

**KANSAS IMPLEMENTATION
PLAN REVISION – KCMA
OZONE MAINTENANCE PLAN,
2007**

APPENDIX B

2002 Kansas City Ozone Maintenance Area Emissions Inventory

Johnson and Wyandotte Counties Kansas

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TABLE OF CONTENTS

1	INTRODUCTION	4
2	SUMMARY OF 2002 AND 2014 EMISSIONS.....	4
3	POINT SOURCES.....	9
3.1	Methodology.....	9
3.2	Point Source Emissions Summary.....	11
4	AREA SOURCES	14
4.1	Methodologies	14
4.2	Area Source Emissions Summary	15
5	OFF-ROAD MOBILE SOURCES.....	19
5.1	Methodologies	19
5.2	Off-road Mobile Source Emissions Summary.....	20
6	ON-ROAD MOBILE SOURCES.....	24
6.1	Methodologies	24
6.2	On-road Mobile Source Emissions Summary	25
7	BIOGENIC SOURCES	26
7.1	Methodologies	26
8	REFERENCES.....	27

LIST OF TABLES AND FIGURES

Table 2-1. 2002 and 2014 Daily Anthropogenic Emissions in Johnson and Wyandotte Counties by Source Type	5
Table 2-2. 2002 Annual Anthropogenic Emissions in Johnson and Wyandotte Counties	5
Table 2-3. 2002 Biogenic Emissions in Johnson and Wyandotte Counties	6
Figure 2-1. 2002 Anthropogenic Ozone Season Day VOC Emissions in Johnson and Wyandotte Counties by Source Type	6
Figure 2-2. 2002 Anthropogenic Ozone Season Day NO _x Emissions in Johnson and Wyandotte Counties by Source Type	7
Figure 2-3. 2002 Anthropogenic Ozone Season Day CO Emissions in Johnson and Wyandotte Counties by Source Type	7
Figure 2-4. Expected Change in Anthropogenic VOC Emissions in Johnson and Wyandotte Counties from 2002-2014	8
Figure 2-5. Expected Change in Anthropogenic NO _x Emissions in Johnson and Wyandotte Counties from 2002-2014	8
Figure 2-6. Expected Change in Anthropogenic CO Emissions in Johnson and Wyandotte Counties from 2002-2014	9
Table 3-1. 2002, 2005, 2008, 2011, and 2014 Daily VOC for Point Sources by SIC	11
Table 3-2. 2002 2005, 2008, 2011, and 2014 Daily NO _x for Point Sources by SIC	12
Table 3-3. 2002 2005, 2008, 2011, and 2014 Daily CO for Point Sources by SIC	12
Table 3-4. 2002 2005, 2008, 2011, and 2014 Annual VOC for Point Sources by SIC	13
Table 3-5. 2002 2005, 2008, 2011, and 2014 Annual NO _x for Point Sources by SIC	14
Table 4-1. 2002 2005, 2008, 2011, and 2014 Daily VOC for Area Sources by Category	15
Table 4-2. 2002 2005, 2008, 2011, and 2014 Daily NO _x for Area Sources by Category	16
Table 4-3. 2002 2005, 2008, 2011, and 2014 Daily CO for Area Sources by Category	16
Table 4-4. 2002, 2005, 2008, 2011, and 2014 Annual VOC for Area Sources by Category	17
Table 4-5. 2002, 2005, 2008, 2011, and 2014 Annual NO _x for Area Sources by Category	18
Table 4-6. 2002, 2005, 2008, 2011, and 2014 Annual CO for Area Sources by Category	19
Table 5-1. Settings for NONROAD Runs	20
Table 5-2. Annual and Daily VOC Emissions for Off-road Mobile Sources by Category	20
Table 5-3. Annual and Daily NO _x Emissions for Off-road Mobile Sources by Category	21
Table 5-4. Annual and Daily CO Emissions for Off-road Mobile Sources by Category	22
Table 6-1. Settings for MOBILE 6.2 Runs	24
Table 6-2. Average Daily VMT by County	24
Table 6-3. Annual and Daily VOC Emissions for On-road Mobile Sources by Category	25
Table 6-4. Annual and Daily NO _x Emissions for On-road Mobile Sources by Category	25
Table 6-5. Annual and Daily CO Emissions for On-road Mobile Sources by Category	26

1 Introduction

An ozone emissions inventory was prepared for the Kansas City Maintenance Area (KCMA) for calendar year 2002. The inventory addresses emissions of volatile organic compounds (VOCs), oxides of nitrogen (NO_x), and carbon monoxide (CO) from point, area, on-road mobile, and off-road mobile sources. VOC and nitrogen oxide (NO_x) emissions from biogenic sources were also addressed. The complete KCMA inventory includes emissions from Johnson and Wyandotte counties in Kansas, and Clay, Jackson, and Platte counties in Missouri. This report covers the Kansas counties in the KCMA.

The objectives of the inventory are to support the revision of the KCMA maintenance plan as required by Clean Air Act § 110(a)(1) and to provide emissions data for transportation planning in the KCMA. In addition, the inventory may be used in future regional ozone modeling applications.

The base year of the emissions inventory is calendar year 2002 for area and mobile sources. Area, on-road mobile, and off-road mobile emissions were projected to the years 2005, 2008, 2011, and 2014 to provide the basis for establishing new motor vehicle emissions budgets for 2005, 2008, 2011, and 2014. Because the motor vehicle emissions budgets do not take biogenic emissions into account, biogenic emissions were not projected to 2005, 2008, 2011, and 2014.

For point sources the base year was 2002 for most sources, and 2005 for electric generating utilities (EGU's) and selected sources whose 2002 emissions were not representative of 2005 actual emissions. Point source emissions were projected to the years 2005 (when necessary), 2008, 2011, and 2014.

The 2002 KCMA emissions inventory was developed using the 2002 Inventory developed by the Central States Regional Air Planning Association (CENRAP). The Missouri Department of Natural Resources (MDNR) and the Kansas Department of Health and Environment (KDHE) used this inventory to estimate emissions for point, area, mobile, and on-road mobile, and off-road mobile sources for Johnson, Wyandotte, Clay, Jackson, and Platte counties. KDHE summarized these emissions for Johnson and Wyandotte counties.

2 Summary of 2002 and 2014 Emissions

Table 2-1 summarizes 2002 and 2014 ozone season day anthropogenic emissions (i.e., point, area, on-road mobile and off-road mobile) by county and source type. Table 2-2 shows 2002 annual emissions from point, area, on-road mobile and off-road mobile sources. Table 2-3 summarizes 2002 biogenic emissions.

Table 2-1. 2002 and 2014 Daily Anthropogenic Emissions in Johnson and Wyandotte Counties by Source Type

	2002 Daily Emissions (tons/OSD)			2014 Daily Emissions (tons/OSD)		
	VOC	NO _x	CO	VOC	NO _x	CO
JOHNSON COUNTY						
Point	1.91	3.91	0.27	2.77	3.77	0.35
Area	24.49	6.40	10.26	24.12	7.75	13.13
On-road Mobile	23.77	42.60	294.02	11.02	15.86	146.33
Off-road Mobile	14.96	19.00	215.95	10.28	10.33	264.59
County Totals	65.13	71.91	520.50	48.19	37.72	424.39
WYANDOTTE COUNTY						
Point	5.80	20.96	3.33	7.41	26.36	4.11
Area	10.60	1.73	4.16	10.64	2.03	5.04
On-road Mobile	8.26	14.81	102.19	3.61	5.19	47.92
Off-road Mobile	3.41	6.86	38.72	2.68	3.14	45.92
County Totals	28.06	44.35	148.39	24.34	36.73	102.99
TOTALS	93.19	116.27	668.89	72.53	74.45	527.39

Table 2-2. 2002 Annual Anthropogenic Emissions in Johnson and Wyandotte Counties

	2002 Annual Emissions (tons/year)		
	VOC	NO _x	CO
JOHNSON COUNTY			
Point	681	1,428	106
Area	11,485	3,108	8,234
On-road Mobile	10,543	16,198	146,821
Off-road Mobile	4,237	5,963	54,218
County Totals	26,946	26,697	209,379
WYANDOTTE COUNTY			
Point	2,018	7,112	1,223
Area	4,754	913	3,066
On-road Mobile	3,664	5,630	51,027
Off-road Mobile	1,036	2,365	10,583
County Totals	11,471	16,020	65,900
TOTALS	38,417	42,717	275,279

Table 2-3. 2002 Biogenic Emissions in Johnson and Wyandotte Counties

	2002 Daily Emissions (tons/OSD)	
	VOC	NO _x
JOHNSON COUNTY	34.79	1.17
WYANDOTTE COUNTY	21.81	0.54
TOTALS	56.61	1.71

Figure 2-1. 2002 Anthropogenic Ozone Season Day VOC Emissions in Johnson and Wyandotte Counties by Source Type

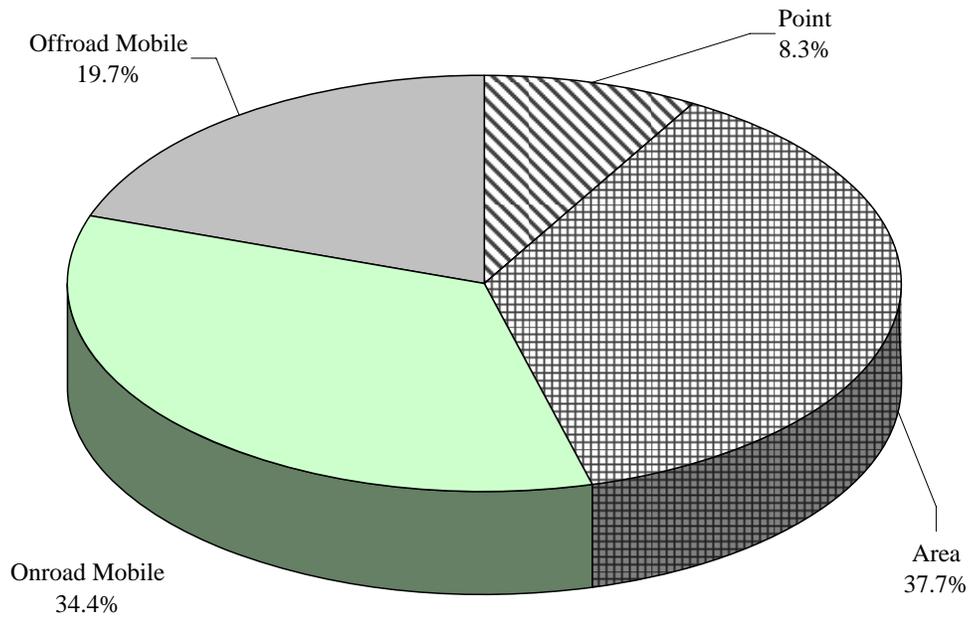


Figure 2-2. 2002 Anthropogenic Ozone Season Day NO_x Emissions in Johnson and Wyandotte Counties by Source Type

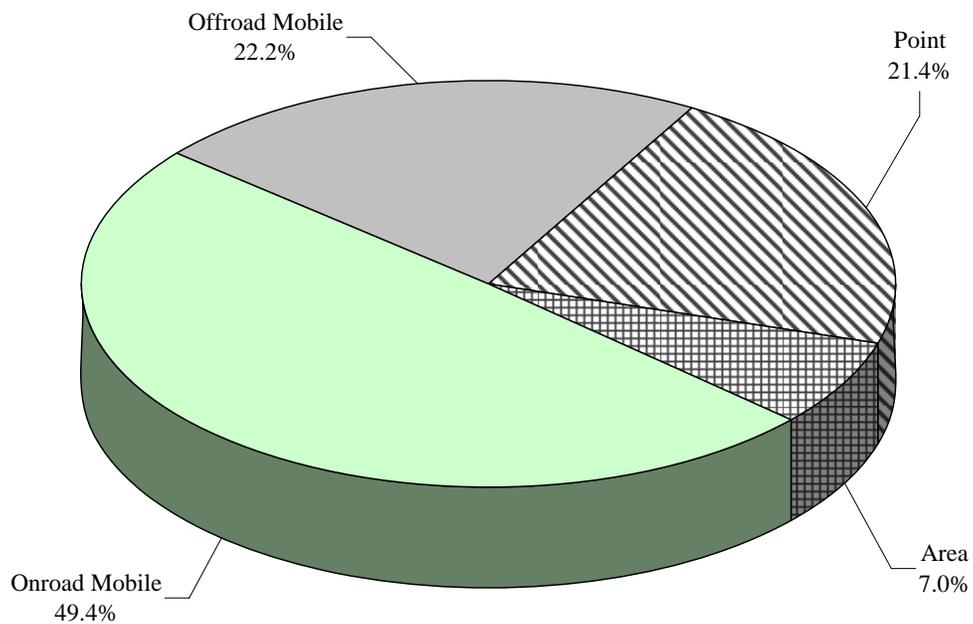


Figure 2-3. 2002 Anthropogenic Ozone Season Day CO Emissions in Johnson and Wyandotte Counties by Source Type

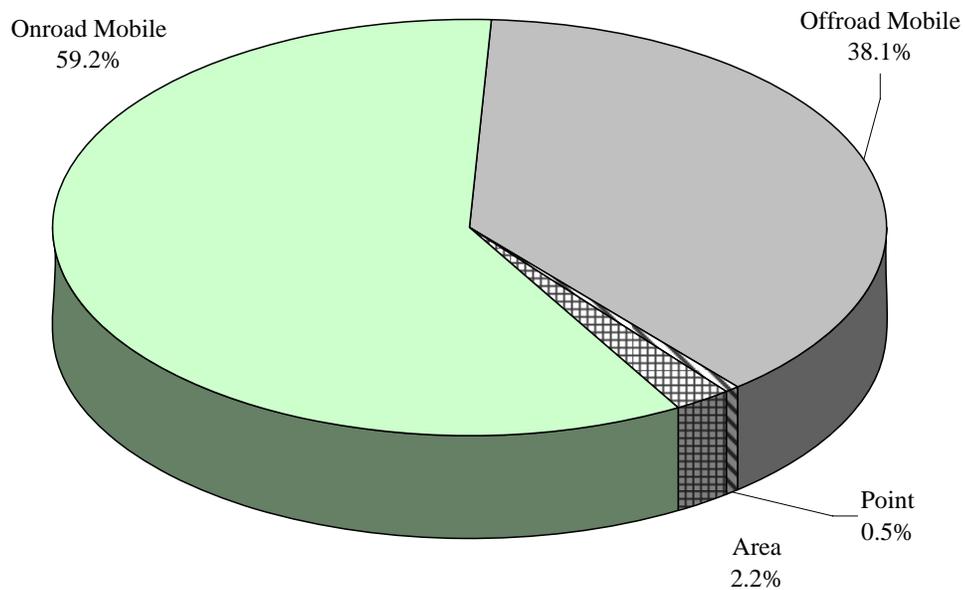


Figure 2-4. Expected Change in Anthropogenic VOC Emissions in Johnson and Wyandotte Counties from 2002-2014

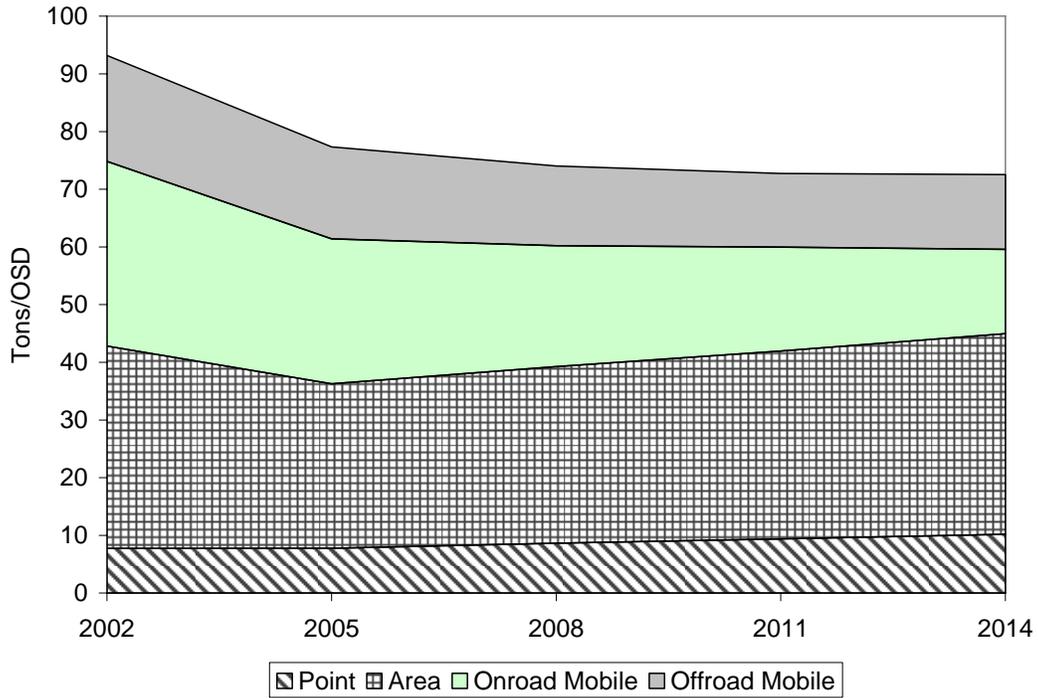


Figure 2-5. Expected Change in Anthropogenic NO_x Emissions in Johnson and Wyandotte Counties from 2002-2014

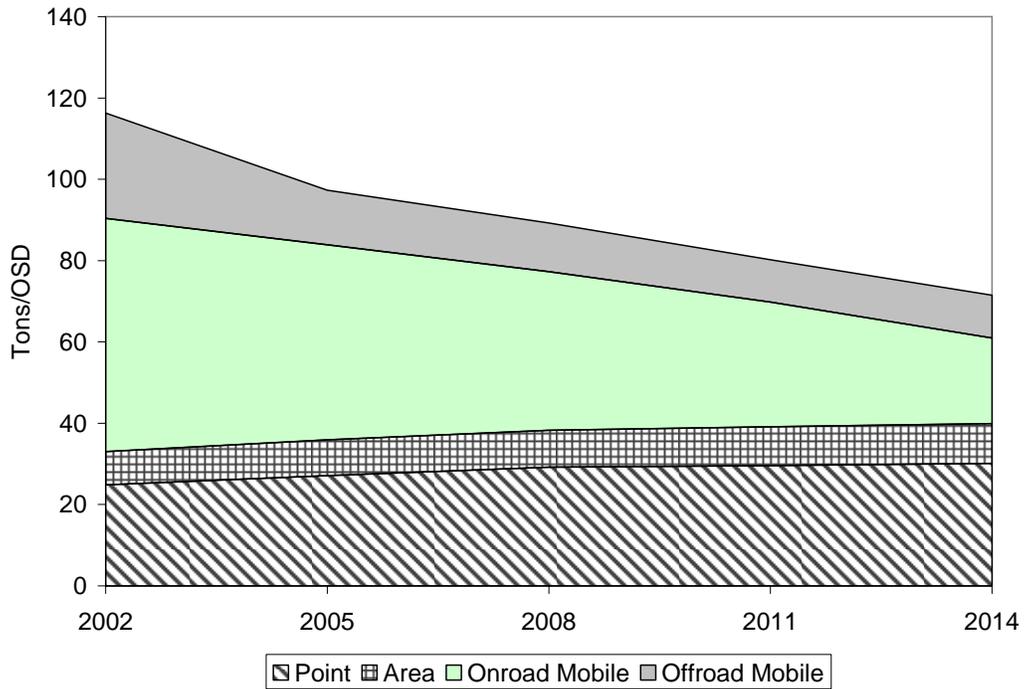
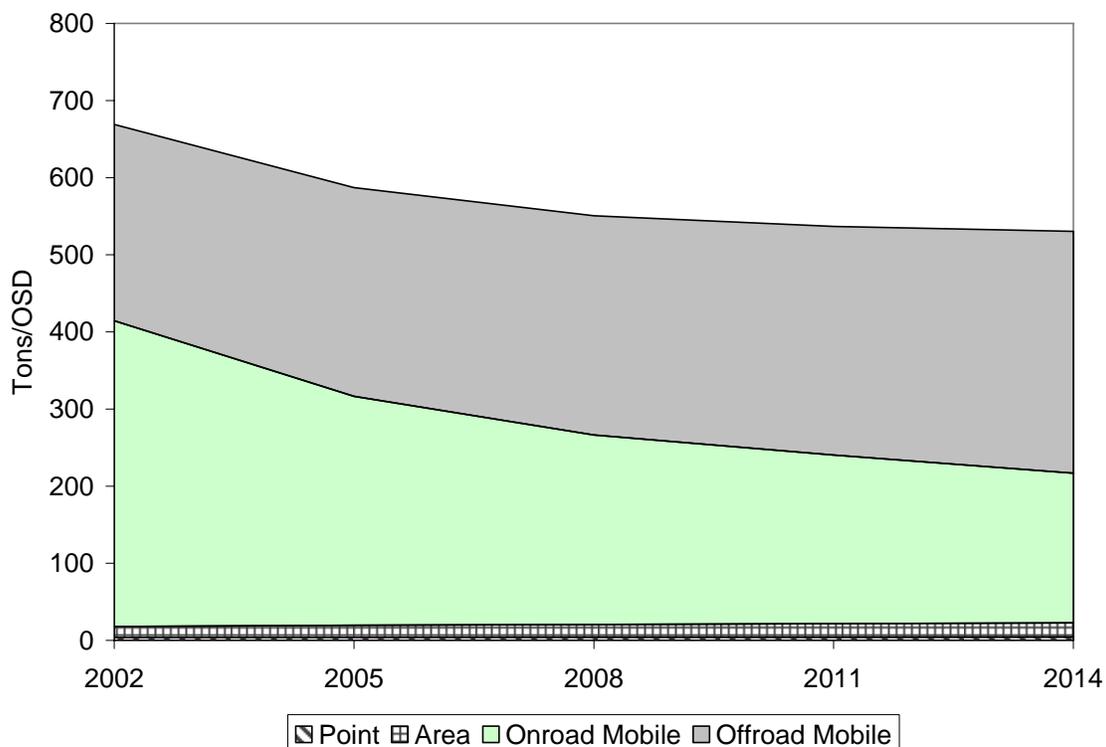


Figure 2-6. Expected Change in Anthropogenic CO Emissions in Johnson and Wyandotte Counties from 2002-2014



The overall trend for anthropogenic emissions in Johnson and Wyandotte counties is downwards. Most reductions are mobile source emission reductions related to federal standards for vehicles and fuels.

The trend for point sources and area sources is slightly upwards, except for VOCs. For 2005, reductions from Stage I vapor recovery systems at gasoline stations and on-board vapor recovery in vehicles account for most of the reductions in Area Source VOC's. Surface coating and solvent use categories continue to rise steadily through 2014.

3 Point Sources

3.1 Methodology

Point source emissions were taken from KDHE's I-Steps emissions inventory database for calendar year 2002, or 2005 for EGU's and other selected sources. The reported emissions represent the results from facility surveys of actual annual emissions emitted in 2002. The actual annual emissions were used to calculate an ozone season daily emission rate based on the days of

operation and the percentage of operating time during the summer months of June through August. The following equation was used:

$$\text{2002 OSD emissions} = (\text{2002 annual emissions}) \times (2,000 \text{ lbs/1 ton}) \times (\text{Summer operating \%}/\text{Days of operation})$$

Emissions projections for calendar years 2005, 2008, 2011, and 2014 were performed using the Department of Commerce's Bureau of Economic Analysis (BEA) growth factors. BEA factors were derived for each Source Classification Code (SCC) and county combination using EPA's Economic Growth Analysis System (EGAS) v4.0 software. Growth of emissions was normalized to the 2002 inventory base year because EGAS v4.0 has a base year of 1996. The following equation was used for the emissions projections:

$$\text{2014 OSD emissions} = (\text{2002 OSD emissions}) \times (\text{2014 growth factor}/\text{2002 growth factor})$$

Sample Calculation: 2002 NO_x Emissions from a Point Source

This example is for a facility that emitted 100 tons of NO_x in 2002. The facility operated 25 days from June through August in 2002, which represents 50% of the facility's annual operations.

$$\begin{aligned} \text{2002 OSD emissions} &= (100 \text{ tons NO}_x \text{ /yr}) \times (2,000 \text{ lbs/1 ton}) \times (0.50/25 \text{ days}) \\ &= 4,000 \text{ lbs NO}_x \text{ /OSD} \end{aligned}$$

Sample Calculation: 2008 NO_x Emissions from a Point Source

This example is for a facility located in Wyandotte County with SCC 10200602 that emits 100 lbs NO_x /OSD. BEA growth factors for SCC 10200602 in Wyandotte County are 1.1137 and 1.4055 for 2002 and 2014, respectively.

$$\begin{aligned} \text{2014 OSD emissions} &= (4,000 \text{ lbs NO}_x \text{ /OSD}) \times (1.4055/1.1137) \\ &= 5,048 \text{ lbs NO}_x \text{ /OSD} \end{aligned}$$

3.2 Point Source Emissions Summary

Tables 3-1 through 3-5 summarize 2002, 2005, 2008, 2011, and 2014 ozone season daily VOC, NO_x, and CO emissions and 2002, 2005, 2008, 2011, and 2014 annual VOC and NO_x emissions from point sources by two-digit Standard Industrial Classification (SIC) code and county.

Table 3-1. 2002, 2005, 2008, 2011, and 2014 Daily VOC for Point Sources by SIC

SIC Code	SIC Description	Daily VOC Emissions (tons/day)				
		2002	2005	2008	2011	2014
JOHNSON COUNTY		2002	2005	2008	2011	2014
20	Food And Kindred Products	0.14	0.15	0.15	0.16	0.17
27	Printing, Publishing And Allied Industries	0.91	1.12	1.15	1.19	1.28
28	Chemicals And Allied Products	0.09	0.10	0.12	0.13	0.14
30	Rubber And Miscellaneous Plastics Products	0.38	0.43	0.49	0.55	0.61
34	Fabricated Metal Products, Except Machinery & Tran	0.05	0.06	0.06	0.07	0.08
39	Miscellaneous Manufacturing Industries	0.25	0.27	0.30	0.33	0.36
49	Electric, Gas And Sanitary Services	0.08	0.09	0.11	0.12	0.13
76	Miscellaneous Repair Services	0.00	0.01	0.01	0.01	0.01
COUNTY TOTALS		1.91	2.22	2.40	2.56	2.77
WYANDOTTE COUNTY		2002	2005	2008	2011	2014
20	Food And Kindred Products	0.44	0.02	0.02	0.03	0.03
26	Plastics, Foil, and Coated Paper Bags	0.00	0.14	0.14	0.14	0.14
27	Printing, Publishing And Allied Industries	0.10	0.11	0.11	0.12	0.13
28	Chemicals And Allied Products	0.22	0.24	0.25	0.26	0.28
29	Petroleum Refining And Related Industries	0.46	0.08	0.08	0.09	0.09
30	Rubber And Miscellaneous Plastics Products	0.37	0.00	0.00	0.00	0.00
32	Stone, Clay, Glass And Concrete Products	0.54	0.58	0.62	0.65	0.71
34	Fabricated Metal Products, Except Machinery & Tran	0.20	0.05	0.05	0.06	0.06
35	Industrial And Commercial Machinery & Computer Eq.	0.09	0.09	0.11	0.12	0.12
36	Electronic & Other Electrical Equipment & Component	0.09	0.09	0.11	0.12	0.13
37	Transportation Equipment	2.43	3.43	4.00	4.49	4.92
49	Electric, Gas And Sanitary Services	0.39	0.21	0.22	0.22	0.23
51	Wholesale Trade-Nondurable Goods	0.47	0.50	0.52	0.55	0.57
COUNTY TOTALS		5.80	5.53	6.23	6.83	7.41
TOTALS		7.70	7.75	8.63	9.38	10.19

Table 3-2. 2002 2005, 2008, 2011, and 2014 Daily NO_x for Point Sources by SIC

SIC Code	SIC Description	Daily NO _x Emissions (tons/day)				
		2002	2005	2008	2011	2014
JOHNSON COUNTY		2002	2005	2008	2011	2014
7	Agricultural Services	0.01	0.01	0.01	0.01	0.01
20	Food And Kindred Products	0.01	0.01	0.01	0.01	0.01
27	Printing, Publishing And Allied Industries	0.03	0.03	0.03	0.04	0.04
29	Petroleum Refining And Related Industries	0.03	0.04	0.04	0.04	0.04
32	Stone, Clay, Glass And Concrete Products	3.77	2.68	3.01	3.26	3.59
49	Electric, Gas And Sanitary Services	0.07	0.08	0.08	0.08	0.09
COUNTY TOTALS		3.91	2.84	3.18	3.44	3.77
WYANDOTTE COUNTY						
		2002	2005	2008	2011	2014
14	Mining And Quarrying Of Nonmetallic Minerals	0.01	0.01	0.01	0.01	0.01
20	Food And Kindred Products	0.09	0.10	0.10	0.11	0.11
28	Chemicals And Allied Products	0.30	0.32	0.35	0.37	0.39
29	Petroleum Refining And Related Industries	0.04	0.04	0.04	0.05	0.05
30	Rubber And Miscellaneous Plastics Products	0.02	0.00	0.00	0.00	0.00
32	Stone, Clay, Glass And Concrete Products	1.24	1.32	1.40	1.45	1.57
34	Fabricated Metal Products, Except Machinery & Tran	0.09	0.10	0.11	0.12	0.13
37	Transportation Equipment	0.10	0.11	0.11	0.12	0.12
49	Electric, Gas And Sanitary Services	19.00	22.21	23.79	23.87	23.90
51	Wholesale Trade-Nondurable Goods	0.03	0.03	0.04	0.04	0.04
82	Educational Services	0.04	0.04	0.04	0.04	0.04
COUNTY TOTALS		20.96	24.29	25.99	26.17	26.36
TOTALS		24.87	27.13	29.17	29.61	30.13

Table 3-3. 2002 2005, 2008, 2011, and 2014 Daily CO for Point Sources by SIC

SIC Code	SIC Description	Daily CO Emissions (tons/day)				
		2002	2005	2008	2011	2014
JOHNSON COUNTY		2002	2005	2008	2011	2014
7	Agricultural Services	0.01	0.01	0.01	0.01	0.01
20	Food And Kindred Products	0.01	0.01	0.01	0.01	0.01
27	Printing, Publishing And Allied Industries	0.15	0.17	0.17	0.18	0.19
29	Petroleum Refining And Related Industries	0.04	0.04	0.04	0.04	0.04
32	Stone, Clay, Glass And Concrete Products	0.05	0.06	0.07	0.07	0.08
49	Electric, Gas And Sanitary Services	0.01	0.01	0.01	0.01	0.01
COUNTY TOTALS		0.27	0.30	0.31	0.33	0.35
WYANDOTTE COUNTY						
		2002	2005	2008	2011	2014

20	Food And Kindred Products	0.08	0.08	0.09	0.09	0.09
28	Chemicals And Allied Products	0.30	0.33	0.36	0.38	0.40
29	Petroleum Refining And Related Industries	0.03	0.04	0.04	0.04	0.04
32	Stone, Clay, Glass And Concrete Products	0.82	0.87	0.92	0.95	1.03
34	Fabricated Metal Products, Except Machinery & Tran	0.65	0.72	0.80	0.87	0.97
37	Transportation Equipment	0.02	0.02	0.03	0.03	0.03
49	Electric, Gas And Sanitary Services	1.32	1.31	1.41	1.40	1.42
51	Wholesale Trade-Nondurable Goods	0.07	0.08	0.08	0.09	0.09
82	Educational Services	0.03	0.03	0.03	0.03	0.03
COUNTY TOTALS		3.33	3.49	3.76	3.89	4.11
TOTALS		3.59	3.78	4.07	4.22	4.45

Table 3-4. 2002 2005, 2008, 2011, and 2014 Annual VOC for Point Sources by SIC

SIC Code	SIC Description	Annual VOC Emissions (tons/yr)				
		2002	2005	2008	2011	2014
JOHNSON COUNTY		2002	2005	2008	2011	2014
20	Food And Kindred Products	46	48	50	53	55
27	Printing, Publishing And Allied Industries	325	401	413	426	461
28	Chemicals And Allied Products	32	36	41	46	50
29	Petroleum Refining And Related Industries	1	1	1	1	1
30	Rubber And Miscellaneous Plastics Products	137	157	180	201	222
34	Fabricated Metal Products, Except Machinery & Tran	17	19	20	22	25
39	Miscellaneous Manufacturing Industries	90	97	110	121	129
49	Electric, Gas And Sanitary Services	31	34	39	44	47
76	Miscellaneous Repair Services	2	2	2	2	3
COUNTY TOTALS		681	794	857	914	992
WYANDOTTE COUNTY		2002	2005	2008	2011	2014
20	Food And Kindred Products	161	9	9	9	10
26	Plastics, Foil, and Coated Paper Bags	0	50	50	50	50
27	Printing, Publishing And Allied Industries	38	39	41	42	46
28	Chemicals And Allied Products	78	83	87	91	100
29	Petroleum Refining And Related Industries	162	28	30	32	34
30	Rubber And Miscellaneous Plastics Products	135	0	0	0	0
32	Stone, Clay, Glass And Concrete Products	200	214	230	241	263
34	Fabricated Metal Products, Except Machinery & Tran	72	17	19	20	22
35	Industrial And Commercial Machinery & Computer Eq.	30	33	37	41	44
36	Electronic & Other Electrical Equip.	31	34	38	42	45
37	Transportation Equipment	867	1,339	1,560	1,755	1,925
49	Electric, Gas And Sanitary Services	71	65	70	70	70
51	Wholesale Trade-Nondurable Goods	172	181	191	199	209
COUNTY TOTALS		2,018	2,092	2,363	2,592	2,817
TOTALS		2,698	2,886	3,219	3,506	3,809

Table 3-5. 2002 2005, 2008, 2011, and 2014 Annual NO_x for Point Sources by SIC

SIC Code	SIC Description	Annual NO _x Emissions (tons/yr)				
		2002	2005	2008	2011	2014
JOHNSON COUNTY		2002	2005	2008	2011	2014
7	Agricultural Services	3	4	4	4	4
20	Food And Kindred Products	3	3	3	3	3
27	Printing, Publishing And Allied Industries	11	12	13	13	14
29	Petroleum Refining And Related Industries	12	14	14	15	15
32	Stone, Clay, Glass And Concrete Products	1,375	975	1,094	1,187	1,306
49	Electric, Gas And Sanitary Services	23	28	29	30	31
COUNTY TOTALS		1,428	1,035	1,157	1,252	1,374
WYANDOTTE COUNTY		2002	2005	2008	2011	2014
14	Mining And Quarrying Of Nonmetallic Minerals	4	4	4	4	5
20	Food And Kindred Products	34	37	38	40	41
28	Chemicals And Allied Products	111	119	128	138	144
29	Petroleum Refining And Related Industries	13	15	15	16	17
30	Rubber And Miscellaneous Plastics Products	5	0	0	0	0
32	Stone, Clay, Glass And Concrete Products	455	484	512	532	575
34	Fabricated Metal Products, Except Machinery & Tran	34	37	40	43	47
37	Transportation Equipment	36	40	42	44	46
49	Electric, Gas And Sanitary Services	6,394	7,488	8,019	8,045	8,055
51	Wholesale Trade-Nondurable Goods	12	12	13	13	14
82	Educational Services	15	15	16	16	16
COUNTY TOTALS		7,112	8,249	8,827	8,892	8,959
TOTALS		8,540	9,284	9,984	10,144	10,333

4 Area Sources

4.1 Methodologies

Area source emissions were taken from the 2002 inventory prepared by CENRAP. The actual annual emissions were used to calculate an ozone season daily emission rate based on the days of operation and the percentage of operating time during the summer months of June through August. Emissions were projected for years 2005, 2008, 2011, and 2014. Federal, state, and local regulations were used to estimate reductions for certain source categories.

4.2 Area Source Emissions Summary

Tables 4-1 through 4-6 summarize 2002, 2005, 2008, 2011, and 2014 ozone season daily VOC, NO_x, and CO emissions and 2002, 2005, 2008, 2011, and 2014 annual VOC, NO_x and CO emissions from area sources by source category.

Table 4-1. 2002 2005, 2008, 2011, and 2014 Daily VOC for Area Sources by Category

SOURCE CATEGORY	Daily VOC Emissions (tons/day)				
	2002	2005	2008	2011	2014
JOHNSON COUNTY					
Adhesive (Industrial) Application	0.56	0.60	0.68	0.75	0.80
Architectural Surface Coating	2.08	2.27	2.49	2.69	2.83
Automobile Refinishing	0.43	0.28	0.31	0.34	0.37
Aviation Gasoline	0.21	0.23	0.26	0.29	0.32
Commercial and Consumer Solvent Use	4.71	4.82	4.95	5.08	5.24
Cutback Asphalt	0.18	0.19	0.21	0.23	0.24
Dry Cleaning	0.04	0.04	0.04	0.04	0.04
Fuel Oil Combustion	0.03	0.03	0.04	0.04	0.04
Gasoline Marketing	4.85	1.32	1.34	1.35	1.34
Graphic Arts	2.68	2.78	2.89	3.00	3.26
Industrial Cooking	0.06	0.06	0.07	0.07	0.07
Manufacturing Surface Coating	5.02	3.53	4.05	4.53	4.99
Natural Gas Combustion	0.34	0.38	0.39	0.41	0.42
Oil and Gas Production	0.14	0.14	0.15	0.17	0.18
Open Burning	0.39	0.42	0.46	0.50	0.53
Pesticides	0.07	0.08	0.08	0.09	0.10
Rubber/Plastics	0.21	0.24	0.27	0.30	0.33
Solvent Cleaning	1.57	1.54	1.68	1.80	2.08
Traffic Markings	0.38	0.38	0.39	0.39	0.39
Waste Disposal, Treatment, and Recovery	0.10	0.11	0.11	0.12	0.13
Wood Combustion	0.45	0.43	0.43	0.42	0.42
COUNTY TOTALS	24.49	19.85	21.29	22.63	24.12
WYANDOTTE COUNTY					
Adhesive (Industrial) Application	0.44	0.48	0.54	0.60	0.64
Architectural Surface Coating	0.69	0.75	0.83	0.89	0.94
Automobile Refinishing	0.11	0.07	0.08	0.09	0.10
Coal Combustion	0.01	0.01	0.01	0.01	0.01
Commercial and Consumer Solvent Use	1.58	1.62	1.66	1.71	1.76
Cutback Asphalt	0.09	0.09	0.10	0.11	0.12
Dry Cleaning	0.02	0.02	0.02	0.02	0.02
Fuel Oil Combustion	0.12	0.12	0.12	0.12	0.12
Gasoline Marketing	2.26	0.86	0.87	0.88	0.88
Graphic Arts	0.40	0.42	0.43	0.45	0.49
Industrial Cooking	0.02	0.02	0.02	0.02	0.02

Manufacturing Surface Coating	2.67	1.98	2.24	2.47	2.72
Miscellaneous Industrial Processes	0.38	0.41	0.47	0.52	0.55
Natural Gas Combustion	0.31	0.34	0.35	0.37	0.38
Rubber/Plastics	0.10	0.11	0.12	0.14	0.15
Solvent Cleaning	1.11	1.08	1.18	1.27	1.46
Traffic Markings	0.13	0.13	0.13	0.13	0.13
Wood Combustion	0.16	0.15	0.15	0.15	0.15
COUNTY TOTALS	10.60	8.66	9.34	9.95	10.64
TOTALS	35.09	28.52	30.63	32.58	34.76

Table 4-2. 2002 2005, 2008, 2011, and 2014 Daily NO_x for Area Sources by Category

SOURCE CATEGORY	Daily NO _x Emissions (tons/day)				
	2002	2005	2008	2011	2014
JOHNSON COUNTY					
Coal Combustion	0.02	0.02	0.02	0.02	0.02
Fuel Oil Combustion	0.26	0.27	0.28	0.29	0.30
LPG Combustion	0.02	0.02	0.02	0.02	0.02
Natural Gas Combustion	5.69	6.20	6.40	6.70	6.85
Open Burning	0.35	0.38	0.42	0.46	0.48
Waste Disposal, Treatment, and Recovery	0.05	0.06	0.06	0.07	0.07
COUNTY TOTALS	6.40	6.95	7.21	7.55	7.75
WYANDOTTE COUNTY					
Coal Combustion	0.02	0.02	0.02	0.02	0.02
Fuel Oil Combustion	0.24	0.24	0.25	0.25	0.27
Miscellaneous Industrial Processes	0.02	0.02	0.03	0.03	0.03
Natural Gas Combustion	1.44	1.56	1.61	1.68	1.72
COUNTY TOTALS	1.73	1.85	1.90	1.98	2.03
TOTALS	8.13	8.80	9.11	9.54	9.78

Table 4-3. 2002 2005, 2008, 2011, and 2014 Daily CO for Area Sources by Category

SOURCE CATEGORY	Daily CO Emissions (tons/day)				
	2002	2005	2008	2011	2014
JOHNSON COUNTY					
Fuel Oil Combustion	0.06	0.06	0.07	0.07	0.07
Industrial Cooking	0.17	0.18	0.19	0.20	0.20
Natural Gas Combustion	4.17	4.60	4.75	5.00	5.12
Open Burning	4.88	5.36	5.88	6.36	6.76

Structural Fires	0.08	0.09	0.09	0.10	0.10
Waste Disposal, Treatment, and Recovery	0.15	0.16	0.18	0.19	0.21
Wood Combustion	0.74	0.66	0.66	0.66	0.66
COUNTY TOTALS	10.26	11.12	11.82	12.58	13.13
WYANDOTTE COUNTY					
Fuel Oil Combustion	0.06	0.06	0.06	0.06	0.06
Industrial Cooking	0.04	0.05	0.05	0.05	0.05
Miscellaneous Industrial Processes	0.02	0.02	0.02	0.03	0.03
Natural Gas Combustion	3.74	4.15	4.29	4.51	4.63
Structural Fires	0.03	0.03	0.03	0.03	0.04
Wood Combustion	0.26	0.23	0.23	0.23	0.23
COUNTY TOTALS	4.16	4.54	4.69	4.92	5.04
TOTALS	14.41	15.66	16.51	17.50	18.17

Table 4-4. 2002, 2005, 2008, 2011, and 2014 Annual VOC for Area Sources by Category

SOURCE CATEGORY	Annual VOC Emissions (tons/year)				
	2002	2005	2008	2011	2014
JOHNSON COUNTY					
Adhesive (Industrial) Application	200	216	245	269	288
Architectural Surface Coating	744	810	889	960	1,011
Automobile Refinishing	156	102	114	125	134
Aviation Gasoline	76	84	96	107	117
Commercial and Consumer Solvent Use	1,718	1,761	1,805	1,856	1,912
Cutback Asphalt	65	69	76	82	89
Dry Cleaning	14	14	14	14	15
Fuel Oil Combustion	13	14	15	15	16
Gasoline Marketing	1,769	480	488	493	489
Graphic Arts	969	1,004	1,045	1,087	1,180
Industrial Cooking	22	23	24	25	26
Manufacturing Surface Coating	1,815	1,274	1,462	1,637	1,802
Natural Gas Combustion	161	174	179	187	190
Oil and Gas Production	50	52	56	62	65
Open Burning	140	154	169	183	194
Pesticides	25	28	30	33	35
Rubber/Plastics	74	84	96	107	118
Solvent Cleaning	569	555	608	652	751
Traffic Markings	140	139	141	143	142
Waste Disposal, Treatment, and Recovery	38	39	41	44	47
Wood Combustion	2,728	2,574	2,574	2,563	2,562
COUNTY TOTALS	11,485	9,652	10,172	10,644	11,182

WYANDOTTE COUNTY	2002	2005	2008	2011	2014
Adhesive (Industrial) Application	160	173	196	215	230
Architectural Surface Coating	247	269	296	319	336
Automobile Refinishing	42	27	30	33	36
Coal Combustion	3	3	3	3	3
Commercial and Consumer Solvent Use	578	592	607	624	643
Cutback Asphalt	31	33	37	40	43
Dry Cleaning	8	8	8	8	9
Fuel Oil Combustion	43	43	43	44	46
Gasoline Marketing	825	314	319	322	320
Graphic Arts	146	151	157	163	177
Industrial Cooking	6	6	6	7	7
Manufacturing Surface Coating	962	713	808	892	979
Miscellaneous Industrial Processes	140	151	171	188	201
Natural Gas Combustion	127	138	143	149	153
Rubber/Plastics	34	38	44	49	54
Solvent Cleaning	401	391	428	459	529
Traffic Markings	48	48	49	49	49
Wood Combustion	955	901	901	897	897
COUNTY TOTALS	4,754	4,000	4,246	4,461	4,710
TOTALS	16,239	13,651	14,417	15,106	15,892

Table 4-5. 2002, 2005, 2008, 2011, and 2014 Annual NO_x for Area Sources by Category

SOURCE CATEGORY	Annual NO_x Emissions (tons/year)				
	2002	2005	2008	2011	2014
JOHNSON COUNTY					
Coal Combustion	8	7	7	7	7
Fuel Oil Combustion	108	115	120	124	130
LPG Combustion	9	9	9	9	9
Natural Gas Combustion	2,836	3,029	3,124	3,239	3,290
Open Burning	128	141	154	167	177
Waste Disposal, Treatment, and Recovery	19	21	22	24	26
COUNTY TOTALS	3,108	3,322	3,437	3,571	3,640
WYANDOTTE COUNTY					
Coal Combustion	7	7	7	7	7
Fuel Oil Combustion	92	93	95	98	102
Miscellaneous Industrial Processes	8	9	10	11	12
Natural Gas Combustion	806	852	878	907	918
COUNTY TOTALS	913	961	990	1,022	1,039
TOTALS	4,021	4,283	4,427	4,593	4,678

Table 4-6. 2002, 2005, 2008, 2011, and 2014 Annual CO for Area Sources by Category

SOURCE CATEGORY	Annual CO Emissions (tons/year)				
	2002	2005	2008	2011	2014
JOHNSON COUNTY					
Fuel Oil Combustion	25	27	28	29	31
Industrial Cooking	63	66	69	72	74
Natural Gas Combustion	1,775	1,936	1,997	2,087	2,131
Open Burning	1,782	1,956	2,145	2,323	2,466
Structural Fires	29	32	35	36	37
Waste Disposal, Treatment, and Recovery	55	59	65	70	76
Wood Combustion	4,505	4,026	4,026	4,008	4,006
COUNTY TOTALS	8,234	8,102	8,365	8,626	8,821
WYANDOTTE COUNTY					
Fuel Oil Combustion	22	23	23	24	25
Industrial Cooking	16	17	18	19	19
Miscellaneous Industrial Processes	7	8	9	9	10
Natural Gas Combustion	1,434	1,580	1,632	1,712	1,754
Structural Fires	10	11	12	13	13
Wood Combustion	1,577	1,409	1,409	1,403	1,402
COUNTY TOTALS	3,066	3,048	3,102	3,180	3,223
TOTALS	11,301	11,149	11,467	11,805	12,044

5 Off-road Mobile Sources

5.1 Methodologies

Off-road mobile source emissions were calculated for ozone season days for 2002, 2005, 2008, 2011, and 2014 using the NONROAD software. Annual emissions were taken from the 2002 CENRAP inventory. Annual emissions were not calculated for any future years for off-road mobile sources.

NONROAD employs several variables that the user may enter to achieve more accurate estimates. The settings used for these estimates follow:

Table 5-1. Settings for NONROAD Runs

Season	Minimum Temperature (°F)	Maximum Temperature (°F)	Gasoline Vapor Pressure (RVP)	Days per Season
Summer	61	90	7.0	107

For the temperatures, the average high and low was calculated for each season using weather.com. Low RVP gasoline is used in Kansas City during the ozone season. The sulfur content for diesel fuel was set to 15 parts per million (ppm) for 2014. The gasoline sulfur content was set at 279 ppm for 2002 and 30 ppm for 2014.

Aircraft, commercial marine vessels, and railroad locomotive emissions were taken from the 2002 inventory prepared by CENRAP. The actual annual emissions were used to calculate an ozone season daily emission rate based on the days of operation and the percentage of operating time during the summer months of June through August.

5.2 Off-road Mobile Source Emissions Summary

Tables 5-2 through 5-4 summarize 2002, 2005, 2008, 2011, and 2014 ozone season daily VOC, NO_x, and CO emissions and 2002, 2005, 2008, 2011, and 2014 annual VOC, NO_x, and CO emissions from area sources by source category.

Table 5-2. Annual and Daily VOC Emissions for Off-road Mobile Sources by Category

SOURCE CATEGORY	2002 Annual VOC Emissions (tons/year)	2002 Daily VOC Emissions (tons/day)	2014 Daily VOC Emissions (tons/day)
JOHNSON COUNTY			
Agricultural Equipment	17.93	0.09	0.05
Airport Equipment	5.65	0.02	0.02
Aircraft	0.01	0.00	0.00
Commercial Equipment	792.47	2.38	1.96
Commercial Marine Vessels	0.00	0.00	0.00
Construction and Mining Equipment	373.21	1.31	0.71
Industrial Equipment	144.58	0.45	0.10
Lawn and Garden Equipment (Com)	1,703.00	6.94	3.95
Lawn and Garden Equipment (Res)	744.53	2.31	1.97
Logging Equipment	0.48	0.00	0.00
Pleasure Craft	42.58	0.11	0.07
Railroad Locomotives	138.99	0.38	0.23
Railroad Equipment	1.79	0.01	0.00

Recreational Equipment	271.96	0.97	1.20
COUNTY TOTALS	4,237.19	14.96	10.28
WYANDOTTE COUNTY			
	2002 Annual VOC Emissions (tons/year)	2002 Daily VOC Emissions (tons/day)	2014 Daily VOC Emissions (tons/day)
Agricultural Equipment	2.09	0.01	0.01
Airport Equipment	0.00	0.00	0.00
Aircraft	0.00	0.00	0.00
Commercial Equipment	156.33	0.47	0.39
Commercial Marine Vessels	0.32	0.00	0.00
Construction and Mining Equipment	35.35	0.12	0.07
Industrial Equipment	82.94	0.26	0.05
Lawn and Garden Equipment (Com)	170.15	0.69	0.40
Lawn and Garden Equipment (Res)	253.08	0.79	0.67
Logging Equipment	0.05	0.00	0.00
Pleasure Craft	52.05	0.13	0.09
Railroad Locomotives	95.57	0.26	0.16
Railroad Equipment	0.97	0.00	0.00
Recreational Equipment	186.89	0.67	0.85
COUNTY TOTALS	1,035.80	3.41	2.68
TOTALS			
	5,272.99	18.37	12.96

Table 5-3. Annual and Daily NO_x Emissions for Off-road Mobile Sources by Category

SOURCE CATEGORY	2002 Annual NO_x Emissions (tons/year)	2002 Daily NO_x Emissions (tons/day)	2014 Daily NO_x Emissions (tons/day)
JOHNSON COUNTY			
Agricultural Equipment	119.38	0.60	0.43
Airport Equipment	0.91	0.00	0.00
Aircraft	0.12	0.00	0.00
Commercial Equipment	422.84	1.28	1.08
Commercial Marine Vessels	0.00	0.00	0.00
Construction and Mining Equipment	1,961.88	7.01	4.38
Industrial Equipment	578.93	1.80	0.61
Lawn and Garden Equipment (Com)	236.82	1.04	0.87
Lawn and Garden Equipment (Res)	40.89	0.12	0.10
Logging Equipment	0.75	0.00	0.00
Pleasure Craft	3.00	0.01	0.01
Railroad Locomotives	2,578.90	7.07	2.79
Railroad Equipment	6.59	0.02	0.02
Recreational Equipment	12.02	0.04	0.05

COUNTY TOTALS	5,963.02	19.00	10.33
WYANDOTTE COUNTY	2002 Annual NOx Emissions (tons/year)	2002 Daily NOx Emissions (tons/day)	2014 Daily NOx Emissions (tons/day)
Agricultural Equipment	13.91	0.07	0.05
Airport Equipment	0.00	0.00	0.00
Aircraft	0.00	0.00	0.00
Commercial Equipment	83.42	0.25	0.21
Commercial Marine Vessels	15.56	0.04	0.04
Construction and Mining Equipment	185.82	0.66	0.42
Industrial Equipment	324.27	1.01	0.32
Lawn and Garden Equipment (Com)	23.66	0.10	0.09
Lawn and Garden Equipment (Res)	13.90	0.04	0.04
Logging Equipment	0.08	0.00	0.00
Pleasure Craft	3.66	0.01	0.01
Railroad Locomotives	1,692.20	4.64	1.94
Railroad Equipment	3.58	0.01	0.01
Recreational Equipment	5.23	0.02	0.02
COUNTY TOTALS	2,365.29	6.86	3.14
TOTALS	8,328.31	25.86	13.48

Table 5-4. Annual and Daily CO Emissions for Off-road Mobile Sources by Category

SOURCE CATEGORY	2002 Annual CO Emissions (tons/year)	2002 Daily CO Emissions (tons/day)	2014 Daily CO Emissions (tons/day)
JOHNSON COUNTY			
Agricultural Equipment	133.46	0.69	0.54
Airport Equipment	170.22	0.47	0.71
Aircraft	0.14	0.00	0.00
Commercial Equipment	15,644.57	51.91	72.94
Commercial Marine Vessels	0.00	0.00	0.00
Construction and Mining Equipment	3,007.54	11.03	9.39
Industrial Equipment	2,240.17	7.18	2.37
Lawn and Garden Equipment (Com)	23,256.11	111.15	136.16
Lawn and Garden Equipment (Res)	7,192.94	24.23	30.90
Logging Equipment	3.12	0.01	0.01
Pleasure Craft	98.06	0.22	0.17
Railroad Locomotives	358.70	0.98	0.68
Railroad Equipment	20.65	0.07	0.08
Recreational Equipment	2,092.54	8.01	10.64
COUNTY TOTALS	54,218.23	215.95	264.59

WYANDOTTE COUNTY	2002 Annual CO Emissions (tons/year)	2002 Daily CO Emissions (tons/day)	2014 Daily CO Emissions (tons/day)
Agricultural Equipment	15.55	0.08	0.06
Airport Equipment	0.00	0.00	0.00
Aircraft	0.00	0.00	0.00
Commercial Equipment	3,086.27	10.24	14.39
Commercial Marine Vessels	2.99	0.01	0.01
Construction and Mining Equipment	284.86	1.04	0.89
Industrial Equipment	1,322.64	4.25	1.42
Lawn and Garden Equipment (Com)	2,323.62	11.11	13.60
Lawn and Garden Equipment (Res)	2,445.06	8.24	10.50
Logging Equipment	0.35	0.00	0.00
Pleasure Craft	119.85	0.27	0.21
Railroad Locomotives	235.20	0.64	0.45
Railroad Equipment	11.21	0.04	0.04
Recreational Equipment	735.47	2.80	4.34
COUNTY TOTALS	10,583.09	38.72	45.92
TOTALS	64,801.31	254.67	310.52

6 On-road Mobile Sources

6.1 Methodologies

On-road mobile source emissions were calculated for summer, spring/fall, and winter days for 2002, 2005, 2008, 2011, and 2014 using the MOBILE 6.2 software. The summer day output was used for the typical ozone season day. Annual emissions were calculated by adding the days in each season and the average daily emissions.

MOBILE 6.2 employs several variables that the user may enter to achieve more accurate estimates. The settings used for these estimates follow:

Table 6-1. Settings for MOBILE 6.2 Runs

Season	Min. Temp (°F)	Max. Temp. (°F)	Gasoline Vapor Pressure (RVP) 2002	Gasoline Vapor Pressure (RVP) 2014	Gasoline Sulfur Content (ppm) 2002	Gasoline Sulfur Content (ppm) 2014	Days per Season
Summer	61	90	7.0	7.0	279	30	107
Spring/Fall	44	63	13.5	13.5	279	30	129
Winter	21	56	15	15	279	30	129

For the temperatures, the average high and low was calculated for each season using weather.com. Low RVP gasoline is used in Kansas City during the ozone season. The 2002 Vehicle Miles Traveled (VMT) for the Kansas City Area was developed by the Mid-America Regional Council (MARC).

Table 6-2. Average Daily VMT by County

COUNTY	2002 DAILY VMT	PERCENT	2014 Daily VMT	PERCENT
JOHNSON	14,260,724	29%	18,542,865	32%
WYANDOTTE	4,956,284	10%	6,072,451	10%
CLAY	6,573,758	14%	7,751,147	13%
JACKSON	19,289,138	40%	22,212,967	38%
PLATTE	3,311,080	7%	4,000,765	7%
TOTAL	48,390,984		58,580,195	

6.2 On-road Mobile Source Emissions Summary

Tables 6-3 through 6-5 summarize 2002, 2005, 2008, 2011, and 2014 ozone season daily VOC, NO_x, and CO emissions and 2002, 2005, 2008, 2011, and 2014 annual VOC, NO_x and CO emissions from area sources by source category.

Table 6-3. Annual and Daily VOC Emissions for On-road Mobile Sources by Category

		Daily VOC Emissions (tons/day)				
COUNTY		2002	2005	2008	2011	2014
JOHNSON		23.77	18.69	15.64	13.49	11.02
WYANDOTTE		8.26	6.43	5.32	4.52	3.61
TOTALS		32.03	25.12	20.96	18.01	14.63

		Annual VOC Emissions (tons/year)				
COUNTY		2002	2005	2008	2011	2014
JOHNSON		10,543	8,489	7,077	6,041	4,876
WYANDOTTE		3,664	2,919	2,408	2,025	1,597
TOTALS		14,207	11,408	9,484	8,067	6,472

Table 6-4. Annual and Daily NO_x Emissions for On-road Mobile Sources by Category

		Daily NO _x Emissions (tons/day)				
COUNTY		2002	2005	2008	2011	2014
JOHNSON		42.60	35.71	29.11	22.96	15.86
WYANDOTTE		14.81	12.28	9.90	7.70	5.19
TOTALS		57.41	47.99	39.01	30.66	21.06

		Annual NO _x Emissions (tons/year)				
COUNTY		2002	2005	2008	2011	2014
JOHNSON		16,198	13,687	11,249	8,950	6,159
WYANDOTTE		5,630	4,707	3,828	3,000	2,017
TOTALS		21,828	18,394	15,077	11,950	8,175

Table 6-5. Annual and Daily CO Emissions for On-road Mobile Sources by Category

	Daily CO Emissions (tons/day)				
COUNTY	2002	2005	2008	2011	2014
JOHNSON	294.02	220.92	183.34	163.77	146.33
WYANDOTTE	102.19	75.97	62.38	54.90	47.92
TOTALS	396.21	296.90	245.72	218.67	194.25

	Annual CO Emissions (tons/year)				
COUNTY	2002	2005	2008	2011	2014
JOHNSON	146,821	118,567	101,870	92,763	83,899
WYANDOTTE	51,027	40,773	34,661	31,096	27,476
TOTALS	197,848	159,340	136,531	123,859	111,375

7 Biogenic Sources

7.1 Methodologies

2002 Biogenic Emissions were taken from the 2002 National Emissions Inventory (NEI). Daily VOC and NO_x emissions are summarized in Table 2-3 for Johnson and Wyandotte Counties.

8 References

- 1 I-Steps Point Source Database, Kansas Department of Health and Environment; Bureau of Air and Radiation, Topeka, KS, 2002.
- 2 Economic Growth Analysis System (EGAS) v4.0, U.S. Environmental Protection Agency, <http://www.epa.gov/ttn/chief/emch/projection/index.html>.
- 3 CENRAP Emissions Inventory 2002
- 4 *Kansas City Ozone Maintenance State Implementation Plan Revision: Emissions Inventories and Motor Vehicle Emissions Budgets for the Kansas City Metropolitan Area*, Kansas Department of Health and Environment, Bureau of Air and Radiation, May, 1995.