:00 a.m.-1:59 p.m.), afternoon peak (2:00 - 6:59 p.m.), and nighttime (7:00 p.m. - 5:59 a.m.). Total daily VMT was calculated by summing the VMT from the four travel periods. Table 15 summarizes the 2002 average weekday VMT by county and roadway type.

Table 15. 2002 Average Weekday VMT by County

County/City	Average Weekday VMT*	Percent of NAA Total VMT
Franklin	3,800,822	7.3%
Jefferson	4,912,146	9.4%
St. Charles	6,684,585	12.8%
St. Louis	28,506,418	54.8%
City of St. Louis	8,160,913	15.7%
St. Louis Nonattainment Area Total	52,064,884	100.0%

* VMT associated with centroid connectors, transit, and metro link classifications is not included.

Speed by VMT File

By default, MOBILE6 uses national fleet data for the distribution of VMT by average speed for freeways and arterial roadways. For the development of the St. Louis base year inventory, the default speed values were replaced with local speed information from the dataset received from EWGCC. This was done by creating speed by VMT (SVMT) file inputs for MOBILE6. The SVMT file includes arterial and freeway VMT distributions over fourteen average speed bins for each hour of the day. Two SVMT files were created—one representing the four most urban counties (Jefferson, St. Charles, St. Louis, and City of St. Louis) and a second one for the more rural Franklin County.

Table 16 lists the fourteen speed bins in MOBILE6. In order to utilize the local speed data, the VMT was grouped into freeway and arterial roadway types as follows: VMT for functional classifications 1, 2, and 8 were grouped into the freeway category, and classifications 3, 4, 5, 6, and 9 were grouped into arterial.

Table 16. Speed Bins Used in Mobile Modeling Runs

Speed Bin	From Speed (mph)	To Speed (mph)	Average Speed (mph)
1	0	2.5	2.5
2	2.5	7.5	5
3	7.5	12.5	10
4	12.5	17.5	15
5	17.5	22.5	20
6	22.5	27.5	25
7	27.5	32.5	30
8	32.5	37.5	35
9	37.5	42.5	40
10	42.5	47.5	45
11	47.5	52.5	50
12	52.5	57.5	55
13	57.5	62.5	60
14	62.5	and higher	65

Using Access relational database software, the arterial and freeway VMT was split into the fourteen speed bins for each of the four time periods. VMT was further broken down by hour of day by dividing the total VMT for a given speed bin and time period by the number of hours in the time period (e.g., morning peak VMT was divided by three to calculate VMT for the 6:00 a.m., 7:00 a.m., and 8:00 a.m. hours). Finally, VMT fractions for each hour and speed bin were calculated by dividing the VMT for a given hour and speed bin by the total VMT for the hour. The SVMT files created for the enhanced I/M area and Franklin County are included in Appendix F.

Specification of Local Control Programs

For the base year of 2002, there are two Inspection and Maintenance (I/M) programs in the St. Louis nonattainment area. The I/M 240 program (enhanced I/M) covers St. Louis City, St. Louis County, St. Charles County, and Jefferson County, and the BAR-90 program (basic I/M) covers

Franklin County only. Input files for both the enhanced and basic I/M program areas reflect the implementation of Stage-II vapor recovery for vehicle refueling and the reformulated gasoline program (specified as Fuel Program 2-South).

A total of 24 MOBILE6 input files were created to estimate the mobile emissions for the St. Louis nonattainment area – a set of 12 monthly inputs for both the enhanced I/M and Franklin County basic I/M program areas. The individual monthly inputs reflected average monthly temperature ranges for each area modeled. In each input file, a MOBILE “scenario” was written for the average speed of each of the 14 speed bins for both arterials and freeways. Appendix F contains the MOBILE6 input files, as well as the ancillary vehicle registration distribution (VRegStl.d) and enhanced I/M cutpoint (Cutpoint.x10) files.

Calculation of Onroad Mobile Emissions

The MOBILE6 runs produced emission factors by roadway type (freeway and arterial) and average speed for each month and I/M program area. The emission factors were composite factors reflecting the vehicle registration distribution contained in the VRegStl.d file. The composite emission factors were multiplied by total daily VMT by speed bin and roadway type for each I/M program area. The emissions were then summed across all speed bins, roadway types, and I/M program areas to generate total daily emissions for the St. Louis nonattainment area.

Typical summer weekday emissions were estimated based on July emission factors. In order to estimate the total yearly mobile emissions, the daily emissions value for each monthly evaluation was multiplied by the number of days in the month to generate a monthly total. The monthly totals were then summed to estimate annual emissions. The following example illustrates how the typical summer weekday emissions were calculated.

Example: Calculation of July weekday VOC emissions for the freeway road type in the St. Louis enhanced I/M area (no Franklin County)

- 1) Obtain VOC emission factors (g/mile) by average speed for the freeway road type from the July MOBILE6 run for the enhanced I/M area:

	2.5	5	10	15	20	25	30	35	40	45	50	55	60	65
	mph	mph	mph	mph	mph	mph	mph							
VOC emission factors in g/mile:	7.843	3.714	2.089	1.661	1.473	1.368	1.297	1.236	1.2	1.17	1.144	1.124	1.111	1.109

- 2) Obtain the freeway VMT by speed bin for the enhanced I/M area summed across all hours of the day:

Bin 1	Bin 2	Bin 3	Bin 4	Bin 5	Bin 6	Bin 7	Bin 8	Bin 9	Bin 10	Bin 11	Bin 12	Bin 13	Bin 14
5,118	125,705	86,126	63,896	118,944	200,736	458,033	441,473	866,379	2,053,571	4,841,112	9,949,450	6,230,318	1,998,639

- 3) Multiply the emission factors for each speed by the total VMT for the corresponding speed bin and convert to tons:

2.7 mph: $(7.843 \text{ g/mi}) \times (5,118 \text{ mi/day}) \times (0.0022046 \text{ lb/g}) \times (1 \text{ ton}/2,000 \text{ lb}) = 0.044 \text{ tpd}$
5 mph: $(3.714 \text{ g/mi}) \times (125,705 \text{ mi/day}) \times (0.0022046 \text{ lb/g}) \times (1 \text{ ton}/2,000 \text{ lb}) = 0.515 \text{ tpd}$
10 mph: $(2.089 \text{ g/mi}) \times (86,126 \text{ mi/day}) \times (0.0022046 \text{ lb/g}) \times (1 \text{ ton}/2,000 \text{ lb}) = 0.198 \text{ tpd}$
15 mph: $(1.661 \text{ g/mi}) \times (63,896 \text{ mi/day}) \times (0.0022046 \text{ lb/g}) \times (1 \text{ ton}/2,000 \text{ lb}) = 0.117 \text{ tpd}$
20 mph: $(1.473 \text{ g/mi}) \times (118,944 \text{ mi/day}) \times (0.0022046 \text{ lb/g}) \times (1 \text{ ton}/2,000 \text{ lb}) = 0.193 \text{ tpd}$
25 mph: $(1.368 \text{ g/mi}) \times (200,736 \text{ mi/day}) \times (0.0022046 \text{ lb/g}) \times (1 \text{ ton}/2,000 \text{ lb}) = 0.303 \text{ tpd}$
30 mph: $(1.297 \text{ g/mi}) \times (458,033 \text{ mi/day}) \times (0.0022046 \text{ lb/g}) \times (1 \text{ ton}/2,000 \text{ lb}) = 0.655 \text{ tpd}$
35 mph: $(1.236 \text{ g/mi}) \times (441,473 \text{ mi/day}) \times (0.0022046 \text{ lb/g}) \times (1 \text{ ton}/2,000 \text{ lb}) = 0.601 \text{ tpd}$
40 mph: $(1.2 \text{ g/mi}) \times (866,379 \text{ mi/day}) \times (0.0022046 \text{ lb/g}) \times (1 \text{ ton}/2,000 \text{ lb}) = 1.146 \text{ tpd}$
45 mph: $(1.17 \text{ g/mi}) \times (2,053,571 \text{ mi/day}) \times (0.0022046 \text{ lb/g}) \times (1 \text{ ton}/2,000 \text{ lb}) = 2.648 \text{ tpd}$
50 mph: $(1.144 \text{ g/mi}) \times (4,841,112 \text{ mi/day}) \times (0.0022046 \text{ lb/g}) \times (1 \text{ ton}/2,000 \text{ lb}) = 6.105 \text{ tpd}$
55 mph: $(1.124 \text{ g/mi}) \times (9,949,450 \text{ mi/day}) \times (0.0022046 \text{ lb/g}) \times (1 \text{ ton}/2,000 \text{ lb}) = 12.327 \text{ tpd}$
60 mph: $(1.111 \text{ g/mi}) \times (6,230,318 \text{ mi/day}) \times (0.0022046 \text{ lb/g}) \times (1 \text{ ton}/2,000 \text{ lb}) = 7.630 \text{ tpd}$
65 mph: $(1.109 \text{ g/mi}) \times (1,998,639 \text{ mi/day}) \times (0.0022046 \text{ lb/g}) \times (1 \text{ ton}/2,000 \text{ lb}) = 2.443 \text{ tpd}$

- 4) Sum emissions for all speeds:

$0.044 + 0.515 + 0.198 + 0.117 + 0.193 + 0.303 + 0.655 + 0.601 + 1.146 + 2.648 + 6.105 + 12.327 + 7.630 + 2.443 = 34.926 \text{ tpd VOC}$ (total freeway VOC emissions for the enhanced I/M area)

Steps 1 through 4 were repeated for each pollutant, roadway type, and I/M program area. Total nonattainment area emissions were calculated by summing the emissions from each roadway type and I/M program area. Emissions were apportioned to each county in the St. Louis nonattainment area by multiplying the total emissions by the percentage of VMT in the county. Appendix F includes tables presenting the VOC, NO_x, and CO emission factors for a typical summer weekday; VMT by speed bin, road type, and I/M program area; and typical summer weekday emissions in tons/day.

B. Changes to Onroad Mobile Emissions Since Previous Base Year Inventory

Several minor corrections were made to the VMT and MOBILE6 inputs for the typical summer weekday onroad mobile emissions in this version of the base year inventory. For the previous version of the inventory submitted to the EPA in June 2006, during the step of disaggregating VMT into the fourteen speed bins for the enhanced I/M counties, some of the VMT in speed bin 14 (speeds greater than 62.5 mph) was double-counted for both freeway and arterial roadway types. This error resulted in an overestimate of weekday VMT by a total of approximately 52,000 in the enhanced I/M counties. In addition, VMT for Franklin County was underestimated by around 600. Changes made to the MOBILE6 input files in this version of the base year inventory include the following:

- The specification of the hours in the SVMT files was corrected. Hour 1 should be 6:00 a.m., but hour 1 was inadvertently set to midnight in the SVMT file used in the previous inventory.
- A separate SVMT file was created for Franklin County. In the previous inventory, the SVMT file for the enhanced I/M area was used for Franklin County as well.

These revisions resulted in slight changes to the onroad mobile emissions for a typical summer weekday, as summarized in Table 18.

Table 17. Summary of Changes to Typical Summer Weekday Onroad Mobile Emissions

“Previous Inventory” refers to the June 2006 version of the base year inventory; “Current Inventory” is the inventory summarized in this document. Basic I/M area is Franklin County, and Enhanced I/M area includes Jefferson, St. Charles, and St. Louis Counties and City of St. Louis.

County/City	Summer Weekday VOC Emissions (tons/day)			Summer Weekday NOx Emissions (tons/day)			Summer Weekday CO Emissions (tons/day)		
	Previous Inventory	Current Inventory	Difference	Previous Inventory	Current Inventory	Difference	Previous Inventory	Current Inventory	Difference
Basic I/M Area	4.8	4.8	0.0	12.9	13.0	-0.2	69.8	70.0	-0.1
Enhanced I/M Area	63.3	63.3	0.0	146.2	146.0	0.2	793.7	792.7	1.0
Totals	68.2	68.1	0.0	159.0	159.0	0.0	863.5	862.6	0.8

VIII. BIOGENIC EMISSIONS

Biogenic sources are biological sources of ozone precursor emissions such as trees, agricultural crops, or microbial activity in soils or water. The EPA’s *Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations* (August 2005) encourages the use of biogenic estimates from the NEI as the basis for SIP planning inventories. The county-level biogenic emissions estimates summarized in the St. Louis base year inventory were obtained from the 2002 preliminary NEI inventory from EPA’s ftp site: <ftp://ftp.epa.gov/EmisInventory/prelim2002nei/biogenic>.

EPA prepared the biogenic emissions using the BEIS3.12 model via the SMOKE modeling system. The BEIS3.12 inputs were based on 2001 annual meteorology and BELD3 landuse data (1 km original data aggregated to the 36 km grid). The county-total emissions from SMOKE were estimated based on the “land area” spatial surrogate.

The biogenic emissions data by county and month of year were extracted from the EPA’s biogenic dataset. The monthly emissions are summarized by county in Table 19. Annual emissions were calculated by totaling the monthly emissions for each county. Average ozone season day emissions were calculated by summing emissions for the months of June, July, and August for each county and dividing the county’s ozone season total by 92 days.

Table 18. 2002 Biogenic Emissions by Month and County

Month	VOC tons	NOx tons	CO tons
FRANKLIN COUNTY			
January	21.7	4.7	6.7
February	31.3	6.2	9.4
March	80.4	8.6	16.9
April	1,582.8	36.8	134.0
May	2,277.5	35.8	174.5
June	3,298.2	27.2	224.4
July	4,466.9	30.9	301.0
August	4,287.3	24.5	292.7
September	2,098.4	17.9	181.6
October	805.7	13.7	98.5
November	81.2	11.7	22.9
December	44.7	8.4	13.6
Franklin Co. Annual Totals	19,076.3	226.4	1,476.2
JEFFERSON COUNTY			
January	20.3	3.1	6.1
February	29.9	4.2	8.7
March	69.2	5.7	14.8
April	1,289.1	18.8	111.1
May	1,829.2	20.8	142.9
June	2,664.7	16.5	185.6
July	3,504.0	18.9	241.9
August	3,343.3	16.1	236.2
September	1,678.4	11.7	148.5
October	688.2	8.9	82.8
November	84.7	7.6	21.7
December	40.4	5.5	11.9
Jefferson Co. Annual Totals	15,241.3	137.7	1,212.2
ST. CHARLES COUNTY			
January	9.3	4.0	2.8
February	13.4	5.5	3.9
March	39.9	7.6	8.2
April	813.3	32.4	79.2
May	1,143.9	34.8	101.9
June	1,673.4	23.3	132.9
July	2,292.5	28.8	179.5
August	2,170.9	22.9	173.8
September	1,109.4	16.3	108.4
October	433.7	12.3	60.2
November	136.4	10.5	25.2
December	32.0	7.4	8.0
St Charles Co. Annual Totals	9,868.1	205.8	884.0
ST. LOUIS COUNTY			
January	8.6	4.0	2.7
February	12.9	5.6	3.9

Month	VOC tons	NOx tons	CO tons
March	36.4	7.7	7.7
April	726.2	28.0	71.7
May	1,006.3	30.4	91.3
June	1,500.9	21.6	120.6
July	2,036.8	26.1	161.0
August	1,903.6	22.4	155.5
September	953.3	16.4	96.7
October	410.3	12.3	56.8
November	217.5	10.5	36.7
December	48.8	7.5	11.0
St Louis Co. Annual Totals	8,861.7	192.5	815.6
CITY OF ST. LOUIS			
January	2.5	2.4	0.9
February	3.8	3.4	1.3
March	14.0	4.6	3.1
April	317.6	19.8	38.1
May	431.3	20.0	48.3
June	655.4	14.9	64.6
July	875.8	16.8	85.3
August	821.6	13.9	82.7
September	419.7	10.0	51.6
October	187.9	7.4	30.6
November	96.3	6.3	17.4
December	5.1	4.5	1.7
City of St. Louis Annual Totals	3,831.1	124.0	425.6