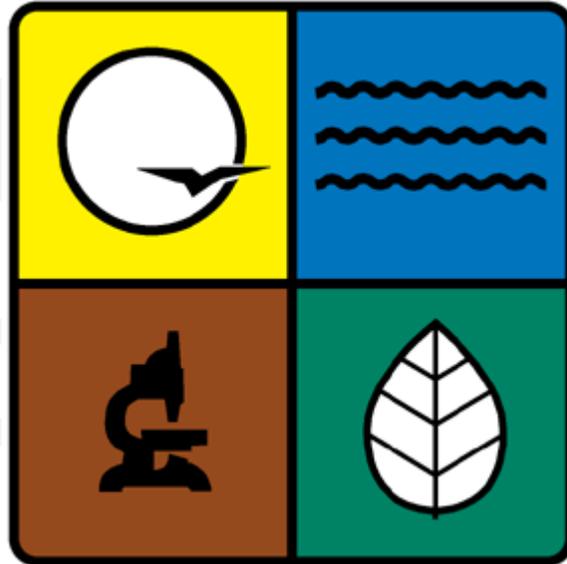


Appendix B

**2008 Base Year Average Winter Day
Carbon Monoxide (CO) Emissions Inventory
For St. Louis County and St. Louis City**



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

Adoption
March 27, 2014

Project Number: 1971-CO-5

Table of Contents

PROJECT NUMBER: 1971-CO-5	TABLE OF CONTENTS	1
LIST OF TABLES.....	3
AVERAGE WINTER DAY CO EMISSIONS INVENTORY SUMMARY.....	4
APPENDIX B-1	2008 POINT AND AREA SOURCE EMISSIONS	4
APPENDIX B-2	2008 AREA SOURCE AVERAGE WINTER DAY EMISSIONS	6
APPENDIX B-3	ON-ROAD MOBILE SOURCE EMISSIONS	15
APPENDIX B-4	2008 OFF-ROAD MOBILE SOURCE EMISSIONS	17
APPENDIX B-5	TEMPORAL ALLOCATION METHODOLOGY APPLIED TO RESIDENTIAL FUEL COMBUSTION AREA SOURCE CATEGORIES	18
COUNTY NONATTAINMENT AREA	20
QA/QC.....	22

List of Tables

Table B-1	2008 Average Winter Day CO Emissions Inventory Summary for St. Louis County and St. Louis City
Table B-2	2008 Point Source CO Emissions for St. Louis County and St. Louis City
Table B-3	2008 Area Source Average Winter Day CO Emissions (Excluding Residential Fuel Combustion)
Table B-4	2008 Average Winter Day CO Emissions for Residential Fuel Combustion
Table B-5	2008 Area Source CO Emissions Summary for St. Louis County and St. Louis City
Table B-6	SCC Codes and Descriptions for Marine and Rail Source Categories Not Included in the Analysis for Area Source Emissions
Table B-7	2008 On-Road Mobile Source Winter Month CO Emissions for St. Louis County and St. Louis City
Table B-8	2008 On-Road Mobile Source Average Winter Day CO Emissions for St. Louis County and St. Louis City
Table B-9	2008 Off-Road Mobile Source Emissions for St. Louis County and St. Louis City (Excludes Marine and Rail Emissions)
Table B-10	2008 Marine and Rail Emissions for St. Louis County and St. Louis City
Table B-11	2008 Total Off-Road Mobile Source Emissions for St. Louis County and St. Louis City
Table B-12	Calculation of Average January Day Temporal Allocation Factors for Residential Fuel Combustion SCCs

Average Winter Day CO Emissions Inventory Summary

Table B-1
2008 Average Winter Day CO Emissions Inventory Summary for
St. Louis County and St. Louis City

Geographic Area	Source Category	2008 CO Emissions (Tons/Average Winter Day)
St. Louis County	Point Sources	13.65
St. Louis County	Area Sources	52.33
St. Louis County	On Road Mobile Sources	425.49
St. Louis County	Off Road Mobile Sources	211.50
St. Louis County	subtotal	702.97
St. Louis City	Point Sources	3.61
St. Louis City	Area Sources	17.93
St. Louis City	On Road Mobile Sources	106.93
St. Louis City	Off Road Mobile Sources	38.97
St. Louis City	subtotal	167.44
Total (St. Louis City and County)	Point Sources	17.26
Total (St. Louis City and County)	Area Sources	70.26
Total (St. Louis City and County)	On Road Mobile Sources	532.42
Total (St. Louis City and County)	Off Road Mobile Sources	250.48
Total (St. Louis City and County)	Total	870.42

* - subtotals may not sum due to rounding

Appendix B-1 2008 Point and Area Source Emissions

The 2008 point source emissions by county for St. Louis County and St. Louis City are summarized below in Table B-2 for an average winter day. The development of the annual point source emissions inventory is detailed in Appendix A, the 2008 Base Year Annual Carbon Monoxide Emissions Inventory for St. Louis county and St. Louis City. The average winter day emissions listed in Table B-2 were developed by dividing the 2008 annual CO emissions from point sources in St. Louis County and St. Louis City and dividing by 366.

Table B-2
2008 Point Source CO Emissions for St. Louis County and St. Louis City

Geographic Area	2008 Point Source CO Emissions (Tons/Average Winter Day)
St. Louis County	13.65
St. Louis City	3.61
Totals	17.26

Appendix B-2 2008 Area Source Average Winter Day Emissions

The development of the 2008 annual CO emissions inventory is detailed in Appendix A. In order to calculate average winter day CO emissions for the all area source categories other than residential fuel combustion, the annual emissions were divided by 366. The 2008 average winter day CO emissions for all area source categories by SCC other than residential fuel combustion are listed in Table B-3.

In order to calculate average winter day emissions for residential fuel combustion the Air Program used the EPA's temporal allocation method. A summary of EPA's temporal allocation method can be found in Appendix B-5. The 2008 average winter day CO emissions for all residential fuel combustion source categories by SCC are listed in Table B-4. The average winter day CO emissions inventory summary for all area sources is listed in Table B-5.

When calculating the area source emissions, certain mobile source categories are calculated with methods similar to area sources, particularly marine and rail categories. Although these off road mobile source categories were calculated with area source methodologies, they are not included in the area source inventory listed in Table B-5. The source classification codes (SCCs) pertaining to these off-road mobile sources that were calculated with area source methodologies are listed in Table B-6, and the emissions from these categories are included as off-road mobile source emissions.

Table B-3 2008 Area Source Average Winter Day CO Emissions (Excluding Residential Fuel Combustion)

Geographic Area	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	2008 CO Emissions (lbs./Average Winter Day)
St. Louis County	2102001000	Stationary Source Fuel Combustion	Anthracite Coal	Industrial	Total: All Boiler Types	-
St. Louis County	2102002000	Stationary Source Fuel Combustion	Bituminous/Subbituminous Coal	Industrial	Total: All Boiler Types	1,651.20
St. Louis County	2102004000	Stationary Source Fuel Combustion	Distillate Oil	Industrial	Total: Boilers and IC Engines	7.87
St. Louis County	2102005000	Stationary Source Fuel Combustion	Residual Oil	Industrial	Total: All Boiler Types	2.24
St. Louis County	2102006000	Stationary Source Fuel Combustion	Natural Gas	Industrial	Total: Boilers and IC Engines	22.62
St. Louis County	2102007000	Stationary Source Fuel Combustion	Liquefied Petroleum Gas (LPG)	Industrial	Total: All Boiler Types	-
St. Louis County	2102008000	Stationary Source Fuel Combustion	Wood	Industrial	Total: All Boiler Types	1,167.10
St. Louis County	2102011000	Stationary Source Fuel Combustion	Kerosene	Industrial	Total: All Boiler Types	-
St. Louis County	2103001000	Stationary Source Fuel Combustion	Anthracite Coal	Commercial/Institutional	Total: All Boiler Types	-
St. Louis County	2103002000	Stationary Source Fuel Combustion	Bituminous/Subbituminous Coal	Commercial/Institutional	Total: All Boiler Types	11.48
St. Louis County	2103004000	Stationary Source Fuel Combustion	Distillate Oil	Commercial/Institutional	Total: Boilers and IC Engines	0.11
St. Louis County	2103005000	Stationary Source Fuel Combustion	Residual Oil	Commercial/Institutional	Total: All Boiler Types	-
St. Louis County	2103006000	Stationary Source Fuel Combustion	Natural Gas	Commercial/Institutional	Total: Boilers and IC Engines	60.49
St. Louis County	2103007000	Stationary Source Fuel Combustion	Liquefied Petroleum Gas (LPG)	Commercial/Institutional	Total: All Combustor Types	3.88
St. Louis County	2103008000	Stationary Source Fuel Combustion	Wood	Commercial/Institutional	Total: All Boiler Types	11.75
St. Louis County	2103011000	Stationary Source Fuel Combustion	Kerosene	Commercial/Institutional	Total: All Combustor Types	0.05

Geographic Area	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	2008 CO Emissions (lbs./Average Winter Day)
St. Louis County	2104002000	Stationary Source Fuel Combustion	Bituminous/Subbituminous Coal	Residential	Total: All Combustor Types	417.4863
St. Louis County	2104004000	Stationary Source Fuel Combustion	Distillate Oil	Residential	Total: All Combustor Types	5.79235
St. Louis County	2104006000	Stationary Source Fuel Combustion	Natural Gas	Residential	Total: All Combustor Types	2758.251
St. Louis County	2104007000	Stationary Source Fuel Combustion	Liquified Petroleum Gas (LPG)	Residential	Total: All Combustor Types	24.59016
St. Louis County	2104008100	Stationary Source Fuel Combustion	Wood	Residential	Fireplace: general	7475.137
St. Louis County	2104008210	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: fireplace inserts; non-EPA certified	11727.87
St. Louis County	2104008220	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: fireplace inserts; EPA certified; non-catalytic	2053.607
St. Louis County	2104008230	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: fireplace inserts; EPA certified; catalytic	506.5574
St. Louis County	2104008310	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: freestanding, non-EPA certified	9610.765
St. Louis County	2104008320	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: freestanding, EPA certified, non-catalytic	1880.109
St. Louis County	2104008330	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: freestanding, EPA certified, catalytic	464.4262
St. Louis County	2104008400	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: pellet-fired, general (freestanding or FP insert)	213.5519
St. Louis County	2104008510	Stationary Source Fuel Combustion	Wood	Residential	Furnace: Indoor, cordwood-fired, non-EPA certified	2260
St. Louis County	2104008610	Stationary Source Fuel Combustion	Wood	Residential	Hydronic heater: outdoor	4162.131
St. Louis County	2104009000	Stationary Source Fuel Combustion	Firelog	Residential	Total: All Combustor Types	806.1202
St. Louis County	2104011000	Stationary Source Fuel Combustion	Kerosene	Residential	Total: All Heater Types	3.060109
St. Louis County	2302002100	Industrial Processes	Commercial Cooking - Charbroiling	Food and Kindred Products: SIC 20	Conveyorized Charbroiling	123.99

Geographic Area	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	2008 CO Emissions (lbs./Average Winter Day)
St. Louis County	2302002200	Industrial Processes	Commercial Cooking - Charbroiling	Food and Kindred Products: SIC 20	Under-fired Charbroiling	351.80
St. Louis County	2302003000	Industrial Processes	Commercial Cooking - Frying	Food and Kindred Products: SIC 20	Deep Fat Frying	-
St. Louis County	2302003100	Industrial Processes	Commercial Cooking - Frying	Food and Kindred Products: SIC 20	Flat Griddle Frying	44.92
St. Louis County	2302003200	Industrial Processes	Commercial Cooking - Frying	Food and Kindred Products: SIC 20	Clamshell Griddle Frying	-
St. Louis County Total						47,829.02
St. Louis City	2102001000	Stationary Source Fuel Combustion	Anthracite Coal	Industrial	Total: All Boiler Types	-
St. Louis City	2102002000	Stationary Source Fuel Combustion	Bituminous/Subbituminous Coal	Industrial	Total: All Boiler Types	986.56
St. Louis City	2102004000	Stationary Source Fuel Combustion	Distillate Oil	Industrial	Total: Boilers and IC Engines	4.70
St. Louis City	2102005000	Stationary Source Fuel Combustion	Residual Oil	Industrial	Total: All Boiler Types	1.37
St. Louis City	2102006000	Stationary Source Fuel Combustion	Natural Gas	Industrial	Total: Boilers and IC Engines	11.15
St. Louis City	2102007000	Stationary Source Fuel Combustion	Liquefied Petroleum Gas (LPG)	Industrial	Total: All Boiler Types	-
St. Louis City	2102008000	Stationary Source Fuel Combustion	Wood	Industrial	Total: All Boiler Types	758.14
St. Louis City	2102011000	Stationary Source Fuel Combustion	Kerosene	Industrial	Total: All Boiler Types	-
St. Louis City	2103001000	Stationary Source Fuel Combustion	Anthracite Coal	Commercial/Institutional	Total: All Boiler Types	-
St. Louis City	2103002000	Stationary Source Fuel Combustion	Bituminous/Subbituminous Coal	Commercial/Institutional	Total: All Boiler Types	11.37
St. Louis City	2103004000	Stationary Source Fuel Combustion	Distillate Oil	Commercial/Institutional	Total: Boilers and IC Engines	0.11
St. Louis City	2103005000	Stationary Source Fuel Combustion	Residual Oil	Commercial/Institutional	Total: All Boiler Types	-

Geographic Area	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	2008 CO Emissions (lbs./Average Winter Day)
St. Louis City	2103006000	Stationary Source Fuel Combustion	Natural Gas	Commercial/Institutional	Total: Boilers and IC Engines	42.95
St. Louis City	2103007000	Stationary Source Fuel Combustion	Liquefied Petroleum Gas (LPG)	Commercial/Institutional	Total: All Combustor Types	3.33
St. Louis City	2103008000	Stationary Source Fuel Combustion	Wood	Commercial/Institutional	Total: All Boiler Types	12.08
St. Louis City	2103011000	Stationary Source Fuel Combustion	Kerosene	Commercial/Institutional	Total: All Combustor Types	0.05
St. Louis City	2104002000	Stationary Source Fuel Combustion	Bituminous/Subbituminous Coal	Residential	Total: All Combustor Types	67.06
St. Louis City	2104004000	Stationary Source Fuel Combustion	Distillate Oil	Residential	Total: All Combustor Types	0.85
St. Louis City	2104006000	Stationary Source Fuel Combustion	Natural Gas	Residential	Total: All Combustor Types	178.48
St. Louis City	2104007000	Stationary Source Fuel Combustion	Liquified Petroleum Gas (LPG)	Residential	Total: All Combustor Types	2.32
St. Louis City	2104008100	Stationary Source Fuel Combustion	Wood	Residential	Fireplace: general	440.92
St. Louis City	2104008210	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: fireplace inserts; non-EPA certified	641.76
St. Louis City	2104008220	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: fireplace inserts; EPA certified; non-catalytic	137.55
St. Louis City	2104008230	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: fireplace inserts; EPA certified; catalytic	35.48
St. Louis City	2104008310	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: freestanding, non-EPA certified	595.41
St. Louis City	2104008320	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: freestanding, EPA certified, non-catalytic	116.06
St. Louis City	2104008330	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: freestanding, EPA certified, catalytic	29.04
St. Louis City	2104008400	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: pellet-fired, general (freestanding or FP insert)	14.17
St. Louis City	2104008510	Stationary Source Fuel Combustion	Wood	Residential	Furnace: Indoor, cordwood-fired, non-EPA certified	141.36

Geographic Area	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	2008 CO Emissions (lbs./Average Winter Day)
St. Louis City	2104008610	Stationary Source Fuel Combustion	Wood	Residential	Hydronic heater: outdoor	260.87
St. Louis City	2104009000	Stationary Source Fuel Combustion	Firelog	Residential	Total: All Combustor Types	53.5
St. Louis City	2104011000	Stationary Source Fuel Combustion	Kerosene	Residential	Total: All Heater Types	0.45
St. Louis City	2302002100	Industrial Processes	Commercial Cooking - Charbroiling	Food and Kindred Products: SIC 20	Conveyorized Charbroiling	44.32
St. Louis City	2302002200	Industrial Processes	Commercial Cooking - Charbroiling	Food and Kindred Products: SIC 20	Under-fired Charbroiling	140.87
St. Louis City	2302003000	Industrial Processes	Commercial Cooking - Frying	Food and Kindred Products: SIC 20	Deep Fat Frying	-
St. Louis City	2302003100	Industrial Processes	Commercial Cooking - Frying	Food and Kindred Products: SIC 20	Flat Griddle Frying	11.80
St. Louis City	2302003200	Industrial Processes	Commercial Cooking - Frying	Food and Kindred Products: SIC 20	Clamshell Griddle Frying	-
St. Louis City Total						16,866.5
Combined St. Louis County and St. Louis City Total						64,695.5

Table B-4 2008 Average Winter Day CO Emissions for Residential Fuel Combustion

Geographic Area	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	2008 CO Emissions (lbs./Average Winter Day)
St. Louis County	2104002000	Stationary Source Fuel Combustion	Bituminous/Subbituminous Coal	Residential	Total: All Combustor Types	952.57
St. Louis County	2104004000	Stationary Source Fuel Combustion	Distillate Oil	Residential	Total: All Combustor Types	13.22
St. Louis County	2104006000	Stationary Source Fuel Combustion	Natural Gas	Residential	Total: All Combustor Types	6,293.46
St. Louis County	2104007000	Stationary Source Fuel Combustion	Liquefied Petroleum Gas (LPG)	Residential	Total: All Combustor Types	24.66
St. Louis County	2104008100	Stationary Source Fuel Combustion	Wood	Residential	Fireplace: general	17,055.89
St. Louis County	2104008210	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: fireplace inserts; non-EPA certified	26,759.28
St. Louis County	2104008220	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: fireplace inserts; EPA certified; non-catalytic	4,685.68
St. Louis County	2104008230	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: fireplace inserts; EPA certified; catalytic	1,155.80
St. Louis County	2104008310	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: freestanding, non-EPA certified	21,928.72
St. Louis County	2104008320	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: freestanding, EPA certified, non-catalytic	4,289.81
St. Louis County	2104008330	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: freestanding, EPA certified, catalytic	1,059.67
St. Louis County	2104008400	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: pellet-fired, general (freestanding or FP insert)	487.26
St. Louis County	2104008510	Stationary Source Fuel Combustion	Wood	Residential	Furnace: Indoor, cordwood-fired, non-EPA certified	5,156.60
St. Louis County	2104008610	Stationary Source Fuel Combustion	Wood	Residential	Hydronic heater: outdoor	9,496.66
St. Louis County	2104009000	Stationary Source Fuel Combustion	Fire log	Residential	Total: All Combustor Types	1,839.31
St. Louis County	2104011000	Stationary Source Fuel Combustion	Kerosene	Residential	Total: All Heater Types	3.07
St. Louis County Total						101,201.67
St. Louis City	2104002000	Stationary Source Fuel Combustion	Bituminous/Subbituminous Coal	Residential	Total: All Combustor Types	836.12
St. Louis City	2104004000	Stationary Source Fuel Combustion	Distillate Oil	Residential	Total: All Combustor Types	10.60
St. Louis City	2104006000	Stationary Source Fuel Combustion	Natural Gas	Residential	Total: All Combustor Types	2,225.33
St. Louis City	2104007000	Stationary Source Fuel Combustion	Liquefied Petroleum Gas (LPG)	Residential	Total: All Combustor Types	12.71
St. Louis City	2104008100	Stationary Source Fuel Combustion	Wood	Residential	Fireplace: general	5,497.48

Geographic Area	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	2008 CO Emissions (lbs./Average Winter Day)
St. Louis City	2104008210	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: fireplace inserts; non-EPA certified	8,001.60
St. Louis City	2104008220	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: fireplace inserts; EPA certified; non-catalytic	1,715.00
St. Louis City	2104008230	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: fireplace inserts; EPA certified; catalytic	442.37
St. Louis City	2104008310	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: freestanding, non-EPA certified	7,423.70
St. Louis City	2104008320	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: freestanding, EPA certified, non-catalytic	1,447.06
St. Louis City	2104008330	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: freestanding, EPA certified, catalytic	362.08
St. Louis City	2104008400	Stationary Source Fuel Combustion	Wood	Residential	Woodstove: pellet-fired, general (freestanding or FP insert)	176.67
St. Louis City	2104008510	Stationary Source Fuel Combustion	Wood	Residential	Furnace: Indoor, cordwood-fired, non-EPA certified	1,762.51
St. Louis City	2104008610	Stationary Source Fuel Combustion	Wood	Residential	Hydronic heater: outdoor	3,252.58
St. Louis City	2104009000	Stationary Source Fuel Combustion	Fire log	Residential	Total: All Combustor Types	667.05
St. Louis City	2104011000	Stationary Source Fuel Combustion	Kerosene	Residential	Total: All Heater Types	2.47
St. Louis City Total						33,835.33
Combined St. Louis County and St. Louis City Total						135,037.00

Table B-5
2008 Area Source CO Emissions Summary for St. Louis County and St. Louis City

Geographic Area	2008 Area Source CO Emissions (Tons/Average Winter Day)
St. Louis County	52.33
St. Louis City	17.93
Totals	70.26

Table B-6
**SCC Codes and Descriptions for Marine and Rail Source Categories Not Included in the
 Analysis for Area Source Emissions**

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four
2280002100	Mobile Sources	Diesel	Marine Vessels, Commercial	Port emissions
2280002200	Mobile Sources	Diesel	Marine Vessels, Commercial	Underway emissions
2285002006	Mobile Sources	Diesel	Railroad Equipment	Line Haul Locomotives: Class I Operations
2285002007	Mobile Sources	Diesel	Railroad Equipment	Line Haul Locomotives: Class II / III Operations

Appendix B-3

On-Road Mobile Source Emissions

EPA released the Mobile Vehicle Emission System (MOVES) in December of 2010, and MOVES is now the official model to use for mobile emissions modeling. Annual 2008 mobile emissions were initially created using Mobile6.2 via the National Mobile Inventory Model (NMIM) for Missouri for the purpose of submitting state wide emissions data for EPA's 2008 National Emissions Inventory (NEI). The NMIM National County Database (NCD) was updated with Missouri specific data. Local vehicle miles traveled (VMT) data, vehicle registration distributions, and meteorology data from the updated NCD were converted to MOVES formatting using EPA provided conversion workbooks.

The emissions for 2008 were calculated using 2008 VMT data provided by the East West Gateway Council of Governments. The 2008 VMT data was originally generated from the Missouri Department of Transportation for state-owned roads, and then East-West Gateway used their Traffic Demand Model to calculate the actual local VMT data for each of the five counties on the Missouri side of the St. Louis Ozone nonattainment area.

The road type distribution in the baseyearvmt table from the NCD was used to distribute the county level VMT to road type. EPA's VMT converter workbook was then used to produce MOVES input tables. A vehicle registration distribution was originally created for NMIM using registration data from Missouri's Department of Revenue. The vehicle distribution was converted to MOVES age distribution table using EPA's VMT converter workbook. The registration data was also used to create the MOVES vehicle population input tables. Vehicle counts were converted from Mobile 6.2 vehicle classes to MOVES source types using the source type fractions from the Source Type Pop Fractions table in EPA's VMT converter workbook.

St. Louis City and St. Louis County both participate in the Gateway Vehicle Inspection Program (GVIP). For counties subject to Emission Inspection/Maintenance (I/M) Programs, MOVES allows for an I/M input table to be created to describe the program in those counties. An I/M input table was created to describe the GVIP for St. Louis City and St. Louis County. Development of the table was in accordance with EPA technical guidance on appropriate input assumptions and sources of data for the use of MOVES 2010 in State Implementation Plans (<http://www.epa.gov/otaq/models/moves/420b10023.pdf>). Documentation for the development protocol for the I/M input table can be found in Appendix A-6.

MOVES base data was used for all other inputs, after reviewing the data to ensure accuracy. The base fuel supply tables in MOVES were used for the runs, as they already took into account the reformulated gasoline used in the St. Louis nonattainment area. A separate input database was created for each county, using county specific data where possible. All of the MOVES input tables, other than templates where EPA default data was used, which were used to create the 2008 on-road mobile emissions inventory referred to in Section 3 of this CO Limited Maintenance Plan can be found in Appendix A.

The MOVES model runs were set up selecting all available gasoline and diesel fuel vehicle type combinations, all months, days, hours, and all road types. A separate run was set-up for St. Louis

County and St. Louis City. The emissions were post-aggregated to the month level using MOVES.

Once MOVES input tables had been created, MOVES 2010a was run and all months for 2008 were selected to create an annual emissions profile. The emissions for the months of December, January, February, and March were totaled and divided by 122 days (2008 was a leap year), the number of days in those months, to give average winter day emissions

Table B-7 summarizes the 2008 on-road emissions for the months of December, January, February, and March as calculated using MOVES 2010A for St. Louis County and St. Louis City. Table B-8 summarizes the average winter day emissions of CO for St. Louis County and St. Louis City. All of the MOVES inputs that were used to create the 2008 annual on-road mobile emissions inventory that were then used to generate the average winter day emissions can be found in Appendix A.

Table B-7
2008 On-Road Mobile Source Winter Month CO Emissions
for St. Louis County and St. Louis City

Geographic Area / Month	2008 On Road Mobile Source CO Emissions (Tons)
St. Louis County / January	15,077.55
St. Louis County / February	12,011.11
St. Louis County / March	11,845.30
St. Louis County / December	12,975.47
St. Louis County (Winter Total)	51,909.43
St. Louis City / January	3,767.59
St. Louis City / February	3,008.64
St. Louis City / March	3,014.92
St. Louis City / December	3,254.01
St. Louis City (Winter Total)	13,045.15

Table B-8
2008 On-Road Mobile Source Average Winter Day CO Emissions
for St. Louis County and St. Louis City

Geographic Area	2008 On Road Mobile Source CO Emissions (Tons/Average Winter Day)
St. Louis County	425.49
St. Louis City	106.93
Totals	532.42

Appendix B-4

2008 Off-Road Mobile Source Emissions

The Air Program Staff followed the 2008 and 2022 modeling protocol submitted by EPA Region 7 to the Department for the development of the 2008 off-road mobile emissions with some exceptions. The Staff used 3.5% oxygen weight instead of 0.35% and 100% ethanol blend market instead if 10%. The EPA Region VII modeling protocol for 2008 and 2022 Off-Road Mobile Source Emissions in the St. Louis Nonattainment area can be found in Appendix B-6 of this document. The data generated by the Air Program Staff for the 2008 off-road mobile source emissions for St. Louis County and St. Louis City is summarized in Table B-9.

Due to the methods that are used to calculate the emissions for the marine and rail categories, these categories are sometimes included as area source emissions, although they really should be classified as off-road mobile source emissions. Therefore, the emissions for rail and marine are not included in the total area source emissions. The 2008 emissions for marine, rail, and air sources are summarized for St. Louis County and St. Louis City in Table B-10. The total 2008 off-road mobile source emissions for St. Louis County and St. Louis City are listed in Table B-11.

Table B-9
2008 Off-Road Mobile Source Emissions for St. Louis County and St. Louis City
(Tons/Average Winter Day)

Area	CO
St. Louis County	207.36
St. Louis City	38.26
Totals	245.62

Table B-10
2008 Marine, Rail, and Air Emissions for St. Louis County and St. Louis City
(Tons/Winter Day)

Area	CO
St. Louis County	4.15
St. Louis City	0.72
Totals	4.86

Table B-11
Total 2008 Off-Road Mobile Source Emissions for St. Louis County and St. Louis City
(Tons/Winter Day)

Area	CO
St. Louis County	211.50
St. Louis City	38.98
Totals	250.48

Appendix B-5

Temporal Allocation Methodology Applied to Residential Fuel Combustion Area Source Categories

The procedures summarized in this Appendix are based on the April 29, 2002 memorandum from Gregory Stella, U.S. EPA, "Temporal Allocation of Annual Emissions using EMCH Temporal Profiles" (http://www.epa.gov/ttn/chief/emch/temporal/temporal_factors_042902.pdf).

Area Source categories for residential fuel combustion were calculated on an annual basis for 2008. Because residential fuel combustion takes place primarily in the winter months, as opposed to simply dividing the annual emissions by 365 to get average winter day emissions, these annual emissions were multiplied by a temporal allocation factor for an average day in January through the following calculation steps:

The first step is to determine the monthly profile for the particular source classification code using EPA's temporal cross reference file which can be found at the following website: <http://www.epa.gov/ttnchie1/emch/temporal/>. The next step is to correlate the monthly profile to a monthly profile factor for the month of interest as well as a total monthly profile factor using EPA's temporal profile document, which can be found at the same website. In order to calculate the fraction of annual emissions for a particular month (January), the monthly profile factor for a specific month is divided by the total monthly profile factor:

Fraction of Annual Emissions for January = (January Profile Factor / Total Monthly Factor)

Then, in order to calculate the temporal allocation factor for an average monthly day, an average day per year is used in the calculation because the monthly profile factors are not weighted for the specific number of days in each month. So the temporal allocation factor for an average January day is calculated as follows:

Temporal Allocation Factor for an Average Day in January =
(Fraction of Annual Emissions for January) / (Days per Year (365) / Months per Year (12))

Example:

Residential Bituminous/Subbituminous Coal Combustion (SCC = 2104002000)

Monthly Profile for SCC 2104002000 = 485

Monthly Profile 485:

January Monthly Profile Factor = 190

Total Monthly Profile Factor = 1002

Fraction of Annual Emissions for January = $190 / 1002 = 0.189621$

Temporal Allocation Factor for an Average Day in January = $(0.189621) / (365 / 12) = 0.0062341$

This temporal allocation factor can then be multiplied by the annual emissions of this SCC in order to calculate the emissions of this SCC for an average January day. Table B-12 gives the monthly profiles and the profile factors for all residential fuel combustion SCCs along with the calculated temporal allocation factors for an average January day.

Table B-12 Calculation of Average January Day Temporal Allocation Factors for Residential Fuel Combustion SCCs

SCC	Monthly Profile #	January Monthly Profile Factor	Total Monthly Profile Factor	Temporal Allocation Factor for an Average January Day
2104002000	485	190	1002	0.0062341
2104004000	485	190	1002	0.0062341
2104006000	485	190	1002	0.0062341
2104007000	262	83	996	0.0027397
2104008100	485	190	1002	0.0062341
2104008210	485	190	1002	0.0062341
2104008220	485	190	1002	0.0062341
2104008230	485	190	1002	0.0062341
2104008310	485	190	1002	0.0062341
2104008320	485	190	1002	0.0062341
2104008330	485	190	1002	0.0062341
2104008400	485	190	1002	0.0062341
2104008510	485	190	1002	0.0062341
2104008610	485	190	1002	0.0062341
2104009000	485	190	1002	0.0062341
2104011000	262	83	996	0.0027397



Appendix B-6 EPA Region 7 Off-Road Emissions Modeling Protocol for 2008 and 2022 for the St. Louis, Missouri-Five County Nonattainment Area

For this modeling exercise, the EPA Region 7 utilized the NONROAD2008a model to calculate an ozone and PM_{2.5} nonroad inventory in five counties in the St. Louis nonattainment area for the 1997 PM_{2.5} annual and 1997 Ozone NAAQS. The NONROAD2008a model provides the emissions for all nonroad source categories except aircraft, commercial marine vessel, and railroad locomotive.

In running the NONROAD model, the user must specify a modeling scenario by the inventory year, geographic area (nation, state, county), period (annual, seasonal, monthly, daily), and the equipment categories. For all other required variables, the NONROAD model provides default input values. For the following modeling exercises, fuel parameters (Reid Vapor Pressure (RVP), oxygen weight, sulfur content, ethanol volume and market percentage) and temperatures for each geographical area were provided by MDNR in lieu of the modeling default settings for more accurate results (see attachment).

Ozone Precursor Emissions

Ozone Methodology/Input Data

Nonroad mobile source emissions for the years of 2008 and 2022 are calculated using the EPA approved model, NONROAD2008a, and included Franklin County, Jefferson County, St. Charles County, St. Louis County and St. Louis City in St. Louis, Missouri.

For modeling ozone precursor pollutants, temperatures and fuel characteristics representative of each county during an ozone summer weekday, were entered into NONROAD2a and modeled to calculate an ozone season weekday emissions for nonroad sources. Minimum, maximum, and average temperatures for a typical summer season were provided by MDNR (see attachment). Modeling input parameters are as follows:

**Table B-13
NONROAD Model Temperature & Fuel Characteristic Input Values by County**

County	Oxygen Weight %	RVP psi	Gasoline Sulfur %	Diesel Sulfur	Marine Diesel Sulfur %	CNG / LPG Sulfur %	Temperatures		
							Min.	Max.	Avg.
Franklin	0.35	7	0.0049	0.0355	0.0402	0.003	61.8	90	75.96
Jefferson	0.35	7	0.0049	0.0355	0.0402	0.003	61	88.6	75.16
St. Charles	0.35	7	0.0049	0.0355	0.0402	0.003	62.2	89.2	76.15
St. Louis	0.35	7	0.0049	0.0355	0.0402	0.003	64.1	89.5	77.1
St. Louis City	0.35	7	0.0049	0.0355	0.0402	0.003	65.1	89.8	77.72

Direct PM_{2.5} / PM_{2.5} Precursor Emissions

Methodology/Input Data

Nonroad mobile source emissions for the years of 2008 and 2022 were calculated using the EPA approved model, NONROAD2008a, and included Franklin County, Jefferson County, St. Charles County, St. Louis County and St. Louis City in St. Louis, Missouri.

For modeling PM_{2.5} and PM_{2.5} precursor pollutants, temperatures and fuel characteristics representative of each county for each of the four seasons (winter, spring, summer, and fall) were entered into the NONROAD2008a model as input parameters. The highest temperature and lowest temperature from each three month period (December-February, March-May, June-August, and September-November) were averaged to create a seasonal average temperature.

Those seasonal average temperatures, seasonal minimum and seasonal maximum temperatures were then utilized in the model, including the fuel parameters, to calculate the total emissions for each county and season. Summing the emissions of all four seasons for each county gave the total annual emissions. The temperatures and fuel characteristics representative of each county were provided by MDNR. Modeling input parameters are as follows:

Table B-14

NONROAD Model Temperature & Fuel Characteristic Input Values by County & Season

County	Season	Oxygen Weight %	RVP psi	Gasoline Sulfur %	Diesel Sulfur	Marine Diesel Sulfur %	CNG / LPG Sulfur %	Temperatures		
								Min.	Max.	Avg.
Franklin	Winter	0.35	11.5	0.0043	0.0355	0.0402	0.003	19.7	47	33.4
Franklin	Spring	0.35	9	0.0046	0.0355	0.0402	0.003	33.5	76.9	55.2
Franklin	Summer	0.35	7	0.0049	0.0355	0.0402	0.003	61.8	90	75.9
Franklin	Autumn	0.35	9	0.0046	0.0355	0.0402	0.003	34.3	80.9	57.6
Jefferson	Winter	0.35	11.5	0.0043	0.0355	0.0402	0.003	18.6	45.6	32.1
Jefferson	Spring	0.35	9	0.0046	0.0355	0.0402	0.003	32.4	75.8	54.1
Jefferson	Summer	0.35	7	0.0049	0.0355	0.0402	0.003	61	88.6	74.8
Jefferson	Autumn	0.35	9	0.0046	0.0355	0.0402	0.003	33.6	79.8	56.7
St. Charles	Winter	0.35	11.5	0.0043	0.0355	0.0402	0.003	18.7	43.9	31.3
St. Charles	Spring	0.35	9	0.0046	0.0355	0.0402	0.003	32.3	75.8	54.1
St. Charles	Summer	0.35	7	0.0049	0.0355	0.0402	0.003	62.2	89.2	75.7
St. Charles	Autumn	0.35	9	0.0046	0.0355	0.0402	0.003	34.8	80.3	57.6
St. Louis	Winter	0.35	11.5	0.0043	0.0355	0.0402	0.003	19.8	44.2	32
St. Louis	Spring	0.35	9	0.0046	0.0355	0.0402	0.003	34.5	76.1	55.3
St. Louis	Summer	0.35	7	0.0049	0.0355	0.0402	0.003	64.1	89.5	76.8
St. Louis	Autumn	0.35	9	0.0046	0.0355	0.0402	0.003	35.5	80.2	57.9
St. Louis City	Winter	0.35	11.5	0.0043	0.0355	0.0402	0.003	20.7	45.5	32.6
St. Louis City	Spring	0.35	9	0.0046	0.0355	0.0402	0.003	35.7	76.4	56
St. Louis City	Summer	0.35	7	0.0049	0.0355	0.0402	0.003	65.1	89.8	77.5
St. Louis City	Autumn	0.35	9	0.0046	0.0355	0.0402	0.003	36.6	80.4	58.5

QA/QC

Quality control and quality assurance were conducted throughout this nonroad modeling process. Data collected from various data sources were verified and correctly entered or transcribed into the model. In some instances, input values, i.e., temperatures and fuel values were double and/or triple checked for accuracy to insure they corresponded to the data supplied by MDNR. In addition, a spot-checking of the modeling results, including rerunning the model for those results in question, was performed to insure reliability.