



Missouri
Department of
Natural Resources

St. Louis 8-Hour Ozone Reasonable Further Progress Demonstration

**Proposed for Public Hearing
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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 designated as a moderate nonattainment area for the 8-hour ozone national ambient air quality standard (NAAQS). Per 40 CFR 51.910(a)(1)(ii), areas have met Reasonable Further Progress (RFP) obligations under subpart 2 of the Clean Air Act Amendments (CAAA) if they have the same boundaries as an area for which EPA approved a 15% Rate of Progress (ROP) plan for the 1-hour ozone standard. For the 8-hour ozone standard, such areas are required to submit a RFP plan under the general nonattainment provisions in section 172(c)(2) of the CAA (subpart 1).

The Missouri side of the St. Louis 8-hour ozone nonattainment area encompasses the City of St. Louis and Franklin, Jefferson, St. Charles, and St. Louis Counties, an area that is geographically identical to the previous 1-hour ozone nonattainment area. The U.S. Environmental Protection Agency (EPA) approved the St. Louis 15% rate of progress plan for the 1-hour ozone standard in February 2000 (65 FR 8083). Therefore, the subpart 2 requirements for RFP have been met for St. Louis, and the general RFP requirements in subpart 1 apply for the 8-hour ozone standard.

For nonattainment areas such as St. Louis with 8-hour ozone attainment dates beyond 5 years after designation, the RFP plan must provide for a 15% reduction in emissions of volatile organic compounds (VOC) and/or oxides of nitrogen (NO_x) from the baseline year within 6 years after the baseline. The baseline year for St. Louis is calendar year 2002, which establishes the RFP target year as 2008. The 2008 projected emissions inventory is intended to account for emissions growth and any local, state, or federal controls implemented between 2002 and 2008.

The purpose of this document is to demonstrate that VOC and NO_x emissions in the Missouri portion of the St. Louis 8-hour ozone nonattainment area will decrease more than 15% from the 2002 base year through 2008. According to the EPA's NO_x Substitution Guidance (December, 1993), NO_x emission reductions may be substituted for VOC reductions on a percentage basis (i.e., 1% NO_x reduction = 1% VOC reduction), provided that the control strategies assumed in the RFP demonstration are consistent with the reductions required to demonstrate attainment of the ozone standard. As discussed in detail in Section IV of this document, the 2008 inventory developed for RFP is as consistent as possible with the 2009 inventory that supports the St. Louis 8-hour ozone attainment demonstration.

Over the time period from 2002 through 2008, VOC and NO_x emissions are projected to decrease 10.6% and 17.5%, respectively, in the St. Louis nonattainment area. The total percentage reduction of 28.1% exceeds the minimum 15% RFP requirement in the St. Louis nonattainment area. These emission reductions are primarily the result of the following mix of state and federal control measures that are being implemented or phased-in between the 2002 base year and 2008:

- the Missouri NO_x State Implementation Plan (SIP) Call rule for industrial boilers,
- various federal Maximum Achievable Control Technology (MACT) standards,
- the federal Tier 2 rule, including light-duty motor vehicle engine standards and low-sulfur gasoline,
- the federal heavy-duty diesel engine standards and low-sulfur diesel, and

- the federal Tier 4 rule, including offroad mobile engine standards that cover most construction, agricultural, and industrial offroad equipment.

Section II of this document summarizes the 2002 base year emissions inventory for RFP purposes. (For the full base year inventory and documentation of its development, see the “2002 Base Year Emissions Inventory for the Missouri Portion of the St. Louis 8-Hour Ozone Nonattainment Area.”) Section III adjusts the base year inventory by removing the non-creditable emissions reductions and accounting for a discrepancy in NONROAD model output. Section IV summarizes the 2008 RFP inventory and describes its preparation, which is as consistent as possible with the development of the 2009 inventory for the St. Louis 8-hour ozone attainment demonstration. Finally, Section V shows the RFP calculation demonstrating that the minimum 15% VOC and NO_x emissions reduction requirement is met for the St. Louis ozone nonattainment counties between 2002 and 2008. Note that for the purpose of this document, “St. Louis nonattainment area” refers to the Missouri portion of the St. Louis ozone nonattainment area only.

II. 2002 BASE YEAR EMISSIONS INVENTORY

Table 1 summarizes the 2002 base year VOC and NO_x emissions for a typical summer weekday in the St. Louis nonattainment counties by source type—electric generating unit (EGU) and non-EGU point sources, area sources, offroad mobile sources, and onroad mobile sources. For RFP purposes, the base year inventory includes anthropogenic VOC and NO_x emissions for a typical summer day only; annual emissions, carbon monoxide (CO) emissions, and biogenic emissions are omitted. For details on the development of the base year inventory and additional emissions summaries, including annual emissions, CO emissions, and biogenic emissions, see the full base year inventory document.

Table 1. 2002 Base Year Emissions Inventory –VOC and NOx Emissions for a Typical Summer Weekday in the St. Louis Nonattainment Counties by Source Type

Source Type	VOC tons/day	NOx tons/day
POINT SOURCES		
Non-EGU	30.8	24.4
EGU	1.9	102.8
Point Source Subtotals	32.7	127.2
AREA SOURCES	71.4	19.4
OFFROAD MOBILE SOURCES		
NONROAD model	45.0	35.6
Commercial marine vessels, locomotives, aircraft	1.9	25.1
Offroad Mobile Source Subtotals	46.9	60.8
ONROAD MOBILE SOURCES	68.1	159.0
Total St. Louis Nonattainment Area Base Year Inventory	219.1	366.3

III. 2002 ADJUSTED BASE YEAR EMISSIONS INVENTORY

A. Base Year Inventory Adjustments

A.1 Adjustment for Non-Creditable Emission Reductions

Emission reductions associated with the federal motor vehicle program implemented prior to the 1990 CAAA are not creditable toward reasonable further progress. The non-creditable reductions for St. Louis 8-hour ozone were calculated by following the procedures outlined in the final Phase II ozone implementation rule preamble, Appendix A – Methods to Account for Non-Creditable Reductions When Calculating ROP Targets for the 2008 and Later ROP Milestone Years.

The EPA’s MOBILE6.2 model was run for July for both 2002 and 2008 with the same vehicle miles traveled (VMT) and temperature inputs as used in the 2002 base year inventory but with all post-1990 CAAA measures turned off. The vehicle inspection and maintenance (I/M) specification was set to the basic I/M program and gasoline Reid vapor pressure (RVP) was set

to 9.0 pounds per square inch (psi), which reflect the programs that were in place in St. Louis in 1990. Although the program and temperature specifications were identical, separate sets of inputs were created for Franklin County and the rest of the nonattainment area (Jefferson, St. Charles, and St. Louis Counties and City of St. Louis) in order to utilize the separate speed by VMT (SVMT) inputs for Franklin versus the rest of the nonattainment area and to be consistent with the way the 2002 VMT was prepared for the base year inventory. See Section VII of the base year inventory document for more information on the preparation of the SVMT inputs and 2002 VMT.

The MOBILE6 runs produced emission factors by pollutant (VOC and NOx), roadway type (freeway and arterial), and average speed (2.5 mph and 10 - 65 mph in 5 mph increments). Equation 1 was used to calculate the non-creditable emission reduction adjustment, which is the difference between the 2002 and 2008 emission factors multiplied by 2002 VMT. The example below illustrates the application of Equation 1 for VOC emissions for 35 mph in the portion of the nonattainment area covering Jefferson, St. Charles, St. Louis County, and City of St. Louis.

$$ADJFACT = (EMFAC_{2002'} - EMFAC_{2008'}) \times VMT_{2002} \quad [1]$$

Where:

ADJFACT = Post-1990 CAA control adjustment factor representing non-creditable emission reductions between 2002 and 2008

EMFAC_{2002'} = 2002 July emission factor without post-1990 CAA controls for a given speed and road type

EMFAC_{2008'} = 2008 July emission factor without post-1990 CAA controls for a given speed and road type

VMT₂₀₀₂ = 2002 VMT for a given speed and road type

Example illustrating the application of Equation 1: Calculation of non-creditable VOC emissions for arterials for 35 mph (Jefferson, St. Charles, St. Louis County, City of St. Louis)

2002 VOC emission factor for arterials for 35 mph with post-1990 CAA controls turned off: 1.766 g/mile

2008 VOC emission factor for arterials for 35 mph with post-1990 CAA controls turned off: 1.557 g/mile

2002 VMT for arterials and speed bin 8 (avg. speed 35 mph): 6,542,059 mile/day

$$(1.766 \text{ g/mi} - 1.557 \text{ g/mi}) \times 6,542,059 \text{ mi/day} \times (0.0022046 \text{ lb/g}) \times (1 \text{ ton}/2,000 \text{ lb}) = 1.507 \text{ tons/day}$$

This calculation procedure was applied to each pollutant, speed, road type, and nonattainment area zone (Franklin County and the rest of the nonattainment counties). The results for each pollutant were then summed across all speeds, road types, and nonattainment area counties. This represents the VOC and NOx reductions that will occur between 2002 and 2008 without the benefits of the post-1990 CAAA measures, i.e., the non-creditable reductions occurring over this time period. For the St. Louis nonattainment counties, the non-creditable VOC and NOx emission reductions from 2002 through 2008 total 11.3 tons/day and 20.0 tons/day, respectively. For RFP purposes, these non-creditable reductions were subtracted from the base year inventory.

Appendix B includes the MOBILE6 input files used to calculate the non-creditable emission reductions. The emission factors, VMT, and resulting post-1990 CAAA control adjustment factors by speed and road type are summarized in Tables B-1, B-2, and B-3, respectively.

A.2 Adjustment for Discrepancies in NONROAD Model Output

As discussed in the base year inventory document, the offroad mobile source emissions in the base year inventory were obtained from CENRAP based on work products from Pechan and Sonoma Technology. The Missouri Department of Natural Resources' Air Pollution Control Program obtained the NONROAD input files that Sonoma Technology created for CENRAP and ran the draft NONROAD2004 version of the model in multiple configurations following the methodologies described in documentation from both Sonoma Technology and Pechan. However, the results from CENRAP could not be duplicated. The department's model run results for the St. Louis nonattainment counties in 2002 were 45.7 tons/day VOC and 35.6 tons/day NOx, which are 0.7 tons/day VOC and 1.7 tons/day NOx higher than the base year inventory NONROAD emissions. For RFP purposes, these differences were added to the base year inventory.

B. Summary of Adjusted 2002 Base Year Emissions Inventory

Table 2 summarizes the adjustments made to the base year inventory for RFP purposes. As described in Section III.A., the base year emissions inventory was adjusted by removing the emission reductions attributable to pre-1990 federal motor vehicle program controls and accounting for a discrepancy in NONROAD model output.

Table 2. Adjusted Base Year Emissions Inventory for RFP – VOC and NOx Emissions for a Typical Summer Weekday by Source Type

Source Type	VOC tons/day	NOx tons/day
POINT SOURCES		
Non-EGU	30.8	24.4
EGU	1.9	102.8
Point Source Subtotals (No changes from base year inventory)	32.7	127.2
AREA SOURCES (No changes from base year inventory)	71.4	19.4
OFFROAD MOBILE SOURCES		
NONROAD model	45.0	35.6
Commercial marine vessels, locomotives, aircraft	1.9	25.1
NONROAD model discrepancy (Add to base year inventory)	0.7	1.7
Adjusted Offroad Mobile Source Subtotals	47.6	62.4
ONROAD MOBILE SOURCES	68.2	159.0
Non-creditable reductions from pre-1990 federal motor vehicle control program (Subtract from base year inventory)	-11.3	-20.0
Adjusted Onroad Mobile Source Subtotals	56.8	139.0
Adjusted Total St. Louis Nonattainment Area Base Year RFP Inventory	208.5	348.0

IV. 2008 REASONABLE FURTHER PROGRESS EMISSIONS INVENTORY

A. Data and Assumptions Used in Preparing 2008 RFP Inventory

A.1 Non-EGU Point Sources

Economic growth factors were generated by county and Source Classification Code (SCC) using the EPA's EGAS 5.0 software (<http://www.epa.gov/ttn/ecas/egas5.htm>). EGAS was run with a base year of 2002 and future year of 2008 using the REMI 5.5 SCC configuration, consistent with the way it was run by Alpine Geophysics for the 2009 ozone attainment demonstration modeling.

The control assumptions used to develop the 2008 non-EGU point source inventory reflect the implementation of federal Maximum Achievable Control Technology (MACT) rules and the Missouri NO_x SIP Call rule for non-EGU boilers. The Missouri NO_x SIP Call for cement kilns was not applied because NO_x reductions as a result of this rule are not expected from the affected kilns subsequent to the 2002 base year.

The same control factors used in the 2009 modeled attainment demonstration were applied in the 2008 RFP inventory. The factors, consisting of control efficiencies and rule effectiveness values, were compiled by Alpine Geophysics based on the control assumptions used in EPA's Clean Air Interstate Rule (CAIR) modeling, CENRAP modeling, and other sources. The technical memorandum in Appendix A provides documentation on the control factors provided by Alpine Geophysics.

The 2002 non-EGU emissions were projected to 2008 using Equation 2.

$$EMISS_{2008} = EMISS_{2002} \times GF \times (1 - (CE \times RE/10,000)) \quad [2]$$

Where:

$EMISS_{2008}$ = 2008 projected VOC or NO_x emissions in tons/day

$EMISS_{2002}$ = 2002 base year VOC or NO_x emissions in tons/day

GF = Growth factor representing emissions growth between 2002 and 2008

CE = VOC or NO_x control efficiency (%); CE = zero where no control is applicable

RE = Rule effectiveness (%); RE = 0 where no control is applicable

For facilities that shut down after the 2002 base year, emissions were "zeroed out" by applying control efficiency and rule effectiveness factors of 100 for both NO_x and VOC.

In addition to the application of linear growth and control factors, the following adjustments were made:

- The 2008 NO_x emissions for non-EGU boilers affected by the NO_x SIP Call were based on the NO_x budgets specified in the Missouri rule, 10 CSR 10-6.360, Control of NO_x Emissions from Electric Generating Units and Non-Electric Generating Boilers. The affected boilers are Anheuser-Busch (510 0003) unit 6 and Trigen (510 0038) unit 5 and 6.
- The 2008 emissions for Chrysler-Fenton (189 0002), Chrysler-South (189 0231), and Anheuser-Busch (510 0003) (except unit 6) were set to the levels used in the 2009 inventory for the attainment demonstration modeling. These levels reflect feedback from these facilities based on recent Emissions Inventory Questionnaires (EIQs) and internal growth information. The letter that was sent to facilities to solicit their input on the draft 2009 attainment demonstration inventory and the response letter from Anheuser-Busch are included in Appendix C. The future-year emissions for the two Chrysler facilities are based on telephone conversations with Terry Tecklenberg, Daimler-Chrysler Paint Operations Specialist, in April 2006 and a review of the 2004 and 2005 EIQs for these facilities.
- Emissions for JW Aluminum (510 0118, formerly Alumax) were held constant at 2002 levels. Subsequent to the 2002 base year, JW Aluminum switched to a solvent with a lower VOC content and requested to bank the resulting VOC emission reductions in accordance with Missouri's emissions banking and trading rule, 10 CSR 10-6.410, Emissions Banking and Trading. In 2002, VOC emissions for this facility were 6.1 tons/day. The total VOC emissions for this facility after the implementation of the new solvent are estimated to be 1.6 tons/day (the new permit limit of 600 tons/year divided by 365 days). The VOC emission reduction credits on a daily basis are approximately 4.5 tons/day (approved credits of 1,655 tons/year divided by 365 days), which is equal to the difference between 6.1 tons/day and 1.6 tons/day. The credits were reflected in the 2008 RFP inventory by setting the 2008 VOC emissions for this facility equal to the 2002 levels of 6.1 tons/day. See the emission reduction credit approval letter in Appendix C.
- The Ford-Hazelwood facility (189 0015) was held at constant 2002 emissions levels. Based on a review of emissions reported on EIQs from 2002 through 2005, VOC emissions for this facility have decreased annually as follows: 2002 – 929.8 tons/year, 2003 – 974.3 tons/year, 2004 – 791.3 tons/year, and 2005 – 309.9 tons/year. In addition, a letter was received from Ron Brasher, Site Manager, stating that the St. Louis Assembly Plant is no longer in production mode, with no production scheduled for the foreseeable future. The department's Air Pollution Control Program believes that the trend of decreasing emissions, along with the "idle mode" status are sufficient justification to hold emissions for this facility constant rather than applying growth through 2008. The letter from Ron Brasher is included in Appendix C.

Table 3 is a summary of the growth and control assumptions used to develop the 2008 non-EGU point source inventory. The 2008 emissions values shown in Table 3 reflect growth and control adjustments, where applicable. Appendix C provides greater detail on the growth and control assumptions for non-EGU point sources, including the growth factors, control efficiency and rule effectiveness values, and the specific MACT rules that were applied at the process level for each non-EGU point source in the St. Louis nonattainment area.

Table 3. Summary of Non-EGU Assumptions Used in Preparing 2008 RFP Inventory

Assumption	2002 VOC tons/day	2008 VOC tons/day	2002 NOx tons/day	2008 NOx tons/day
GROWTH ONLY (NO CONTROL)	11.3	13.1	19.0	23.1
EMISSIONS HELD CONSTANT				
Ford – Hazelwood (189 0015)	3.5	3.5	0.1	0.1
JW Aluminum (510 0118)	6.1	6.1	0.1	0.1
<i>Subtotals</i>	<i>9.6</i>	<i>9.6</i>	<i>0.2</i>	<i>0.2</i>
2008 EMISSIONS BASED ON FACILITY FEEDBACK				
Chrysler – Fenton (189 0002)	1.4	1.5	0.1	0.1
Chrysler – North (189 0231)	2.4	2.5	0.3	0.3
Anheuser Busch – except boiler 6 (510 0003)	0.7	0.7	2.4	2.1
<i>Subtotals</i>	<i>4.6</i>	<i>4.7</i>	<i>2.8</i>	<i>2.5</i>
NOX SIP CALL FOR NON-EGU BOILERS - BUDGETS FROM MO RULE				
Anheuser Busch boiler 6 (510 0003)	0.0	0.0	0.0	0.1
Trigen boiler 5/6	0.0	0.0	0.0	0.2
<i>Subtotals</i>	<i>0.0</i>	<i>0.0</i>	<i>0.0</i>	<i>0.3</i>
SHUTDOWNS	0.5	0.0	0.1	0.0
MACT CONTROLS	4.9	2.5	2.3	2.4
NON-EGU POINT SOURCE TOTALS	30.8	29.9	24.4	28.4

A.2 EGU Point Sources

The 2008 EGU emissions were based on the 2009 ozone season Clean Air Interstate Rule (CAIR) budgets from the Missouri rule, 10 CSR 10-6.364 Clean Air Interstate Rule Seasonal NOx Trading Program. After evaluating the NOx SIP Call budgets that will be in place in 2008, the department's Air Pollution Control Program chose to apply the CAIR budgets instead for RFP purposes because they are more conservative for the EGUs located in the St. Louis nonattainment area. Table 4 compares the NOx SIP Call budgets and the CAIR budgets for the units in the St. Louis nonattainment area. It should be noted that the 2009 ozone attainment demonstration modeling relies on output from the Integrated Planning Model (IPM), which is more conservative than both the NOx SIP Call budgets and the CAIR budgets for the St. Louis nonattainment area counties.

For the 2008 RFP inventory, the NOx emissions for affected EGUs were set equal to the summer day NOx emissions estimated from the 2009 seasonal CAIR budgets. The seasonal CAIR budgets apply from May through September. Typical ozone season weekday NOx emissions for 2008 for each affected unit in the St. Louis nonattainment area were estimated by dividing the ozone season budgets by 153, the number of days from May through September. Table 4 shows the ozone season season day emissions that were calculated by dividing the CAIR budget by 153 days. The 2008 NOx emissions for non-EGU point sources was set to the total of 76.1 tons/day NOx.

Table 4. 2008 NOx SIP Call and 2009 CAIR Budgets for EGUs Located in the St. Louis Nonattainment Area Counties

Unit	2008 NOx SIP Call Budget tons/ozone season	2009 NOx CAIR Budget tons/ozone season	2009 NOx CAIR Budget/153 days tons/day
Ameren – Labadie 1	1,449	1,220	8.0
Ameren – Labadie 2	1,339	1,292	8.4
Ameren – Labadie 3	1,146	1,384	9.0
Ameren – Labadie 4	1,263	1,283	8.4
Ameren – Meramec 1	152	333	2.2
Ameren – Meramec 2	280	305	2.0
Ameren – Meramec 3	88	529	3.5
Ameren – Meramec 4	114	770	5.0
Ameren – Meramec 5	5	3	0.0
Ameren – Rush Island 1	1,405	1,346	8.8
Ameren – Rush Island 2	1,395	1,221	8.0
Ameren – Sioux 1	809	980	6.4
Ameren – Sioux 2	726	982	6.4
Ameren – Howard Bend	3	1	0.0
St. Louis Nonattainment Area Total EGU NOx Emissions	10,174	11,649	76.1

The 2008 VOC emissions for EGU point sources were calculated using Equation 3. The growth factors were generated at the county and SCC level with EGAS 5.0, which was run using the REMI 5.5 SCC configuration, consistent with the 2009 ozone attainment demonstration modeling.

$$EMISS_{2008} = EMISS_{2002} \times GF \quad [3]$$

Where:

EMISS₂₀₀₈ = 2008 projected VOC or NOx emissions in tons/day

EMISS₂₀₀₂ = 2002 base year VOC or NOx emissions in tons/day

GF = Growth factor representing emissions growth between 2002 and 2008

Because the EGU sector is such a small contributor to overall VOC emissions in the St. Louis area, the emissions were grown without applying control factors. The total 2008 VOC emissions from EGU point sources in the St. Louis nonattainment area is estimated to be 2.2 tons/day. Appendix D shows the growth factors that were applied to the VOC emissions at the process level for each of the non-EGU point sources in the St. Louis nonattainment area.

A.3 Area Sources

The EGAS 5.0 tool was used to generate economic growth factors by county and SCC. EGAS 5.0 was run with a base year of 2002 and future year of 2008 using the REMI 5.5 SCC configuration, consistent with the way it was run by Alpine Geophysics for the 2009 ozone attainment demonstration modeling.

The control assumptions used to develop the 2008 area source inventory reflect the implementation of federal Maximum Achievable Control Technology (MACT) rules, onboard vapor recovery, and the New Source Performance Standard (NSPS) for residential wood combustion. The same control factors used in the 2009 modeled attainment demonstration were applied in the 2008 RFP inventory. The factors, consisting of control efficiencies and rule effectiveness and rule penetration values, were compiled by Alpine Geophysics based on the control assumptions used in EPA's CAIR modeling, CENRAP modeling, and other sources. The technical memorandum in Appendix A provides documentation on the control factors provided by Alpine Geophysics.

The 2002 area emissions were projected to 2008 using Equation 4.

$$EMISS_{2008} = EMISS_{2002} \times GF \times (1 - (CE \times RE \times RP/1,000,000)) \quad [4]$$

Where:

$EMISS_{2008}$ = 2008 projected VOC or NO_x emissions in tons/day

$EMISS_{2002}$ = 2002 base year VOC or NO_x emissions in tons/day

GF = Growth factor representing emissions growth between 2002 and 2008

CE = VOC or NO_x control efficiency (%); CE = zero where no control is applicable

RE = Rule effectiveness (%); RE = 0 where no control is applicable

RP = Rule penetration (%); RP = 0 where no control is applicable

A summary of assumptions and controls assumed in the area source 2008 inventory is in Table 5. The 2008 emissions values shown in Table 5 include growth and control where applicable. Appendix E presents the detailed area source growth and control assumptions by county and SCC, including the growth factors, the control efficiencies, rule effectiveness, and rule penetration values.

Table 5. Summary of Area Assumptions Used in Preparing 2008 RFP Inventory

Assumption	2002 VOC tons/day	2008 VOC tons/day	2002 NOx tons/day	2008 NOx tons/day
GROWTH ONLY (NO CONTROL)	59.1	65.2	19.4	20.3
ONBOARD VAPOR RECOVERY	1.3	1.0	0.0	0.0
NSPS- RESIDENTIAL WOOD COMBUSTION	0.2	0.1	0.0	0.0
MACT CONTROLS	10.8	7.2	0.0	0.0
Area Source Totals	71.4	73.6	19.4	20.3

A.4 Offroad Mobile Sources

The 2008 offroad mobile inventory was prepared in two separate pieces. For the offroad mobile SCCs included in EPA's NONROAD model, the draft NONROAD2004 model was run for 2008 (<http://www.epa.gov/otaq/models/nonrdmdl/nr-arch.htm>). The NONROAD model projects growth in offroad engine populations and incorporates the impacts of federal rules such as the final Tier 4 nonroad diesel engine standards.

The draft NONROAD2004 model was run for each month in 2008 using the same temperature and fuel inputs as used in the annual onroad mobile base year inventory. The resulting monthly totals were summed to calculate an annual total. Typical summer weekday emissions were calculated by applying the same monthly and day-of-week temporal factors as used in the 2002 base year inventory. For the 2008 RFP inventory, NONROAD model emissions were estimated to be 31.3 tons/day VOC and 31.0 tons/day NOx. See Appendix C of the base year inventory document for a description of the typical summer weekday calculations, and Appendix F of that document for the monthly MOBILE input temperature and fuel parameters.

For the remaining offroad categories not included in NONROAD—aircraft, locomotives, commercial marine vessels—emissions were projected by applying growth and control factors using Equation 4. EGAS 5.0 was used to generate economic growth factors by county and SCC. EGAS 5.0 was run with a base year of 2002 and future year of 2008 using the REMI 5.5 SCC configuration, consistent with the way it was run by Alpine Geophysics for the 2009 ozone attainment demonstration modeling.

The control assumptions used to develop the 2008 offroad mobile source inventory reflect the implementation of federal locomotive and commercial marine vessel standards. The same control factors used in the 2009 modeled attainment demonstration were applied in the 2008 RFP inventory. The factors, consisting of control efficiencies and rule effectiveness and rule penetration values, were compiled by Alpine Geophysics based on the control assumptions used in EPA's CAIR modeling, CENRAP modeling, and other sources. The technical memorandum in Appendix A provides documentation on the control factors provided by Alpine Geophysics.

A summary of assumptions and controls assumed in the aircraft, locomotive, and commercial marine vessel 2008 inventory is in Table 6. The 2008 emissions values shown in Table 6 include growth and control where applicable. Appendix F lists the detailed aircraft, locomotive, and

commercial marine vessel growth and control assumptions by county and SCC, including the growth factors, the control efficiencies, rule effectiveness, and rule penetration values.

Table 6. Summary of Commercial Marine, Aircraft, Locomotive Assumptions Used in Preparing 2008 RFP Inventory

Assumption	2002 VOC tons/day	2008 VOC tons/day	2002 NOx tons/day	2008 NOx tons/day
GROWTH ONLY (NO CONTROLS)	1.0	1.2	4.7	5.9
FEDERAL LOCOMOTIVE STANDARDS	0.5	0.4	8.5	4.4
FEDERAL CMV STANDARDS	0.5	0.5	12.0	11.9
Marine, Aircraft, Locomotive Totals	1.9	2.1	25.1	22.2

A.5 Onroad Mobile Sources

The 2008 onroad mobile emissions were estimated using a methodology consistent with the preparation of the 2002 onroad mobile emissions in the base year inventory. The emissions were calculated by multiplying 2008 emission rates (units of mass/mile) by 2008 projected 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>).

The 2002 VMT data were provided by the East-West Gateway Coordinating Council. The original dataset contained average weekday VMT, road type, and congested speed information for each link in the St. Louis regional road network. The VMT was grouped into MOBILE6's 14 speed bins for the arterial and freeway road types. The 14 speed bins contained in MOBILE6 are listed in Table 7. The procedure to disaggregate VMT by road type and speed bin was done separately for Franklin County and the rest of the nonattainment area counties (Jefferson, St. Charles, and St. Louis Counties and City of St. Louis). See Section VII of the base year inventory document for more information about the preparation of the 2002 VMT by speed and road type.

Table 7. 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

The average weekday VMT for 2002 was grown to 2008 using Equation 5, with a growth rate of 1.7% per year. The example below illustrates the application of Equation 5 for VOC emissions for speed bin 8 in the portion of the nonattainment area covering Jefferson, St. Charles, St. Louis County, and City of St. Louis.

$$\text{VMT}_{2008} = \text{VMT}_{2002} \times \text{GF} \quad [5]$$

Where:

VMT₂₀₀₈ = Projected VMT in 2008 for a given speed and road type

VMT₂₀₀₂ = VMT in 2002 for a given speed and road type

GF = Growth factor of 1.102 (growth of 1.7% per year over 6 years)

Example illustrating application of Equation 5: Projection of 2002 arterial VMT for speed bin 8 (avg. speed 35 mph) for Jefferson, St. Charles, St. Louis Counties and City of St. Louis

2002 VMT for arterials and speed bin 8: 6,542,059 mi/day

Growth factor: 1.102

$$(6,542,059 \text{ mi/day}) \times 1.102 = 7,209,349 \text{ mi/day}$$

The growth rate of 1.7% per year is consistent with the average region-wide growth rate for the St. Louis nonattainment area counties wide (both Missouri and Illinois sides) used in the 2009 attainment demonstration modeling. The average growth rate assumed in the 2009 attainment demonstration for the Missouri-side counties is about 2% per year, as derived from VMT data assembled by EPA for their most recent CAIR rulemaking. According to the East-West Gateway Coordinating Council, VMT growth in the St. Louis region is expected to be in the range of 1 – 1.5% per year. For the 2008 RFP inventory, the department's Air Pollution Control Program chose to use the region-wide growth of 1.7% per year rather than the Missouri-side growth of 2% per year because 1.7% is closer to the actual rate of expected growth in the region. It should be noted that both the 1.7% and 2% per year VMT growth rates are conservative assumptions and likely overestimate VMT growth through 2008/2009.

The VMT projection calculations were applied to each of the 14 speed bins and road types (freeway and arterial). The VMT calculations were also done separately for Franklin County and the rest of the nonattainment area (Jefferson, St. Charles, St. Louis Counties and the City of St. Louis) to be consistent with the way the VMT was prepared in the 2002 base year inventory.

The emission factors to calculate 2008 onroad mobile source emissions were generated using the MOBILE6.2 model with the same temperature inputs as used in the base year inventory. The local program specifications for the 2008 run were as follows: reformulated gasoline, the basic I/M performance standard, and Stage II vapor recovery. In addition to the local motor vehicle programs, the MOBILE6 model accounts for the impacts of the federal rules, such as the Tier 2 motor vehicle emission standards and low-sulfur gasoline. Although the local program and temperature specifications were identical, separate sets of inputs were created for Franklin County and the rest of the nonattainment area (Jefferson, St. Charles, and St. Louis Counties and City of St. Louis) in order to utilize the separate speed by VMT (SVMT) inputs for Franklin

versus the rest of the nonattainment area and to be consistent with the way the 2002 VMT was prepared for the base year inventory. The MOBILE6 input files used in the preparation of the 2008 RFP inventory are included in Appendix B. See Section VII of the base year inventory document for more information on the temperature inputs and preparation of the SVMT inputs.

The MOBILE6 runs produced emission factors by pollutant (VOC and NOx), roadway type (freeway and arterial), and average speed (2.5 mph and 10 - 65 mph in 5 mph increments). Equation 6 was used to calculate the 2008 onroad mobile emissions. The example below illustrates the application of Equation 6 for VOC emissions for 35 mph in the portion of the nonattainment area covering Jefferson, St. Charles, St. Louis County, and City of St. Louis.

$$\text{EMISS}_{2008} = \text{EMFAC}_{2008} \times \text{VMT}_{2008} \quad [6]$$

Where:

EMISS₂₀₀₈ = 2008 emissions for a given speed, road type, and nonattainment area zone

EMFAC₂₀₀₈ = 2008 emission factor for a given speed, road type, and nonattainment area zone

VMT₂₀₀₈ = 2008 VMT for a given speed, road type, and nonattainment area zone

Example illustrating application of Equation 6: Calculation of 2008 VOC emissions for arterials for an average speed of 35 mph for Jefferson, St. Charles, St. Louis County, City of St. Louis

2008 VOC emission factor for arterials for avg. speed of 35 mph: 0.779 g/mile

2008 VMT for arterials and speed bin 8: 7,209,349 mi/day

$$(0.779 \text{ g/mi}) \times 7,209,349 \text{ mi/day} \times (0.0022046 \text{ lb/g}) \times (1 \text{ ton}/2,000 \text{ lb}) = 6.191 \text{ tons/day}$$

This calculation procedure was applied to each pollutant, speed, road type, and nonattainment area zone (Franklin versus the rest of the nonattainment counties). The results for each pollutant were summed across all speeds, road types, and nonattainment area counties. For the St. Louis nonattainment counties, the 2008 onroad mobile VOC and NOx emissions are estimated to be 47.3 tons/day and 109.2 tons/day, respectively.

Appendix B includes the MOBILE6 input files used to generate the 2008 emission factors. The 2008 emission factors, VMT, and resulting emissions by speed and road type are summarized in Tables B-4, B-5, and B-6, respectively.

B. Summary of 2008 RFP Emissions Inventory

Table 8 summarizes 2008 VOC and NOx emissions for a typical summer weekday in the St. Louis nonattainment counties by source type. As described in Section IV.A, the 2008 RFP inventory reflects emissions growth and the impacts of the following mix of state and federal control measures:

- the Missouri NOx State Implementation Plan (SIP) Call rule for industrial boilers,
- various federal Maximum Achievable Control Technology (MACT) standards,
- the federal Tier 2 rule, including light-duty motor vehicle engine standards and low-sulfur gasoline,
- the federal heavy-duty diesel engine standards and low-sulfur diesel, and
- the federal Tier 4 rule, including offroad mobile engine standards that cover most construction, agricultural, and industrial offroad equipment.

Table 8. 2008 RFP Emissions Inventory – VOC and NOx Typical Summer Weekday Emissions in St. Louis Nonattainment Counties by Source Type

Source Type	VOC tons/day	NOx tons/day
POINT SOURCES		
Non-EGU	29.9	28.4
EGU	2.2	76.1
Point Source Subtotals	32.1	104.5
AREA SOURCES	73.6	20.3
OFFROAD MOBILE SOURCES		
NONROAD model	31.3	31.0
Commercial marine vessels, locomotives, aircraft	2.1	22.2
Offroad Mobile Source Subtotals	33.4	53.2
ONROAD MOBILE SOURCES	47.3	109.2
Total St. Louis Nonattainment Area 2008 RFP Inventory	186.4	287.2

V. RFP CALCULATION

Table 9 steps through the RFP calculation demonstrating that the minimum 15% VOC and NO_x emissions reduction requirement is met for the St. Louis ozone nonattainment counties between 2002 and 2008. The 2002 base year emissions inventory in tons/day (tpd) is shown in column B. Column C lists the adjustments made to the base year inventory: 1) the noncreditable onroad mobile reductions associated with the pre-1990 CAAA motor vehicle control program that are subtracted from the base year (shown in the table as negative values) and 2) the discrepancy of the NONROAD model output that are added to the base year. The adjusted 2002 base year inventory in column D is the sum of columns B and C. The 2008 RFP inventory is presented in column E. The reductions occurring over the 2002 and 2008 time period are calculated by subtracting the 2008 RFP inventory in column E from the adjusted base year inventory in column D. The last column simply converts the emission reductions in mass units of tons/day to percentages.

As seen from Table 9, VOC emissions are expected to decrease 10.6% from 2002 to 2008 in the St. Louis nonattainment area counties, and NO_x emissions are expected to decrease 17.5% over the same time period. Adding the VOC and NO_x percentage reductions results in a total reduction of 28.1%, which exceeds the minimum RFP requirement of 15%.

Table 9. RFP Calculation – VOC and NOx Emission Reductions Occurring Between 2002 - 2008 in the St. Louis Nonattainment Area

Column A	Column B	Column C	Column D	Column E	Column F	Column G
		Adjustments for non-creditable onroad mobile reductions and discrepancy in NONROAD model output. <i>Positive values are added to base year; negative values are subtracted from the base.</i>	Column B plus Column C		Column D minus Column E <i>Negative values indicate increasing emissions.</i>	Column F divided by Column D, multiplied by 100 <i>Negative values indicate increasing emissions.</i>
VOC						
Source Type	2002 Base Year Inventory VOC (tpd)	Adjustments VOC (tpd)	Adjusted 2002 Inventory for RFP VOC (tpd)	2008 RFP Inventory VOC (tpd)	Difference Between 2002 and 2008 VOC (tpd)	Difference Between 2002 and 2008 Percent (%)
POINT SOURCES						
Non-EGU	30.8	0.0	30.8	29.9	0.9	2.9
EGU	1.9	0.0	1.9	2.2	-0.3	-15.8
Point Source Subtotals	32.7	0.0	32.7	32.1	0.6	1.8
AREA SOURCES	71.4	0.0	71.4	73.6	-2.2	-3.1
OFFROAD MOBILE SOURCES						
NONROAD model	45.0	0.7	45.7	31.3	14.4	31.5
Commercial marine vessels, locomotives, aircraft	1.9	0.0	1.9	2.1	-0.2	-10.5
Offroad mobile Subtotals	46.9	0.7	47.6	33.4	14.2	29.8
ONROAD MOBILE SOURCES	68.1	-11.3	56.8	47.3	9.5	16.7
St. Louis Nonattainment Area VOC Totals	219.1	-10.6	208.5	186.4	22.1	10.6

Column A	Column B	Column C	Column D	Column E	Column F	Column G
		Adjustments for non-creditable onroad mobile reductions and discrepancy in NONROAD model output. <i>Positive values are added to base year; negative values are subtracted from the base.</i>	Column B plus Column C		Column D minus Column E <i>Negative values indicate increasing emissions.</i>	Column F divided by Column D, multiplied by 100 <i>Negative values indicate increasing emissions.</i>
NOx						
Source Type	2002 Base Year Inventory NOx (tpd)	Adjustments NOx (tpd)	Adjusted 2002 Inventory for RFP NOx (tpd)	2008 RFP Inventory NOx (tpd)	Difference Between 2002 and 2008 NOx (tpd)	Difference Between 2002 and 2008 Percent (%)
POINT SOURCES						
Non-EGU	24.4	0.0	24.4	28.4	-4.0	-16.4
EGU	102.8	0.0	102.8	76.1	26.7	26.0
Point Source Subtotals	127.2	0.0	127.2	104.5	22.7	17.8
AREA SOURCES	19.4	0.0	19.4	20.3	-0.9	-4.6
OFFROAD MOBILE SOURCES						
NONROAD model	35.6	1.7	37.3	31.0	6.3	16.9
Commercial marine vessels, locomotives, aircraft	25.1	0.0	25.1	22.2	2.9	11.6
Offroad mobile subtotals	60.7	1.7	62.4	53.2	9.2	14.7
ONROAD MOBILE SOURCES	159.0	-20.0	139.0	109.2	29.8	21.4
St. Louis Nonattainment Area Total NOx Emissions	366.3	-18.3	348.0	287.2	60.8	17.5
Total VOC plus NOx percentage reductions (10.6% + 17.5%)						28.1